TESE DE DOUTORAMENTO

RENEWABLE ENERGY INVESTMENTS IN THE MIDDLE EAST AND NORTH AFRICA REGION. AN ANALYSIS OF THE ENVIRONMENT, RISKS, AND BARRIERS

Nidal Abdallah Hasan Tayeh

ESCOLA DE DOUTORAMENTO INTERNACIONAL
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D. Nidal Abdallah Hasan Tayeh

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Renewable energy investments in the Middle East and North Africa region. An analysis of the environment, risks, and barriers

Dna. María del Carmen Sánchez Carreira

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Resumo

Os países de Oriente Medio e Norte de África, coñecidos como MENA polas súas siglas en inglés, son ricos en recursos enerxéticos renovables. Porén, a existencia destes recursos non resulta suficiente para un importante desenvolvemento nas enerxías renovables. Así, actualmente, só se utiliza o 6% dos recursos de enerxía renovable, a pesar de que todos os países contan con estratexias, políticas, plans e obxectivos de enerxía renovable para os anos 2020, 2025 ou 2030. Co fin de cumprir cos compromisos nacionais actuais de redución de emisións, e conforme ao Acordo de París de 2015, a Axencia Internacional da Enerxía (AIE) estima que o investimento total necesario para producir electricidade a partir de fontes de enerxía renovable é de 8,8 billóns de dólares USA en todo o mundo durante o período 2010-2035, dos cales 184 mil millóns investiranse na rexión MENA ata o ano 2030.

Para acadar eses obxectivos de investimento sería necesaria unha importante participación tanto do sector público como do sector privado nos proxectos de enerxía renovable. Porén, estes dous ámbitos atópanse con notables dificultades para o desenvolvemento do sector. Así, na maioría dos países da rexión MENA os recursos públicos non son suficientes para un notable desenvolvemento das enerxías renovables. Iso débese especialmente á situación económica actual na rexión. Ademais, os países exportadores de petróleo vense afectados pola evolución dos prezos, que máis alá da súa volatilidade, mostran unha tendencia á redución dende hai uns anos. En relación co sector privado, destaca a súa limitada participación nos proxectos de enerxía renovable na rexión MENA. Unha das principais razóns que pode explicar esa tendencia encóntrase nos diferentes riscos asociados cos investimentos en enerxías renovables, que inclúen os riscos políticos, financeiros, do entorno empresarial, regulamentarios e xerados por aspectos sociais e ambientais. Este estudo analiza eses riscos, tanto dende a perspectiva teórica como empírica, a través da realización de enquisas a distintos axentes involucrados no sector; e a relación entre os diferentes tipos de risco e os investimentos en enerxías renovables. Plantéxanse distintas hipóteses que suxiren un impacto negativo dos diferentes riscos nos investimentos en enerxías renovables, debido a que limitan o atractivo destes investimentos e desincentivan a participación do sector privado no desenvolvemento deste sector.

Os resultados mostran unha estreita relación entre os riscos analizados e os investimentos en enerxías renovables. Para contribuír a unha maior participación do sector privado no desenvolvemento do sector, os gobernos deben utilizar distintos instrumentos e mecanismos de apoio, combinados con actuacións que reduzan ou mesmo eliminen os riscos asociados a este tipo de investimentos.

Palabras clave: enerxías renovables, investimentos, sector privado, riscos políticos, riscos financeiros, riscos regulamentarios, riscos do entorno empresarial, MENA

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Resumen

Los países de Oriente Medio y Norte de África, conocidos como MENA por sus siglas en inglés, son ricos en recursos energéticos renovables. Sin embargo, la existencia de estos recursos no resulta suficiente para un importante desarrollo en las energías renovables. Así, actualmente, solo se utiliza el 6% de los recursos de energía renovable, a pesar de que todos los países cuentan con estrategias, políticas, planes y objetivos de energía renovable para los años 2020, 2025 o 2030. Con el fin de cumplir con los compromisos nacionales actuales de reducción de emisiones, y conforme al Acuerdo de París de 2015, la Agencia Internacional de la Energía (AIE) estima que la inversión total necesaria para producir electricidad a partir de fuentes de energía renovable es de 8,8 billones de dólares USA en todo el mundo durante el período 2010-2035, de los cuales 184 mil millones se invertirán en la región MENA hasta el año 2030.

Para alcanzar esos objetivos de inversión sería necesaria una importante participación tanto del sector público como del sector privado en los proyectos de energía renovable. Sin embargo, estos dos ámbitos se encuentran con notables dificultades para el desarrollo del sector. Así, en la mayoría de los países de la región MENA los recursos públicos no son suficientes para un notable desarrollo de las energías renovables. Ello se debe especialmente a la situación económica actual en la región. Además, los países exportadores de petróleo se ven afectados por la evolución de los precios, que más allá de su volatilidad, muestran una tendencia a la reducción desde hace unos años. En relación con el sector privado, destaca su limitada participación en los proyectos de energía renovable en la región MENA. Una de las principales razones que puede explicar esa tendencia se encuentra en los diferentes riesgos asociados con las inversiones en energías renovables, que incluyen los riesgos políticos, financieros, del entorno empresarial, regulatorios y generados por aspectos sociales y ambientales. Este estudio analiza esos riesgos, tanto desde la perspectiva teórica como empírica, a través de la realización de encuestas a distintos agentes involucrados en el sector; y la relación entre los diferentes tipos de riesgo y las inversiones en energías renovables. Se plantean distintas hipótesis que sugieren un impacto negativo de los diferentes riesgos en las inversiones en energías renovables, debido a que limitan el atractivo de estas inversiones y desincentivan la participación del sector privado en el desarrollo de este sector.

Los resultados muestran una estrecha relación entre los riesgos analizados y las inversiones en energías renovables. Para contribuir a una mayor participación del sector privado en el desarrollo del sector, los gobiernos deben utilizar distintos instrumentos y mecanismos de apoyo, combinados con actuaciones que reduzcan o incluso eliminen los riesgos asociados a este tipo de inversiones.

Palabras clave: energías renovables, inversiones, sector privado, riesgos políticos, riesgos financieros, riesgos regulatorios, riesgos del entorno empresarial, MENA

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Abstract

The countries of the Middle East and North Africa, known as MENA, are rich in renewable energy resources. However, the existence of these resources is not sufficient for a major development in renewable energy. Thus, only 6% of renewable energy resources are currently used, despite the fact that all countries have renewable energy strategies, policies, plans and targets for the years 2020, 2025 or 2030. In order to meet current national emission reduction commitments, and in line with the Paris Agreement of 2015, the International Energy Agency (IEA) estimates that the total investment needed to produce electricity from renewable energy sources is USD 8.8 trillion worldwide over the period 2010-2035, of which USD 184 billion will be invested in the MENA region up to 2030.

Achieving these investment targets would require significant public and private sector involvement in renewable energy projects. However, these two areas face significant challenges to the development of the sector. Thus, in most countries of the MENA region, public resources are not sufficient for a remarkable development of renewable energies. This is particularly due to the current economic situation in the region. In addition, oil-exporting countries are affected by the evolution of prices, which, beyond their volatility, have been showing a downward trend for a few years now. In relation to the private sector, its limited participation in renewable energy projects in the MENA region is noteworthy. One of the main reasons that can explain this trend is found in the different risks associated with investments in renewable energy, which include political, financial, business environment, regulatory and social and environmental risks. This study analyses those risks, both from theoretical and empirical perspectives, through surveys to different stakeholders involved in the sector, and the relationship between different types of risk and investments in renewable energies. Different hypotheses that suggest a negative impact of the different risks in renewable energy investments raise, because they limit the attractiveness of these investments and discourage the participation of the private sector in the development of this sector.

The results show a close relationship between the risks analysed and investments in renewable energy. In order to contribute to greater involvement of the private sector in the development of the sector, the governments should use different instruments and support mechanisms, combined with actions that reduce or even eliminating the risks associated with this type of investment.

Keywords: renewable energy, investments, private sector, political risks, financial risks, regulatory risks, business environment risks, MENA

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Resumo extenso

Segundo o Banco Mundial, a rexión de Oriente Medio e Norte de África (MENA, polas súas siglas en inglés) inclúe 20 países: Alxeria, Bahrein, Djibuti, Exipto, Irán, Israel, Iraq, Xordania, Kuwait, Líbano, Libia, Marrocos, Omán, Qatar, Arabia Saudita, Siria, Tunisia, Emiratos Árabes, Palestina e Iemen. Dita rexión é rica en fontes de enerxía renovable, destacando, en particular, enerxía solar; se ben o sector das enerxías renovables aínda está pouco desenvolvido.

Na última década realizáronse numerosos estudos sobre os investimentos en enerxías renovables e, en particular, analizando os riscos, as barreiras e as políticas. Porén, a rexión MENA, que representa un dos principais centros enerxéticos do mundo, recibiu moi pouca atención. Precisamente, este estudo está motivado por esa carencia existente na literatura, considerando a importancia de identificar e coñecer os riscos vinculados aos diferentes aspectos que afectan ás decisións de investimento no sector das enerxías renovables nos países MENA. Os investimentos en enerxías renovables nos países MENA aínda se encontran en niveis insuficientes, a pesar de que algúns países anunciaron plans para aumentar os investimentos neste ámbito. Moitos países xa presentaron distintos programas e instrumentos para impulsar os investimentos neste sector clave, aínda que seguen lonxe de acadar as metas fixadas neses plans, debido á limitada efectividade das políticas públicas na rexión e á evolución económica. Por iso, resulta necesaria unha comprensión más profunda das políticas e medidas implementadas na rexión. Outro motivo que xustifica esta investigación é a necesidade de limitar o gasto público nas economías da rexión debido ao contexto político dalgúns países e ás implicacións duns baixos prezos do petróleo para os países exportadores netos. Ademais, debe avaliarse o desempeño das políticas actuais ao afrontar estas situacións.

Espérase que a demanda de enerxía renovable aumente a nivel mundial nas próximas dúas décadas, impulsada polos prezos volátiles da enerxía, o esgotamento gradual das reservas de combustibles fósiles e as consecuencias do quecemento global, incluíndo a necesidade de mitigar as emisións de gases de efecto invernadoiro. A necesidade de reducir os gases de efecto invernadoiro está apoiada por moitas obrigas internacionais, especialmente o Acordo de París en virtude da Convención Marco das Nacións Unidas sobre o Cambio Climático, que se adoptou o 12 de decembro de 2015.

Para lograr os compromisos nacionais actuais de redución de emisións, o investimento total necesario para producir electricidade a partir de fontes de enerxía renovables estímase en 8,8 billóns de dólares estadounidenses a nivel mundial no período 2010-2035 (IEA, 2014). Porén, é pouco probable que as forzas do mercado por si soas sexan suficientes para estimular o investimento en enerxías renovables, xa que a tecnoloxía para moitos tipos de enerxía renovable aínda non é viable comercialmente en comparación cos recursos enerxéticos tradicionais. Ademais, mesmo se a tecnoloxía existente é competitiva, o prezo da electricidade xerada por enerxías renovables non pode competir cos prezos da enerxía subsidiada para os usuarios finais que se atopan na maioría das economías da rexión MENA. Para corrixir esta imperfección do mercado, necesítase a intervención do goberno para apoiar o investimento no sector. A OCDE traballou no ámbito dos incentivos ao investimento e especificamente nos incentivos ao investimento estranxeiro directo (IED). Porén, realizouse un traballo limitado con respecto aos mecanismos de apoio ou incentivos ao investimento dirixidos especificamente a proxectos de enerxía renovable na rexión MENA (OCDE, 2013b).

Nos últimos anos, varias economías da área MENA comezaron a implementar políticas e programas proactivos de enerxía renovable, para contribuír ao seu desenvolvemento. Moitos deses proxectos involucraron algún grao de asociacións público-privadas. Porén, os acontecementos recentes suspenderon esas iniciativas nalgúns países. A crise financeira mundial e a crise de liquidez aumentaron o custo de investir en enerxía renovable e outros proxectos de infraestrutura. Ademais, os eventos políticos de 2011 coñecidos como Primavera Árabe poñen de relevo os desafíos económicos e os problemas de gobernanza que os gobernos da rexión MENA deben superar para atraer investidores. Entre eses problemas destacan a falta de transparencia nas políticas de investimento e nos programas de apoio dispoñibles; man de obra pouco cualificada, as perspectivas polo menos no curto prazo de menor crecemento económico e investimento privado nos países en transición, ou as disparidades económicas rexionais. Neste contexto, as necesidades e prioridades poden levar a considerar que fomentar o investimento no sector das enerxías renovables é un ben de luxo superior que moitas economías da área MENA non poden permitirse actualmente.

Debe terse en conta a evolución recente do panorama no sector enerxético e, en particular, a evolución dos prezos do petróleo nos últimos dous anos (2018-2019). Os prezos comezaron a aumentar despois de que a Organización de Países Exportadores de Petróleo (OPEP), que representa algúns dos principais produtores do mundo, chegara a un acordo global histórico coa maioría dos exportadores que non pertencen á OPEP para limitar a produción nun intento de limitar o excedente de oferta e aumentar os prezos. En cambio, a redución dos prezos do petróleo supón un reto para o desenvolvemento das enerxías renovables na rexión MENA, pois reconsideran e revisan as súas políticas de promoción de investimentos en enerxía renovable. Aínda que esa situación poda resultar cómoda para os importadores netos de enerxía da rexión, non deberían limitar o seu traballo na promoción de investimentos en enerxías renovables, tendo en conta que se trata dunha estratexia de longo prazo. Os países produtores netos de petróleo deben recoñecer que a dependencia do petróleo non é un bo enfoque para un desenvolvemento a longo prazo. Unha redución de prezos significa menos ingresos e iso debería conducir a unha nova concepción das políticas destes países cara unha nova combinación enerxética, cunha menor dependencia do petróleo para xerar electricidade e unha maior importancia das fontes de enerxía renovables.

Un cambio rápido a sistemas de enerxía de baixas emisións implica elevados investimentos financeiros. Segundo o *Global Energy Assessment* (GEA, 2012), o investimento mundial en eficiencia enerxética e xeración de enerxía con baixas emisións de carbono deberá aumentar entre 1,7 e 2,2 billóns USD por ano nas próximas décadas para afrontar os desafíos combinados de acceso á enerxía, seguridade enerxética e cambio climático. Ese aumento contrasta cos niveis actuais de investimento, que equivalen aproximadamente a 1,3 billóns de dólares USD anuais. Para contribuír a aumentar a relevancia da enerxía renovable na maioría dos países, debe contarse co esforzo público e privado. Porén, os desenvolvedores dos proxectos frecuentemente afrontan dificultades para acceder ás elevadas contías de financiamento que necesitan na maioría dos países. Ademais, aínda cando está dispoñible, o custo do financiamento deste investimento inicial é substancialmente máis alto que nos países desenvolvidos, o que se traduce en maiores custos de xeración de enerxía para tecnoloxías de enerxía renovable.

Manter un aumento da temperatura global este século inferior aos dous grados centígrados por riba dos niveis preindustriais significaría un panorama de investimento diferente. Tras o Acordo de París adoptado en decembro de 2015 durante a COP21, estímase que o mundo requirirá 53 billóns de dólares en investimento acumulado ata 2035: ao redor de 40 billóns de

dólares en subministro de enerxía, unha cifra comparable ao Escenario de Novas Políticas da Axencia Internacional de Enerxía (IAE, polas súas siglas en inglés), pero con menos combustibles fósiles e máis enerxías renovables, e 14 billóns de dólares en eficiencia enerxética. Para 2035, prevese que o investimento en subministro de enerxía con baixas emisións de carbono aumentará a case 900 mil millóns de dólares e o gasto en eficiencia enerxética superará o billón de dólares (IEA, 2014).

Os elevados custos de financiamento na maioría dos países reflexan unha serie de barreiras informativas, técnicas, regulamentarias, financeiras e administrativas, percibidas ou reais, e os riscos de investimento asociados. Así, un país debe proporcionar taxas de retorno potencialmente moi altas aos investidores para ter éxito na atracción de investimentos privados para o desenvolvemento de proxectos renovables, principalmente se os produtores independentes de enerxía (PIE) se enfrontan a barreiras no acceso ás redes, procesos longos e incertos para emitir permisos, experiencia limitada de subministro local ou ausencia de garantías de prezos a longo prazo. Máis que un problema de xeración de capital, o desafío clave de financiar a transición cara un sistema enerxético baixo en carbono consiste en abordar os riscos existentes para os investidores que afectan aos custos de financiamento e á competitividade da enerxía renovable na maioría dos países. Abordar estes riscos dos investidores inspirou o desenvolvemento dunha ampla gama de instrumentos públicos nos últimos anos.

Se ben os responsables da formulación de políticas poden utilizar unha ampla variedade de instrumentos diferentes para abordar os riscos de investimento en enerxía renovable e as súas barreiras subxacentes, certos tipos de instrumentos acadaron maior relevancia que outros e a miúdo denomínanse instrumentos fundamentais. Un instrumento fundamental céntrase nos riscos de investimento clave e é a base sobre a que se constrúen todas as políticas e os instrumentos financeiros complementarios. En xeral, os instrumentos fundamentais como o acordo de compra de enerxía (PPA) e o sistema de primas (FiT) compleméntanse cunha serie de políticas e instrumentos financeiros para abordar os riscos de investimento residuais. Identificar unha combinación axeitada de instrumentos de redución de riscos financeiros e de políticas que complementen un instrumento fundamental pode resultar moi difícil na práctica. A rixidez das barreiras ao investimento en enerxías renovables varía segundo as localizacións e as tecnoloxías. As diferentes dotacións de recursos, as condicións do mercado e os obxectivos nacionais significan que non existe unha combinación única de instrumentos públicos que sirva igualmente para todos os casos (Tödtling & Trippl, 2005).

Os responsables da toma de decisións encargados de seleccionar unha combinación de instrumentos óptima deben ter en conta distintas consideracións. Así, deben identificar as diferentes partes interesadas asociadas con cada barreira ao investimento e comprender os diferentes intereses que xeraron a barreira. É necesario avaliar a idoneidade das diferentes medidas públicas para abordar estas barreiras: algúns instrumentos públicos poden ser menos efectivos e requirir máis tempo para ter efecto nalgúns países que noutros. Por exemplo, o fortalecemento institucional dentro dos ministerios pode ser un precursor importante dun sistema de primas ben deseñado. Se ben un instrumento público pode ser eficaz, os gastos públicos necesarios para logralo poden ser desproporcionados e, polo tanto, politicamente inaceptables. A determinación do custe ex ante dos instrumentos públicos implica múltiples e complexos supostos (Schmidt, Born, & Schneider, 2012). Os incentivos financeiros directos para a enerxía renovable están sendo especialmente controvertidos nos países industrializados

e é probable que resulten aínda máis problemáticos nos países en desenvolvemento (Frondel, Ritter & Schmidt, 2008; Peters et al., 2012; Hoppmann, 2013).

Co fin de comprender mellor o impacto das diferentes combinacións de mecanismos públicos que se poden utilizar para atraer investimentos no sector das enerxías renovables, e permitir que os planificadores e tomadores de decisións elixan os mellores mecanismos baseados nas mellores prácticas, utilízase a experiencia e os estudos de caso existentes especialmente nos países da OCDE e noutros países. Esta investigación pretende ter implicacións políticas, ao proporcionar recomendacións para mellorar as políticas de investimento para atraer o investimento privado en enerxía renovable na rexión MENA a través da redución de riscos dos investimentos en enerxía renovable.

Os países da rexión MENA non lograron ata agora atraer os investimentos necesarios do sector privado para contar cunha participación significativa no desenvolvemento dos recursos de enerxía renovable, a pesar de establecer obxectivos, programas e medidas dirixidos a promover os investimentos en enerxía renovable. Por iso, resulta necesario investigar as razóns deste modesto resultado, centrándose nas barreiras e riscos que afrontan os investimentos en enerxías renovables na rexión MENA.

A principal contribución deste estudo á literatura existente é que se trata do primeiro estudo que analiza os riscos dos investimentos en enerxía renovable na rexión de Oriente Medio e Norte de África, tanto dende a perspectiva teórica como empírica. A análise empírica baséase na realización dun cuestionario a axentes implicados no sector. Este traballo pretende ofrecer información valiosa para a adopción de políticas máis efectivas que permitan reducir ou mesmo eliminar ditos riscos e contribuír a un maior desenvolvemento das enerxías renovables, tendo en conta os recursos existentes na rexión.

As preguntas de investigación que se plantexan nesta tese de doutoramento son as seguintes:

1. ¿Cal é o estado do sector das enerxías renovables na rexión MENA?

2. ¿Cal é a tendencia mundial de investimentos en enerxía renovable, en particular, na rexión MENA?

3. ¿Cales son os beneficios do despregue de fontes de enerxía renovable na rexión MENA

4. ¿Cales son as políticas de apoio ás enerxías renovables implementadas na rexión MENA?

5. ¿Cales son os diferentes riscos que afectan aos investimentos en enerxía renovable e cal é o seu impacto nos investimentos en enerxía renovable?

O obxectivo principal desta tese de doutoramento é analizar os riscos e barreiras que afrontan os investimentos en enerxías renovables na rexión MENA e estudar a relación entre os investimentos en enerxías renovables e as diversas categorías de riscos asociados, e as posibles actuacións que permitan reducir e eliminar eses riscos. Ademais, os obxectivos específicos que se propón esta tese son os seguintes:

1. Analizar o estado do sector das enerxías renovables na rexión MENA.

2. Analizar as tendencias globais nos investimentos en enerxía renovable cun enfoque especial na rexión MENA.

3. Identificar e describir os riscos asociados cos investimentos en enerxías renovables.

4. Analizar os riscos que afectan aos investimentos en enerxía renovable na rexión MENA.

As hipóteses plantexadas na investigación baseadas na literatura son as seguintes:

- Hipótese 1: Os riscos relacionados coa situación política teñen un efecto negativo nos investimentos en enerxías renovables.

- Hipótese 2: Os riscos relacionados co entorno empresarial das enerxías renovables teñen un efecto negativo nos investimentos en enerxías renovables.

- Hipótese 3: Os riscos relacionados co marco regulamentario das enerxías renovables teñen un efecto negativo nos investimentos en enerxías renovables.

- Hipótese 4: Os riscos relacionados cos ingresos teñen un efecto negativo nos investimentos en enerxías renovables.

- Hipótese 5: Os riscos relacionados cos custos da fase de construción teñen un efecto negativo nos investimentos en enerxías renovables.

- Hipóteses 6: Os riscos relacionados cos custos da fase operativa teñen un efecto negativo nos investimentos en enerxías renovables.

- Hipótese 7: Os riscos relacionados coa estrutura financeira teñen un efecto negativo nos investimentos en enerxías renovables.

- Hipótese 8: Os riscos relacionados con cuestións ambientais e sociais teñen un efecto negativo nos investimentos en enerxía renovable.

En relación coa metodoloxía da investigación, combínase a análise teórica, baseada na revisión da literatura, coa análise empírica. Tendo en conta o número limitado de investigacións académicas sobre a temática abordada na tese na área MENA, o estudo intenta recompilar e analizar os estudos e enquisas relevantes que reflexan e discuten os distintos aspectos do problema abordado. Na análise empírica, utilízanse datos secundarios sobre o sector de enerxías renovables na rexión MENA procedentes de estatísticas oficiais, informes de entidades relevantes no sector e a literatura, e informes oficiais, así como datos primarios. Os datos primarios obtéñense das entrevistas semi-estruturadas baseadas en cuestionarios abertos e flexibles realizados con distintos grupos de actores involucrados nos investimentos en enerxía renovable na rexión MENA. Cabe sinalar que se realizou un primeiro cuestionario piloto que se enviou a un número de expertos en diferentes especializacións, incluídos investimentos, xestión e estatísticas, entre outras. Baseándose no feedback recibido nese cuestionario de proba, desenvolveuse a versión final do cuestionario, que se distribuíu á mostra seleccionada.

En relación coa estrutura, a tese de doutoramento divídese en dúas partes principais: unha parte teórica e unha parte empírica. Na súa parte teórica, preséntase a situación das enerxías renovables e as súas perspectivas, tanto no seu nivel de desenvolvemento, como especialmente nos investimentos. Ademais de describir as tendencias de ditos investimentos, o estudo céntrase

en analizar os riscos e as barreiras que afrontan os investimentos en enerxías renovables, prestando especial atención aos investidores privados e ás especificidades da rexión MENA. A parte empírica describe a metodoloxía do estudo, os seus obxectivos e hipóteses. Ademais, analiza os resultados do cuestionario realizado e verifica as hipóteses plantexadas.

O estudo mostra que a maioría dos países MENA anunciaron obxectivos para o desenvolvemento de proxectos de enerxía renovable, e comprometéronse co Acordo da Conferencia das Partes de París (COP21). Ademais, comprometeron o seu apoio a un clima sostible cunha serie de medidas concretas que contribuirán á consecución do Obxectivo de Desenvolvemento Sostible 7 (ODS 7) relacionado coa enerxía. Porén, só algúns países aprobaron oficialmente o plan. Observáronse varios desafíos no programa de desenvolvemento enerxético na rexión MENA. A dificultade de acceso á rede e da preparación da infraestrutura da rede para apoiar o desenvolvemento da enerxía renovable foron as principais barreiras identificadas. Na maioría dos países, as condicións de acceso á enerxía renovable e os mapas de rede son en grande medida inaccesibles para as empresas eléctricas privadas. Ademais, a capacidade da infraestrutura de rede actual é insuficiente para absorber enerxía renovable en moitos países.

Se ben a rexión MENA é rica en recursos renovables, a rexión só conta co 6% da enerxía procedente de fontes renovables. E iso a pesar de todos os plans ambiciosos dos países da rexión para aumentar a participación de enerxía renovable na capacidade instalada xeral. Por iso, esta investigación céntrase en analizar os riscos e barreiras relacionados cos investimentos en enerxías renovables, prestando especial atención á perspectiva do investidor. A continuación, destácanse algúns dos riscos e barreiras máis importantes. Identifícanse moitas lagoas nas regulacións na maioría dos países da rexión, incluída a ausencia de metas nacionais comparables en toda a rexión. Ademais, moitos países non contan con metas claras e oficialmente adoptadas por autoridades políticas superiores, incorporadas en normas legais, documentos vinculantes, e apoiadas por unha estratexia detallada ou un plan de acción para logralos. A ausencia dunha lei clara de enerxía renovable xera incerteza para os investidores. Só algúns países aprobaron leis de enerxía renovable.

Cabe destacar que a ausencia de sinais claras dende os gobernos sobre o número total de proxectos a desenvolver mediante o proceso de licitación pública xera incerteza para os investidores. En moitos países, o proceso de licitación pública planifícase actualmente só para un ou dous proxectos de enerxía renovable. Ademais, os procedementos para o proceso de licitación pública requiren tempo e son complexos. Un dos principais problemas da rexión que está afectando ao entorno do investimento en enerxías renovables son os subsidios á enerxía. As tarifas eléctricas fortemente subsidiadas para os consumidores levan a que o investimento en enerxía renovable resulte menos atractiva.

Nos países onde as tarifas eléctricas son baixas, a medición neta sen introducir prezos de compra preferenciais para o exceso de electricidade é insuficiente para crear incentivos para o investimento en enerxías renovables. Os prezos actuais da electricidade son demasiado baixos para poder xerar ganancias adicionais ás que poderían lograrse como resultado dunha política de medición neta. Con respecto á medición neta, moitos países da rexión experimentan cortes de enerxía regulares que impiden que os clientes leven o exceso de electricidade á rede e se beneficien desa política. Ademais, non existen na rexión instrumentos de política distintos da medición neta que ofrezan aos investidores privados no sector de enerxías renovables a seguridade de que a electricidade xerada se comprará a un prezo fixo a longo prazo con acceso garantido á rede eléctrica.

Moitos países da rexión non estableceron reguladores independentes que funcionen ben e con competencias suficientes en áreas clave como a fixación de tarifas, a emisión de licenzas, a vixilancia, control e sanción do sector eléctrico. Ademais, a maioría dos mercados de electricidade seguen estando dominados polo sector público cunha xestión non transparente. A iso únese o feito de que a maioría dos países non contan con axencias de enerxía renovable capaces de deseñar políticas de enerxía renovable, simplificar os procedementos administrativos, facilitar o desenvolvemento de proxectos privados de enerxía renovable e liderar o despregue de demostracións e outros proxectos públicos de enerxía renovable.

Case a metade dos países da rexión non contan con medidas fiscais (exencións fiscais, créditos fiscais, redución de impostos e exención de aranceis aduaneiros) para reducir os custos de proxectos de enerxía renovable e apoiar o desenvolvemento de enerxías renovables. Asemade, a maioría dos países da rexión carecen de fondos de enerxía renovable ben financiados ou outros mecanismos que faciliten o acceso ao financiamento por parte de desenvolvedores privados.

A maioría dos proxectos de enerxía renovable considéranse proxectos nacionais e son implementados polas autoridades públicas, mentres que o nivel de participación dos investidores privados no sector das enerxías renovables é moi baixo. Pódese observar que existe unha baixa participación de investimento privado e as políticas non son capaces de atraer firmas locais e/ou internacionais.

Por outra parte, as enerxías renovables non se incorporaron suficientemente aos sistemas educativos da rexión. Existen algúns programas especializados nos departamentos de ciencias e enxeñaría, pero a enerxía renovable aínda non se incorporou á xestión, política, economía e outros programas de ciencias sociais. Ademais, constátase unha falta de apoio claro para as actividades de I+D e coñecer as posibilidades de diversas aplicacións de enerxía renovable no contexto local. As axencias gobernamentais e as empresas de servizos públicos non están o suficientemente preparadas para afrontar os problemas relativos ás enerxías renovables. Os ministerios de planificación, finanzas e educación son algunhas das áreas de goberno que deben contribuír ao desenvolvemento as capacidades para o investimento en enerxías renovables.

O investimento en enerxías renovables na rexión MENA diminuíu un 8% a 15,2 mil millóns USD en 2019, dende o valor máximo de 16,5 mil millóns USD acadado en 2018. Varios países que se converteran en importantes investidores anteriormente de 2018, como Xordania, Exipto e Marrocos, reduciron o investimento, o que se debe principalmente ás brechas nos programas de poxas, pauta que se observa na rexión no seu conxunto. En 2019 as vendas en sistemas solares a pequena escala a clientes non revelados na rexión MENA ascenderon a uns 5.000 millóns de dólares.

Emiratos Árabes Unidos (EAU) foi, con gran diferenza, o principal investidor en enerxías renovables na rexión en 2019. Esa posición preeminente débese totalmente a un proxecto de gran envergadura como é Al Maktoum IV de $4,3 mil millóns, composto por 600 MW de enerxía solar térmica, enerxía dun complexo de concas parabólicas e 100 MW dunha torre solar, con 250 MW máis de paneis fotovoltaicos.

Os tres mercados de enerxías renovables máis activos no norte e leste de África (Marrocos, Exipto e Xordania) investiron un total de 15.7 mil millóns USD durante o período 2015-2019, se ben 2019 foi un ano relativamente débil nesa área. O maior financiamento de activos correspóndese con 302 millóns USD para a carteira fotovoltaica de 420MW ONEE Marrocos e 325 millóns USD para o parque eólico Lekela Power West Bakr de 250MW en Exipto.

A rexión MENA deberá instalar 88 GW de capacidade de xeración durante o período 2019-2023, o que implicaría un investimento de 142 mil millóns USD para xeración e aproximadamente 68 mil millóns USD para transmisión e distribución. Os investimentos en enerxía renovable continúan crecendo na rexión MENA, onde representan o 34% dos investimentos totais en enerxía, e benefícianse de mecanismos de financiamento flexibles e personalizados. Porén, é probable que moitos países se sitúen por debaixo dos obxectivos previstos por razóns técnicas e regulamentarias.

O alto risco do investimento é inherente aos cambios repentinos nas políticas aplicables e á inestabilidade na maioría das moedas locais. Ademais, os resultados mostran unha forte relación estatisticamente significativa entre os riscos políticos e os investimentos en enerxías renovables, indicando o impacto negativo dos riscos políticos nos investimentos en enerxías renovables. As institucións enquisadas que están traballando en proxectos de enerxía renovable consideraron o risco de alta inestabilidade política debido ao estado de dereito e as institucións deficientes como o máis importante dos riscos políticos, sendo o risco de impedimentos debido á guerra, ao terrorismo e/ou ao risco de disturbios civís o menos importante.

Segundo os resultados do estudo, existe unha relación estatisticamente significativa entre os riscos relacionados co entorno empresarial de enerxías renovables e os investimentos en enerxías renovables, indicando o impacto negativo dos riscos relacionados co entorno empresarial de enerxías renovables nos investimentos en enerxías renovables. Neste sentido, os resultados tamén mostran que as institucións enquisadas que traballan en proxectos de enerxía renovable consideraron que o risco de resolver a insolvencia é o máis importante dos riscos relacionados co entorno empresarial das enerxías renovables, mentres que o risco de protexer aos investidores minoritarios é o menos importante.

Cabe sinalar a relación estatisticamente significativa entre os riscos relacionados co marco de enerxía renovable e os investimentos en enerxías renovables, indicando o impacto negativo desta categoría de riscos nos investimentos en enerxías renovables. Neste sentido, os resultados tamén mostran que as institucións enquisadas que traballan en proxectos de enerxía renovable consideraron o risco do proceso de apelación contra decisións regulamentarias o máis importante dos riscos relacionados co marco das enerxías renovables, sendo o risco menos importante o referido á medición neta.

En canto á relación entre os riscos relativos aos ingresos e os investimentos en enerxías renovables, os resultados do estudo mostran unha forte relación estatisticamente significativa, indicando o impacto negativo dos riscos relacionados cos ingresos nas enerxías renovables. Neste sentido, os resultados mostran que as institucións enquisadas que traballan en proxectos de enerxía renovable consideraron o risco de redución o máis importante dos relativos aos ingresos, e o risco de estudos de avaliación de dispoñibilidade de recursos o menos importante.

Se ben o coñecemento técnico é limitado e as cadeas industriais son relativamente débiles e non integradas, os resultados mostran unha relación estatisticamente significativa entre os riscos relacionados cos custos da fase de construción e os investimentos en enerxías renovables e, indican o impacto negativo dos riscos relacionados cos custos da fase de construción sobre os investimentos en enerxías renovables. Os resultados mostran que as institucións enquisadas que están traballando en proxectos de enerxía renovable consideraron que o risco de dispoñibilidade de fabricantes locais experimentados é o máis importante dos riscos relativos aos custos da fase de construción, mentres que o risco de loxística é o menos importante.

En canto á relación entre os riscos relacionados cos custos da fase operativa e os investimentos en enerxías renovables, os resultados mostran unha relación estatisticamente significativa, indicando o impacto negativo dos riscos relacionados cos custos da fase operativa sobre os investimentos en enerxías renovables. Neste sentido, os resultados mostran que as institucións enquisadas que están traballando en proxectos de enerxía renovable consideraron o risco de dispoñibilidade de fabricantes locais experimentados como o maior dos riscos relativos aos custos da fase operativa, sendo o risco de loxística o menos importante.

Ao observar a relación entre os riscos relativos á estrutura financeira e os investimentos en enerxías renovables, os resultados mostran unha relación estatisticamente significativa, indicando o impacto negativo dos riscos relacionados coa estrutura financeira sobre os investimentos en enerxías renovables. Os resultados mostran que as institucións enquisadas que están traballando en proxectos de enerxía renovable consideraron que o risco referido á taxa de inflación é o máis importante da categoría de riscos relativos á estrutura financeira, mentres que o risco relativo ao fondo estatal dedicado á enerxía renovable é o menos importante.

A política enerxética na rexión xeralmente é implementada por un pequeno grupo de tecnócratas sen consultar a outras partes interesadas, incluídos grupos ambientais, defensores dos consumidores e mesmo parlamentarios electos. Neste contexto, os resultados mostran unha forte relación estatisticamente significativa entre os riscos relacionados cos temas ambientais e sociais e os investimentos en enerxías renovables, indicando o impacto negativo dos riscos relacionados cos temas ambientais e sociais nos investimentos en enerxías renovables. Neste sentido, os resultados mostran que as institucións enquisadas que están traballando en proxectos de enerxía renovable consideraron que o risco de resistencia social relacionada con preocupacións que “non están no meu patio traseiro” é o risco máis importante entre os riscos relativos aos problemas ambientais e sociais, mentres que o risco de descoñecemento dos proxectos de enerxías renovables é o menos relevante.

Con respecto á categoría de riscos, os resultados mostran que as institucións enquisadas que están traballando en proxectos de enerxía renovable consideraron que os riscos relativos aos custos da fase operativa son o risco máis importante entre todas as categorías de risco. Pola contra, os riscos relacionados coa situación política son o grupo de riscos menos importante.

Se ben os responsables da formulación de políticas poden utilizar unha variedade de instrumentos diferentes para abordar os riscos de investimento en enerxía renovable e as súas barreiras subxacentes, certos tipos de instrumentos acadaron maior relevancia que outros e, frecuentemente, denomínanse instrumentos fundamentais. Un instrumento fundamental céntrase nos riscos de investimento clave e é a base sobre a que se constrúen todas as políticas e os instrumentos financeiros complementarios.

Tendo en conta o traballo realizado nos últimos anos por diferentes plataformas, principalmente organismos internacionais e rexionais, o obxectivo principal desta tese é investigar e comprender a relación entre os investimentos en enerxías renovables e varias categorías de riscos asociados a este tipo de investimentos, así como os posibles instrumentos para reducir e eliminar eses riscos. Neste contexto, o estudo trata de coñecer as características do sector das enerxías renovables nos países de Oriente Medio e Norte de África, que tipos de políticas de promoción de investimentos utilizan os gobernos dos países MENA, así como os principais riscos e barreiras asociados co sector privado. Tamén pretende proporcionar un conxunto de recomendacións para promover os investimentos en enerxía renovable nos países MENA.

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Resumen extendido

Según el Banco Mundial, la región de Oriente Medio y Norte de África (MENA, por sus siglas en inglés) incluye 20 países: Argelia, Bahrein, Djibouti, Egipto, Irán, Israel, Irak, Jordania, Kuwait, Líbano, Libia, Marruecos, Omán, Qatar, Arabia Saudita, Siria, Túnez, Emiratos Árabes, Palestina, e Yemen. Dicha región es rica en fuentes de energía renovable, destacando, en particular, la energía solar; si bien el sector de las energías renovables aún está poco desarrollado.

En la última década se han realizado numerosos estudios sobre las inversiones en energías renovables y, en particular, analizando los riesgos, las barreras y las políticas. Sin embargo, la región MENA, que representa uno de los principales centros energéticos del mundo, ha recibido muy poca atención. Precisamente, este estudio está motivado por esa carencia existente en la literatura, considerando la importancia de identificar y conocer los riesgos vinculados a los diferentes aspectos que afectan las decisiones de inversión en el sector de las energías renovables en los países MENA. Las inversiones en energías renovables en los países MENA aún se encuentran en niveles insuficientes, a pesar de que algunos países anunciaron planes para aumentar las inversiones en este ámbito. Muchos países han presentado distintos programas e instrumentos para impulsar las inversiones en este sector clave, aunque siguen lejos de alcanzar las metas fijadas en esos planes, debido a la limitada efectividad de las políticas públicas en la región y a la evolución económica. Por ello, resulta necesaria una comprensión más profunda de las políticas y medidas que ya se han implementado en la región. Otro motivo que justifica esta investigación es la necesidad de limitar el gasto público en las economías de la región debido al contexto político de algunos países y las implicaciones de unos bajos precios del petróleo para los países exportadores netos. Además, debe evaluarse el desempeño de las políticas actuales al afrontar estas situaciones.

Se espera que la demanda de energía renovable aumente a nivel mundial en las próximas dos décadas, impulsada por los precios volátiles de la energía, el agotamiento gradual de las reservas de combustibles fósiles y las consecuencias del calentamiento global, incluyendo la necesidad de mitigar las emisiones de gases de efecto invernadero. La necesidad de reducir los gases de efecto invernadero está apoyada por muchas obligaciones internacionales, especialmente el Acuerdo de París en virtud de la Convención Marco de las Naciones Unidas sobre el Cambio Climático, que se adoptó el 12 de diciembre de 2015.

Para lograr los compromisos nacionales actuales de reducción de emisiones, la inversión total necesaria para producir electricidad por fuentes de energía renovables se estima en 8,8 billones de dólares estadounidenses a nivel mundial en el período 2010-2035 (IEA, 2014). Sin embargo, es poco probable que las fuerzas del mercado por si solas sean suficientes para estimular la inversión en energías renovables, ya que la tecnología para muchos tipos de energía renovable aún no es viable comercialmente en comparación con los recursos energéticos tradicionales. Además, incluso si la tecnología existente es competitiva, el precio de la electricidad generada a partir de energías renovables no puede competir con los precios de la energía subsidiada para los usuarios finales que se encuentran en la mayoría de las economías de la región MENA. Para corregir esta imperfección del mercado, se necesita la intervención del gobierno para apoyar la inversión en el sector. La OCDE ha trabajado en el ámbito de los incentivos a la inversión y específicamente en los incentivos a la inversión extranjera directa (IED). Sin embargo, se ha realizado un limitado trabajo con respecto a los mecanismos de apoyo

o incentivos a la inversión dirigidos específicamente a proyectos de energía renovable en la región MENA (OCDE, 2013b).

En los últimos años, varias economías del área MENA han comenzado a implementar políticas y programas proactivos de energía renovable, para contribuir a su desarrollo. Muchos de esos proyectos han involucrado algún grado de asociaciones público-privadas. Sin embargo, los acontecimientos recientes han suspendido esas iniciativas en algunos países. La crisis financiera mundial y la crisis de liquidez han aumentado el coste de invertir en energía renovable y otros proyectos de infraestructura. Además, los eventos políticos de 2011 conocidos como Primavera Árabe han puesto de relieve los desafíos económicos y los problemas de gobernanza que los gobiernos de la región MENA deben superar para atraer inversores. Entre esos problemas destacan la falta de transparencia en las políticas de inversión y en los programas de apoyo disponibles; mano de obra poco calificada, las perspectivas por lo menos en el corto plazo de menor crecimiento económico e inversión privada en los países en transición, o las disparidades económicas regionales. En este contexto, las necesidades y prioridades pueden llevar a considerar que fomentar la inversión en el sector de las energías renovables es un bien de lujo superior que muchas economías da área MENA no pueden permitirse actualmente.

La evolución reciente del panorama en el sector energético debe tenerse en cuenta, en particular, la evolución de los precios del petróleo en los últimos dos años (2018-2019). Los precios comenzaron a aumentar después de que la Organización de Países Exportadores de Petróleo (OPEP), que representa algunos de los principales productores del mundo, llegara a un acuerdo global histórico con la mayoría de los exportadores que no pertenecen a la OPEP para limitar la producción en un intento de limitar el excedente de oferta y aumentar los precios. En cambio, la reducción de los precios del petróleo supone un reto para el desarrollo de las energías renovables en la región MENA, pues reconsideran y revisan sus políticas de promoción de inversiones en energía renovable. Aunque esa situación pueda resultar cómoda para los importadores netos de energía de la región, no deberían limitar su trabajo en la promoción de inversiones en energías renovables, teniendo en cuenta que se trata de una estrategia de largo plazo. Los países productores netos de petróleo deben reconocer que la dependencia del petróleo no es un buen enfoque para un desarrollo a largo plazo. Una reducción de precios significa menos ingresos y ello debería conducir a una nueva concepción de las políticas de estos países hacia una nueva combinación energética, con una menor dependencia del petróleo para generar electricidad y una mayor importancia de las fuentes de energía renovables.

Un cambio rápido a sistemas de energía de bajas emisiones implica elevadas inversiones financieras. Según la *Global Energy Assessment* (GEA, 2012), la inversión mundial en eficiencia energética y generación de energía con bajas emisiones de carbono deberá aumentar entre 1,7 y 2,2 billones USD por año en las próximas décadas para afrontar los desafíos combinados de acceso a la energía, seguridad energética y cambio climático. Ese aumento contrasta con los niveles actuales de inversión, que equivalen aproximadamente a 1,3 billones de dólares USD anuales. Para contribuir a aumentar la relevancia de la energía renovable en la mayoría de los países, debe contarse con el esfuerzo público y privado. Sin embargo, los desarrolladores de los proyectos frecuentemente afrontan dificultades para acceder a las elevadas cuantías de financiación que necesitan en la mayoría de los países. Además, aun cuando está disponible, el coste de financiación de esta inversión inicial es sustancialmente más alto que en los países desarrollados, lo que se traduce en mayores costes de generación de energía para tecnologías de energía renovable.

Mantener un aumento de la temperatura global este siglo inferior a los dos grados centígrados por encima de los niveles preindustriales significaría un panorama de inversión diferente. Tras el Acuerdo de París en diciembre de 2015 durante la COP21, se estima que el mundo requerirá 53 billones de dólares en inversión acumulada hasta 2035: alrededor de 40 billones de dólares en suministro de energía, una cifra comparable al Escenario de Nuevas Políticas de la Agencia Internacional de Energía (IAE, por sus siglas en inglés), pero con menos combustibles fósiles y más energías renovables, y 14 billones de dólares en eficiencia energética. Para 2035, se prevé que la inversión en suministro de energía con bajas emisiones de carbono aumentará a casi 900 mil millones de dólares y el gasto en eficiencia energética superará el billón de dólares (IEA, 2014).

Los elevados costes de financiación en la mayoría de los países reflejan una serie de barreras informativas, técnicas, regulatorias, financieras y administrativas, percibidas o reales, y los riesgos de inversión asociados. Así, un país debe proporcionar tasas de retorno potencialmente muy altas a los inversores para tener éxito en la atracción de inversiones privadas para el desarrollo de proyectos renovables, principalmente si los productores independientes de energía (PIE) se enfrentan a barreras en el acceso a las redes, procesos largos e inciertos para emitir permisos, experiencia limitada de suministro local o ausencia de garantías de precios a largo plazo. Más que un problema de generación de capital, el desafío clave de financiar la transición hacia un sistema energético bajo en carbono consiste en abordar los riesgos existentes para los inversores que afectan a los costes de financiación y la competitividad de la energía renovable en la mayoría de los países. La tarea de abordar estos riesgos de los inversores ha inspirado el desarrollo de una amplia gama de instrumentos públicos en los últimos años.

Si bien los responsables de la formulación de políticas pueden utilizar una amplia variedad de instrumentos diferentes para abordar los riesgos de inversión en energía renovable y sus barreras subyacentes, ciertos tipos de instrumentos han alcanzado mayor relevancia que otros y a menudo se denominan instrumentos fundamentales. Un instrumento fundamental se centra en los riesgos de inversión clave y es la base sobre la que se construyen todas las políticas y los instrumentos financieros complementarios. En general, los instrumentos fundamentales como el acuerdo de compra de energía (PPA) y el sistema de primas (FiT) se complementan con una serie de políticas e instrumentos financieros para abordar los riesgos de inversión residuales. Identificar una combinación adecuada de instrumentos de reducción de riesgos financieros y de políticas que complementen un instrumento fundamental puede resultar muy difícil en la práctica. La rigidez de las barreras a la inversión en energías renovables varía según las ubicaciones y las tecnologías. Las diferentes dotaciones de recursos, las condiciones del mercado y los objetivos nacionales significan que no existe una combinación única de instrumentos públicos que sirva igualmente para todos los casos (Tödtling & Trippl, 2005).

Los responsables de la toma de decisiones encargados de seleccionar una combinación de instrumentos óptima deben tener en cuenta distintas consideraciones. Así, deben identificar las diferentes partes interesadas asociadas con cada barrera a la inversión y comprender los diferentes intereses que han generado la barrera. Es necesario evaluar la idoneidad de las diferentes medidas públicas para abordar estas barreras: algunos instrumentos públicos pueden ser menos efectivos y requerir más tiempo para surtir efecto en algunos países que en otros. Por ejemplo, el fortalecimiento institucional dentro de los ministerios puede ser un precursor importante de un sistema de primas bien diseñado. Si bien un instrumento público puede ser eficaz, los gastos públicos necesarios para lograrlo pueden ser desproporcionados y, por lo

tanto, políticamente inaceptables. La determinación del coste ex ante de los instrumentos públicos implica múltiples y complejos supuestos (Schmidt et al., 2012). Los incentivos financieros directos para la energía renovable están siendo especialmente controvertidos en los países industrializados y es probable que resulten aún más problemáticos en los países en desarrollo (Frondel, Ritter & Schmidt, 2008; Peters et al., 2012; Hoppmann, 2013).

Con el fin de comprender mejor el impacto de las diferentes combinaciones de mecanismos públicos que se pueden utilizar para atraer inversiones en el sector de las energías renovables, y permitir que los planificadores y tomadores de decisiones elijan los mejores mecanismos basados en las mejores prácticas, se utiliza la experiencia y los estudios de caso existentes especialmente en los países de la OCDE y en otros países. Esta investigación pretende tener implicaciones políticas, al proporcionar recomendaciones para mejorar las políticas de inversión para atraer la inversión privada en energía renovable en la región MENA a través de la reducción de riesgos de las inversiones en energía renovable.

Los países de la región MENA no han logrado hasta ahora atraer las inversiones necesarias del sector privado para contar con una participación significativa en el desarrollo de los recursos de energía renovable, a pesar de establecer objetivos, programas y medidas dirigidos a promover las inversiones en energía renovable. Por ello, resulta necesario investigar las razones de este modesto resultado, centrándose en las barreras y riesgos que afrontan las inversiones en energías renovables en la región MENA.

La principal contribución de este estudio a la literatura existente es que se trata del primer estudio que analiza los riesgos de las inversiones en energía renovable en la región de Oriente Medio y Norte de África, tanto desde la perspectiva teórica como empírica. El análisis empírico se basa en la realización de un cuestionario a agentes implicados en el sector. Este trabajo pretende ofrecer información valiosa para la adopción de políticas más efectivas que permitan reducir o incluso eliminar dichos riesgos y contribuir a un mayor desarrollo de las energías renovables, teniendo en cuenta los recursos existentes en la región.

Las preguntas de investigación que se plantean en esta tesis son las siguientes:

1. ¿Cuál es el estado del sector de las energías renovables en la región MENA?

2. ¿Cuál es la tendencia mundial de inversiones en energía renovable, en particular, en la región MENA?

3. ¿Cuáles son los beneficios del despliegue de fuentes de energía renovable en la región MENA?

4. ¿Cuáles son las políticas de apoyo a las energías renovables implementadas en la región MENA?

5. ¿Cuáles son los diferentes riesgos que afectan las inversiones en energía renovable y cuál es su impacto en las inversiones en energía renovable?

El objetivo principal de esta tesis doctoral es analizar los riesgos y barreras que afrontan las inversiones en energías renovables en la región MENA y estudiar la relación entre las inversiones en energías renovables y las diversas categorías de riesgos asociados, y las posibles actuaciones que permitan reducir y eliminar esos riesgos. Además, los objetivos específicos que se propone esta tesis son los siguientes:

1. Analizar el estado del sector de las energías renovables en la región MENA.

2. Analizar las tendencias globales en las inversiones en energía renovable con un enfoque especial en la región MENA.

3. Identificar y describir los riesgos asociados con las inversiones en energías renovables.

4. Analizar los riesgos que afectan las inversiones en energía renovable en la región MENA.

Las hipótesis planteadas en la investigación basadas en la literatura son las siguientes:

- Hipótesis 1: Los riesgos relacionados con la situación política tienen un efecto negativo en las inversiones en energías renovables.

- Hipótesis 2: Los riesgos relacionados con el entorno empresarial de las energías renovables tienen un efecto negativo en las inversiones en energías renovables.

- Hipótesis 3: Los riesgos relacionados con el marco regulatorio de las energías renovables tienen un efecto negativo en las inversiones en energías renovables.

- Hipótesis 4: Los riesgos relacionados con los ingresos tienen un efecto negativo en las inversiones en energías renovables.

- Hipótesis 5: Los riesgos relacionados con los costes de la fase de construcción tienen un efecto negativo en las inversiones en energías renovables.

- Hipótesis 6: Los riesgos relacionados con los costes de la fase operativa tienen un efecto negativo en las inversiones en energías renovables.

- Hipótesis 7: Los riesgos relacionados con la estructura financiera tienen un efecto negativo en las inversiones en energías renovables.

- Hipótesis 8: Los riesgos relacionados con cuestiones ambientales y sociales tienen un efecto negativo en las inversiones en energía renovable.

En relación con la metodología de investigación, se combina el análisis teórico, basado en la revisión de la literatura, con el análisis empírico. Teniendo en cuenta el número limitado de investigaciones académicas sobre la temática abordada en la tesis en el área MENA, el estudio intenta recopilar y analizar los estudios y encuestas relevantes que reflejan y discuten los distintos aspectos del problema abordado. En el análisis empírico, se utilizan datos secundarios sobre el sector de energías renovables en la región MENA procedentes de estadísticas oficiales, informes de entidades relevantes en el sector y la literatura, e informes oficiales, así como datos primarios. Los datos primarios se obtienen de las entrevistas semiestructuradas basadas en cuestionarios abiertos y flexibles realizados con distintos grupos de actores involucrados en las inversiones en energía renovable en la región MENA.

Cabe señalar que se realizó un primer cuestionario piloto que se envió a un número de expertos en diferentes especializaciones, incluidas inversiones, gestión, estadísticas, entre otras. Basándose en el feedback recibido en ese cuestionario de prueba, se desarrolló la versión final del cuestionario, que se distribuyó a la muestra seleccionada.

En relación con la estructura, la tesis doctoral se divide en dos partes principales: una parte teórica y una parte teórica. En su parte teórica, se presenta la situación de las energías renovables y sus perspectivas, tanto en su nivel de desarrollo, como especialmente en las inversiones. Además de describir las tendencias de dichas inversiones, el estudio se centra en analizar los riesgos y las barreras que afrontan las inversiones en energías renovables, prestando especial atención a los inversores privados y a las especificidades de la región MENA. La parte empírica describe la metodología del estudio, sus objetivos e hipótesis. Además, analiza los resultados del cuestionario realizado y verifica las hipótesis planteadas.

El estudio muestra que la mayoría de los países MENA han anunciado objetivos para el desarrollo de proyectos de energía renovable, y se comprometieron con el Acuerdo de la Conferencia de las Partes de París (COP21). Además, comprometieron su apoyo a un clima sostenible con una serie de medidas concretas que contribuirán a la consecución del Objetivo de Desarrollo Sostenible 7 (ODS 7) relacionado con la energía. Sin embargo, solo algunos países han aprobado oficialmente o plan. Se han observado varios desafíos en el programa de desarrollo energético en la región MENA. La dificultad de acceso a la red y la preparación de la infraestructura de la red para apoyar el desarrollo de la energía renovable han sido las principales barreras identificadas. En la mayoría de los países, las condiciones de acceso a la energía renovable y los mapas de red son en gran medida inaccesibles para las empresas eléctricas privadas. Además, la capacidad de la infraestructura de red actual es insuficiente para absorber energía renovable en muchos países.

Si bien la región MENA es rica en recursos renovables, la región solo cuenta con el 6% de la energía procedente de fuentes renovables. Y ello a pesar de todos los planes ambiciosos de los países de la región para aumentar la participación de energía renovable en la capacidad instalada general. Por ello, esta investigación se centra en analizar los riesgos y barreras relacionados con las inversiones en energías renovables, prestando especial atención a la perspectiva del inversor. A continuación, se destacan algunos de los riesgos y barreras más importantes. Se identifican muchas lagunas en las regulaciones en la mayoría de los países de la región, incluida la ausencia de metas nacionales comparables en toda la región. Además, muchos países no cuentan con metas claras y oficialmente adoptadas por autoridades políticas superiores, incorporadas en normas legales. documentos vinculantes, y apoyados por una estrategia detallada o un plan de acción para lograrlos. La ausencia de una ley clara de energía renovable genera incertidumbre para los inversores. Solo algunos países han aprobado leyes de energía renovable.

Cabe destacar que la ausencia de señales claras desde los gobiernos sobre el número total de proyectos a desarrollar mediante el proceso de licitación pública genera incertidumbre para los inversores. En muchos países, el proceso de licitación pública se planifica actualmente solo para uno o dos proyectos de energía renovable. Además, los procedimientos para el proceso de licitación pública requieren tiempo y son complejos. Uno de los principales problemas de la región que está afectando al entorno de inversión en energías renovables son los subsidios a la energía. Las tarifas eléctricas fuertemente subsidiadas para los consumidores llevan a que la inversión en energía renovable resulte menos atractiva.

En países donde las tarifas eléctricas son bajas, la medición neta sin introducir precios de compra preferenciales para el exceso de electricidad es insuficiente para crear incentivos para la inversión en energías renovables. Los precios actuales de la electricidad son demasiado bajos para poder generar ganancias adicionales a las que podrían lograrse como resultado de una política de medición neta. Con respecto a la medición neta, muchos países de la región

experimentan cortes de energía regulares que impiden que los clientes lleven el exceso de electricidad a la red y se beneficien de esa política. Además, no existen en la región instrumentos de política distintos de la medición neta que ofrezcan a los inversores privados en el sector de energías renovables la seguridad de que la electricidad generada se comprará a un precio fijo a largo plazo con acceso garantizado a la red eléctrica.

Muchos países de la región no han establecido reguladores independientes que funcionen bien y con competencias suficientes en áreas clave como la fijación de tarifas, la emisión de licencias, la vigilancia, control y sanción del sector eléctrico. Además, la mayoría de los mercados de electricidad siguen estando dominados por el sector público con una gestión no transparente. A ello se une el hecho de que la mayoría de los países no cuentan con agencias de energía renovable capaces de diseñar políticas de energía renovable, simplificar los procedimientos administrativos, facilitar el desarrollo de proyectos privados de energía renovable y liderar el despliegue de demostraciones y otros proyectos públicos de energía renovable.

Casi la mitad de los países de la región no cuentan con medidas fiscales (exenciones fiscales, créditos fiscales, reducción de impuestos y exención de aranceles aduaneros) para reducir los costes de proyectos de energía renovable y apoyar el desarrollo de energías renovables. Asimismo, la mayoría de los países de la región carecen de fondos de energía renovable bien financiados u otros mecanismos que faciliten el acceso al financiamiento por parte de desarrolladores privados.

La mayoría de los proyectos de energía renovable se consideran proyectos nacionales y son implementados por las autoridades públicas, mientras que el nivel de participación de los inversores privados en el sector de las energías renovables es muy bajo. Se puede observar que existe una baja participación de inversión privada y las políticas no son capaces de atraer firmas locales y/o internacionales.

Por otra parte, las energías renovables no se han incorporado suficientemente a los sistemas educativos de la región. Existen algunos programas especializados en los departamentos de ciencia e ingeniería, pero la energía renovable aún no se ha incorporado a la gestión, la política, la economía y otros programas de ciencias sociales. Además, se constata una falta de apoyo claro para las actividades de I+D y conocer las posibilidades de diversas aplicaciones de energía renovable en el contexto local. Las agencias gubernamentales y las empresas de servicios públicos no están lo suficientemente preparadas para afrontar los problemas relativos a las energías renovables. Los ministerios de planificación, finanzas y educación son algunas de las áreas de gobierno que deben contribuir a desarrollar las capacidades para la inversión en energías renovables.

La inversión en energías renovables en la región MENA disminuyó un 8% a 15,2 mil millones USD en 2019, desde el valor máximo de 16,5 mil millones USD alcanzado en 2018. Varios países que se habían convertido en importantes inversores en años anteriores a 2018, como Jordania, Egipto y Marruecos, han reducido la inversión, lo que se debe principalmente a las brechas en los programas de subastas, pauta que se observa en la región en su conjunto. En 2019 las ventas en sistemas solares a pequeña escala a clientes no revelados en la región MENA ascendieron a unos 5.000 millones de dólares

Emiratos Árabes Unidos (EAU) fue, con gran diferencia, el principal inversor en energías renovables en la región en 2019. Esa posición preeminente se debe totalmente a un proyecto de gran envergadura como es Al Maktoum IV de $4,3 mil millones, compuesto por 600 MW de

energía solar térmica, energía de un complejo de cuencas parabólicas, y 100 MW de una torre solar, con 250 MW más de paneles fotovoltaicos.

Los tres mercados de energías renovables más activos en el norte y este de África (Marruecos, Egipto y Jordania) invirtieron un total de 15.7 mil millones USD durante el período 2015-2019, si bien 2019 fue un año relativamente débil en esa área. El mayor financiamiento de activos se corresponde con 302 millones USD para la cartera fotovoltaica de 420MW ONEE Marruecos y 325 millones USD para el parque eólico Lekela Power West Bakr de 250MW en Egipto.

La región MENA deberá instalar 88 GW de capacidad de generación durante el período 2019-2023, lo que implicaría una inversión de 142 mil millones USD para generación y aproximadamente 68 mil millones USD para transmisión y distribución. Las inversiones en energía renovable continúan creciendo en la región MENA, donde representan el 34% de las inversiones totales en energía, y se benefician de mecanismos de financiación flexibles y personalizados. Sin embargo, es probable que muchos países se sitúen por debajo de los objetivos previstos por razones técnicas y reglamentarias.

El alto riesgo de inversión es inherente a los cambios repentinos en las políticas aplicables y a la inestabilidad en la mayoría de las monedas locales. Además, los resultados muestran una fuerte relación estadísticamente significativa entre los riesgos políticos y las inversiones en energías renovables, indicando el impacto negativo de los riesgos políticos en las inversiones en energías renovables. Las instituciones encuestadas que están trabajando en proyectos de energía renovable consideraron el riesgo de alta inestabilidad política debido al estado de derecho y las instituciones deficientes como el más importante de los riesgos políticos, siendo el riesgo de impedimentos debido a la guerra, el terrorismo y/o el riesgo de disturbios civiles el menos importante.

Según los resultados del estudio, existe una relación estadísticamente significativa entre los riesgos relacionados con el entorno empresarial de energías renovables y las inversiones en energías renovables, indicando el impacto negativo de los riesgos relacionados con el entorno empresarial de energías renovables en las inversiones en energías renovables. En este sentido, los resultados también muestran que las instituciones encuestadas que trabajan en proyectos de energía renovable consideraron que el riesgo de resolver la insolvencia es el más importante de los riesgos relacionados con el entorno empresarial de las energías renovables, mientras que el riesgo de proteger a los inversores minoritarios es el menos importante.

Cabe señalar la relación estadísticamente significativa entre los riesgos relacionados con el marco de energía renovable y las inversiones en energías renovables, indicando el impacto negativo de esta categoría de riesgos en las inversiones en energías renovables. En este sentido, los resultados también muestran que las instituciones encuestadas que trabajan en proyectos de energía renovable consideraron el riesgo del proceso de apelación contra decisiones regulatoria el más importante de los riesgos relacionados con el marco de las energías renovables, siendo el riesgo menos importante el referido a la medición neta.

En cuanto a la relación entre los riesgos relacionados con los ingresos y las inversiones en energías renovables, los resultados del estudio muestran una fuerte relación estadísticamente significativa, indicando el impacto negativo de los riesgos relacionados con los ingresos en las energías renovables. En este sentido, los resultados muestran que las instituciones encuestadas que están trabajando en proyectos de energía renovable consideraron que el riesgo de reducción

es el más importante de los riesgos relativos a los ingresos, siendo el riesgo de estudios de evaluación de disponibilidad de recursos el menos importante.

Si bien el conocimiento técnico es limitado y las cadenas industriales son relativamente débiles y no integradas, los resultados muestran una relación estadísticamente significativa entre los riesgos relacionados con los costes de la fase de construcción y las inversiones en energías renovables, indicando el impacto negativo de los riesgos relacionados con los costes de la fase de construcción sobre las inversiones en energías renovables. Los resultados muestran que las instituciones encuestadas que están trabajando en proyectos de energía renovable consideraron que el riesgo de disponibilidad de fabricantes locales experimentados es el más importante de los riesgos relativos a los costes de la fase de construcción, mientras que el riesgo de logística es el menos importante.

En cuanto a la relación entre los riesgos relacionados con los costes de la fase operativa y las inversiones en energías renovables, los resultados muestran una relación estadísticamente significativa, indicando el impacto negativo de los riesgos relacionados con los costes de la fase operativa sobre las inversiones en energías renovables. En este sentido, los resultados muestran que las instituciones encuestadas que están trabajando en proyectos de energía renovable consideraron el riesgo de disponibilidad de fabricantes locales experimentados como el mayor de los riesgos relativos a los costes de la fase operativa, siendo el riesgo de logística el menos importante.

Al observar la relación entre los riesgos relativos a la estructura financiera y las inversiones en energías renovables, los resultados muestran una relación estadísticamente significativa, indicando el impacto negativo de los riesgos relacionados con la estructura financiera sobre las inversiones en energías renovables. Los resultados muestran que las instituciones encuestadas que están trabajando en proyectos de energía renovable consideraron que el riesgo referido a la tasa de inflación es el riesgo más importante de la categoría de riesgos relacionados con la estructura financiera, mientras que el riesgo relativo a un fondo estatal dedicado a la energía renovable es el menos importante.

La política energética en la región generalmente es implementada por un pequeño grupo de tecnócratas sin consultar a otras partes interesadas, incluidos grupos ambientales, defensores de los consumidores e incluso parlamentarios electos. En este contexto, los resultados muestran una fuerte relación estadísticamente significativa entre los riesgos relacionados con los temas ambientales y sociales y las inversiones en energías renovables, indicando el impacto negativo de los riesgos relacionados con los temas ambientales y sociales en las inversiones en energías renovables. En este sentido, los resultados muestran que las instituciones encuestadas que están trabajando en proyectos de energía renovable consideraron que el riesgo de resistencia social relacionada con preocupaciones que “no están en mi patio trasero” es el riesgo más importante entre los riesgos relativos a los problemas ambientales y sociales, mientras que el riesgo de desconocimiento de los proyectos de energías renovables es el menos relevante.

Con respecto a la categoría de riesgos, los resultados muestran que las instituciones encuestadas que están trabajando en proyectos de energía renovable consideraron que los riesgos relativos a los costes de la fase operativa son el riesgo más importante entre todas las categorías de riesgo. Por el contrario, los riesgos relacionados con la situación política son el grupo de riesgos menos importante.

Si bien los responsables de la formulación de políticas pueden utilizar una variedad de instrumentos diferentes para abordar los riesgos de inversión en energía renovable y sus

barreras subyacentes, ciertos tipos de instrumentos han alcanzado mayor relevancia que otros y, frecuentemente, se denominan instrumentos fundamentales. Un instrumento fundamental se centra en los riesgos de inversión clave y es la base sobre la que se construyen todas las políticas y los instrumentos financieros complementarios.

Teniendo en cuenta el trabajo que han realizado en los últimos años por diferentes plataformas, principalmente organismos internacionales y regionales, el objetivo principal de esta tesis es investigar y comprender la relación entre las inversiones en energías renovables y varias categorías de riesgos asociados a este tipo de inversiones, así como los posibles instrumentos para reducir y eliminar esos riesgos. En este contexto, el estudio trata de conocer las características del sector de las energías renovables en los países de Oriente Medio y Norte de África, qué tipos de políticas de promoción de inversiones utilizan los gobiernos de los países MENA, así como los principales riesgos y barreras asociados con el sector privado. También pretende proporcionar un conjunto de recomendaciones para promover las inversiones en energía renovable en los países MENA.

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List of Abbreviations

ADEME	Agency for Environment and Energy Management
ALM	Asset-Liability Management
ARP	Assembly of the Representatives of the people of Tunisia
BAU	Business as usual
BCM	Billion cubic metres
BNDES	Brazilian Development Bank
BNEF	Bloomberg New Energy Finance
BP	British Petroleum
BTI	Bertelsmann Transformation Index
CAC Bank	Cooperative and Agricultural Credit Bank - Yemen
CCGTs	Combined Cycle Gas Turbines
CEE	Central and Eastern Europe
CEF	Clean Energy Funds
CEO	Chief Executive Officer
CEP	Council of Economic Policies (Switzerland)
CfD	Contract -for-Difference
CFMs	Capital Flow Measures
CMS	Conditional Monitoring System
COP21	Conference of Parties - The 2015 United Nations Climate Change Conference
CSP	Concentrated Solar Power
D2S	Diesel to Solar
EBIT	Expenses Before Interest and Taxes
EBITDA	Earnings Before Interest, Taxes, Depreciation, and Amortization
EDB	Ease of Doing Business
EETCC	Egyptian Electricity Transmission Company
EGP	Enel Green Power
EIB	European Investment Bank
EMRC	Jordanian Energy and Minerals Regulatory Commission
EPC	Engineering, Production and Construction
EU	European Union
EWEA	European Wind Energy Association
FAUS	Fund for Universal Access to Services
FDI	Foreign Direct Investment
FIDeR	Final Investment Decisions Enabling for Renewables
FiP	Feed-in-Premiums

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FiTs	Feed-in-Tariffs
GCC	Cooperation Council for the Arab States of the Gulf
GCI	Global Competitive Index
GDP	Gross Domestic Product
GEA	Global Energy Assessment
GEF	Global Environment Fund
GHG	Greenhouse Gas Emission
GHI	Global Horizontal Irradiance
GICI	German International Climate Initiative
GW	Giga Watt
GWh	Giga Watt-hour
I+D	Investigación y Desarrollo
IAEA	International Atomic Energy Agency
IEA	International Energy Agency
IED	Inversión Extranjera Directa
ILO	International Labour Organisation
INDCs	Intended Nationally Determined Contributions
IPC	Independent Power Corporation
IPPs	Independent Power Producers
IRENA	International Renewable Energy Agency
KACARE	King Abdullah City for Atomic and Renewable Energy
KAHRAMAA	Qatar General Electricity and Water Corporation
Kb/d	Thousand of Barrels Per Day
KW	Kilo Watt
kWp	Kilowatt peak
ktoe	Kilotonne of Oil Equivalent
LDCs	Least Developed Countries
LICs	Low Income Countries
MASEN	Moroccan Agency for Sustainable Energy
MENA	Middle East and North Africa
MNEs	Multinational Enterprises
MRE	Marine Renewable Energy
MW	Miga Watt
MWh	Miga Watt-hour
MWp	Miga Watt- Peak
M/S	Metres per second
MT	Metric ton
MToe	Migatonne of Oil Equivalent

NEEAP	National Energy Efficiency Action Plan
NEPCO	National Power Electric Company (Jordan)
NFFO	Non-Fossil Fuel Obligation
NICs	National Insurance Contributions
NIMBY	Not in my back yard
NPV	Net Present Value
NREAP	National Renewable Energy Action Plan
NSW	New South Wales
OECD	Organisation for Economic Cooperation and Development
ONEE	National Office of Electricity and Drinking Water
OPEC	Organisation of the Petroleum Exporting Countries
OPEP	Organización de Países Exportadores de Petróleo
O&M	Operation & Maintenance
PF	Project Financing
PIE	Productores Independientes de Energía
PPA	Power Purchase Agreement
PPIAF	The Public-Private Infrastructure Advisory Facility in Brazil
PPP	Public Private Partnership
PRI	Political Risks Insurance
PV	Photovoltaic
R&D	Research and Development
RD&D	Research, Development and Demonstration
RCREEE	Regional Centre for Renewable Energy and Energy Efficiency (Centro Regional de Energías Renovables y Eficiencia Energética)
RE	Renewable Energy
REAOL	Renewable Energy Authority of Libya
RETs	Renewable Energy Technologies
RIA	Regulatory Impact Assessment
SDG7	Sustainable Development Goal 7
SDGs	Sustainable Development Goals
SHM	Structural Health Monitoring
Solar-MED-Atlas	Solar Atlas for the Mediterranean
SPSS	Statistical Package for the Social Sciences
TGC	Tradable Green Certificates
TRIS	Toxic Release Inventory System
TWh	Terawatt-hour
UAE	United Arab Emirates
UN	United Nations
UNDP	United Nations Development Programme

UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
USD	United States Dollars
USSR	Union of Soviet Socialist Republics
VAT	Value Added Tax
WEF	World Economic Forum
WTO	World Trade Organisation

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INTRODUCTION

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A. PRESENTATION

The Middle East and North Africa region (MENA) includes 20 countries: Algeria, Bahrain, Djibouti, Egypt, Iran, Israel, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Syria, Tunisia, United Arab Emirates, Palestine, and Yemen, according to the World Bank. This region is rich in renewable energy sources, being solar energy the most important source. However, the renewable energy sector is still underdeveloped. The Regional Centre for Renewable Energy and Energy Efficiency (RCREEE) estimates that the share of renewable energy in the region's total energy mix is only 6% (Mahmoud & Habib, 2019).

The demand for renewable energy is expected to increase worldwide over the next two decades, driven by volatile energy prices, the gradual depletion of fossil fuel reserves and the consequences of global warming, including the need to mitigate greenhouse gas emissions. This need to reduce greenhouse gases is underlined by many international obligations, especially the Paris Agreement under the United Nations Framework Convention on Climate Change, which was adopted on December 12, 2015.

In order to achieve current national commitments to reduce emissions, the total investment required to produce electricity from renewable energy sources is estimated at USD 8.8 trillion worldwide over the period 2010-2035 (IEA, 2014). Nevertheless, market forces alone are unlikely to be sufficient to spur investment in renewable energies, as the technology for many types of renewable energy is not yet commercially viable compared to traditional energy resources. In addition, even if existing technology is competitive, the price of electricity generated from renewables cannot compete with the existing prices of subsidised energy for end-users in most MENA economies. To correct this market imperfection, government intervention is needed to support investment in the sector, as several authors acknowledge (Mazzucato, 2015, Mazucato & Semienuk, 2018; Borrás & Edler, 2020). The OECD has worked in the area of investment incentives and specifically on investment incentives for foreign direct investment (FDI). However, little work has been done on supporting instruments or investment incentives specifically targeted at renewable energy projects in the MENA region (OECD, 2013b).

In recent years, several economies in the MENA area have started to implement proactive renewable energy policies and programmes to contribute to the development of power generation from renewable energy. Many of these projects have involved some degree of public-private partnerships. However, recent developments have suspended such developments in some countries. The global financial crisis and liquidity crises have increased the cost of investing in renewable energy and other infrastructure projects. Moreover, the 2011 political events, known as the Arab Spring, have highlighted economic challenges and governance issues that MENA governments need to overcome to attract investors. These challenges include a lack of transparency in investment policies and available support schemes; low skilled labour, and a short-term decrease in economic growth and private investment in the countries undergoing transition, and regional economic disparities. In this context, the needs and priorities may lead to consider that encouraging investment in the renewable energy sector is a superior or luxury good that many MENA economies currently cannot afford.

The recent developments in the energy sector landscape should be taken into consideration, in particular, the evolution of oil prices in the last two years (2018-2019). These prices started to maintain its low prices after the Organisation of the Petroleum Exporting Countries (OPEC),

which represents some of the world major producers, reached a historic global agreement with most of the non-OPEC countries to limit production in an attempt to limit excess supply and raise prices. In contrast, lower oil prices present an opportunity for the development of renewable energy in the MENA region. Thus, these countries may reconsider and revise their policies for promoting renewable energy investments. While this situation may be comfortable for the net energy importers in the region, they should not rely on that to slow down their work on promoting renewable energy investment, considering that this is a long-term strategy. Net oil-producing countries should consider that dependence on oil is not a good approach. Lower prices mean less income, and this should lead to a rethinking of policies in these countries towards a new energy mix, with less dependence on oil for electricity generation and higher importance of renewable energy sources.

A rapid change to low-emission energy systems involves high financial investments. According to the Global Energy Assessment (GEA, 2012), global investment in energy efficiency and low-carbon power generation will need to increase by $1.7 to $2.2 trillion per year over the next decades to address the combined challenges of energy access, energy security, and climate change. That increase contrasts with current investment levels of approximately $1.3 trillion per year. To help increase the relevance of renewable energy in most countries, both public and private efforts should be combined. Concerning the private sector, with enabling policies and aligned investment practices, the global capital markets have the size and depth to deal with such investment amounting to $177.5 trillion in financial assets (SIFMA, 2019). However, project developers often face difficulties in accessing the high amounts of financing that they need in most countries. Moreover, even when available, the cost of financing this initial investment is substantially higher than in developed countries, which translates into higher power generation costs for renewable energy technologies (Roxburgh, Lund, & Piotrowski, 2011).

Maintaining a global temperature increase this century below two degrees Celsius above pre-industrial levels would mean a different investment scenario. Following the Paris Agreement approved in December 2015 during COP21, it is estimated that the world will require $53 trillion in cumulative investment to 2035: about $40 trillion in energy supply, a figure comparable to the New Policy Scenario elaborated by IEA, but with a new energy mix based on lower fossil fuel and higher renewable energy; and $14 trillion in energy efficiency. Investment in low-carbon energy supply is projected to increase to nearly $900 billion by 2035, and spending on energy efficiency to exceed $1 trillion (IEA, 2014).

The higher financing costs in most countries reflect a range of perceived or actual information, technical, regulatory, financial, and administrative barriers, and their associated investment risks. A country needs to provide potentially very high rates of return to investors in order to succeed in attracting private investment for the development of renewable projects, especially if the independent power producers (IPPs) face barriers in accessing to grids, such as length and uncertainty of permitting processes, limited expertise of local supply or lack of long-term price guarantees. Rather than a capital generation problem, the key challenge in financing the transition towards a low carbon energy system is to address the existing investors risks that affect the costs of financing and the competitiveness of renewable energy in most countries. The task of addressing these investor risks has inspired the development of a wide range of public instruments in recent years.

While policy-makers can use a wide variety of different instruments to address the risks of investing in renewable energy and their underlying barriers, certain types of instruments have

become more relevant than others and are often referred to as "cornerstone instruments". A cornerstone instrument targets key investment risks, and it is the foundation on which all complementary policy and financial instruments are built. In general, cornerstone instruments, such as the Power Purchase Agreement (PPA) and feed-in tariffs (FiTs), are supplemented by a number of policy and financial instruments to address investment risks and barriers. Identifying an appropriate combination of policy and financial de-risking instruments to complement a cornerstone instrument can prove very challenging in practice. The rigidity of barriers to investment in renewable energy varies by location and technology. Different resource endowments, market conditions and national goals mean that there is no one-size-fits-all best public instrument mix.

Direct financial incentives for renewable energy are becoming particularly controversial in industrial countries and are likely to prove even more problematic in developing countries (Frondel, Ritter, & Schmidt, 2008; Peters et al., 2012; Hoppmann, 2013).

Decision-makers responsible for selecting an optimal combination of instruments should take into account different considerations. They have to identify the different stakeholders associated with each barrier to investment and understand the varied interests that have generated the barrier. The appropriateness of different public measures to address these barriers needs to be assessed: some public instruments may be less effective and require more time to take effect in some countries than in others. For example, institutional strengthening within ministries may be an important precursor to a well-designed FiT system. While a public instrument may be effective, the public expenditures required to achieve it may be disproportionate, and, therefore, politically unacceptable. Determining the ex-ante cost of public instruments involves multiple and complex assumptions (Schmidt et al., 2012). Direct financial incentives for renewable energy are becoming particularly controversial in industrial countries and even more problematic in developing countries (Frondel, Ritter & Schmidt, 2008; Peters et al., 2012; Hoppmann, 2013).

In order to better understand the impact of different combinations of public mechanisms that can be used to attract investments in the renewable energy sector, and to enable planners and decision-makers to choose the best mechanisms based on best practices, existing experience and case studies are used especially in OECD and other countries. This research aims at providing innovative policy recommendations for improving investment policies to attract private investment in renewable energy in the MENA region through de-risking renewable energy investments.

B. MOTIVATION OF THE STUDY

Many studies have been conducted over the last decade on renewable energy investments, risks and barriers, as well as policy frameworks, but little attention was paid to one of the world's major leading energy hubs, the MENA region. This study is motivated precisely to fill this gap in the literature considering the high importance of assessing the risks linked to different elements that affect investment decisions in the renewable energy sector in the MENA countries. Renewable energy investments in the MENA countries are still insufficient, despite the fact that some countries have announced plans to increase the investments in this field.

Many countries have already presented some mechanisms to promote investments in this key sector, but the efficiency of the public policy in the region is still far from reaching the goals set in these plans, due to the limited effectiveness of public policies in the region, or even the economic cycles. Therefore, a deeper understanding of the policies and measures already in place in the region is needed. Another motivation is the need to limit public spending in the economies of the MENA region, due to the political context in some countries in the region and the current low oil prices for net exporting countries.

Renewable energy investments face additional risks and barriers to any kind of investment, due to the specific nature of renewable energy sector. The dependence of technology, high required investment, long-term returns, regulation, incentives instability or limited financing for this investment are some of these specific issues. Christensen & Hain (2017) identifies some of the problems faced by renewable energy investments, due to the limited statistic information available needed for investment decisions, as well as the difficulty of identifying investors. These shortcomings undermine the potential investment as well as the effectiveness of the policies, due to the absence of foundational knowledge to make the best decisions. Moreover, the spatial context analysed in this research, MENA region, also involves additional challenges, due to the institutional, social, and economic context.

C. CONTRIBUTION OF THE STUDY AND RESEARCH QUESTIONS

While attempting to achieve their goals in promoting renewable energy investments, MENA countries have so far failed to attract the necessary investments from the private sector to participate with major share in the development of renewable energy resources. An investigation should be conducted to understand the reasons behind this modest result.

The main contribution of this research is to analyse the risks of renewable energy investments in the Middle East and North Africa (MENA) region, both from a theoretical and empirical perspective. The literature has not paid enough attention to renewable energy investments and their risks and barriers specific to this area, despite its abundance of renewable resources. It attempts to be the first study about risks on renewable energy investments focused on the MENA region. This study analyses those risks, both from theoretical and empirical perspectives. In this sense, it should be noted the originality of the empirical approach, based on a qualitative survey to different stakeholders involved in the sector in the MENA region. It also provides valuable information for the adoption of more effective policies that will reduce or even eliminate these risks and contribute to the development of renewable energies, taking into account the existing resources in the region. Thus, this input can be useful to contribute to developing a reliable framework for promoting renewable energy investments in the MENA countries.

This thesis has proposed the following research questions**:**

1. What is the status of the renewable energy sector in the MENA region?

2. What are the worldwide renewable energy investments trends, in particular, in the MENA region?

3. What are the benefits from deploying renewable energy sources in the MENA region?

4. What are the policies supporting renewable energy implemented in the MENA region?

5. What are the different risks that affect renewable energy investments, and what is their impact on renewable energy investments?

D. RESEARCH OBJECTIVES

The main aim of this thesis is to analyse the risks and barriers facing renewable energy investments in the MENA region. It also approaches the relation between renewable energy investments and several risks categories, which are associated with investments in renewable energies and the possible tools to reduce and eliminate those risks. In addition, the study addresses to provide policy advice for a more effective design and implementation of policies that promote and support investments in the renewable energy sector in the MENA region.

In addition, the specific objectives of this thesis are the following ones:

1. To analyse the state of the renewable energy sector in the MENA region.

2. To analyse the global trends in renewable energy investments with a special focus on the MENA region.

3. To identify and describe the risks associated with renewable energy investments.

4. To analyse the risks affecting renewable energy investments in the MENA region.

E. METHODOLOGY

The methodology of this thesis combines the theoretical and empirical approach, as usual in the applied economics research. This research adopts a conceptual and analytical framework that uses theoretical and statistical comparative cross-sectional data to analyse and to achieve the proposed objectives.

This study is mainly based on primary data obtained from a survey conducted with key players through a dedicated designed questionnaire. It follows the methodology of semi-structured interviews based on open-ended and flexible questionnaires conducted with several groups of stakeholders interested or involved in renewable energy investments in the targeted region or countries.

This research aims at analysing risks and barriers that are facing investors in the renewable energy sector in the MENA region. Therefore, the target population of the survey are the companies that invest in the renewable energy sector in the MENA region. Based on this information, the study identified the companies based on the only publicly available report that is listing all the registered companies that are investing in the renewable energy sector. This report was published in 2017 by the League of Arab states, and it lists 413 companies, including private and state-owned.(League of Arab States, 2017)

It should also be noted that there are some countries in MENA that were not reachable for various reasons, mainly due to the limited available data. Thus, this research is focused on the following 15 MENA countries: Algeria, Bahrain, Egypt, Jordan, Kuwait, Lebanon, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Sudan, Tunisia and United Arab Emirates.

This study elaborated a survey tool to check the concerns and risks related to renewable energy investment s in the Middle East and North Africa countries. For the purpose of creating this tool, the questionnaire, the study follows these steps:

1. Reviewing the administrative literature and previous studies relevant to the subject of the study, and taking advantage of them in the construction of the questionnaire and the formulation of its clauses.
2. Consulting with many experienced people in determining the dimensions of the questionnaire and its clauses.
3. Identifying the key areas covered by the questionnaire.
4. Determining the elements hat fall under each factor.
5. Designing the questionnaire.
6. Sending a pilot questionnaire to some experts in different fields as referees.
7. Developing the final structure of the questionnaire.

The study questionnaire, which is presented in Annex II, consists of two main parts as follows:

- Part I: This part includes the personal information of the respondents and demographic information about several items, such as sector of activity, type of institution, ownership, level of involvement, type of renewable energy technology, total number of employees working in 2018, annual revenue, position of respondents, respondent level of education and institution age.
- Part II: This part contains the elements related to the main themes of the study and includes questions concerning the factors that are tested in this research. These factors are distributed into eight groups of questions, each of these groups addresses one of the main hypotheses of this research.

This study also uses secondary data, which are obtained from existing literature (both theory and empirical studies) and official statistics. The websites of the leading organisations and institutions that offer real-time data and statistics are also consulted. Taking into consideration the limited number of academic research in the MENA area, this study attempts to gather and analyse the relevant studies and surveys that have been conducted by different researchers that reflect and discuss the most important elements of the research problem.

To conduct this study, seven hypotheses are proposed and tested, based on the literature review and the theoretical framework. Moreover, an extensive review of other surveys previously carried out is done to outline the existing investments trends, barriers, and risks. In addition, the results obtained from the survey are analysed to investigate different factors and propose possible solutions or/ and recommendations.

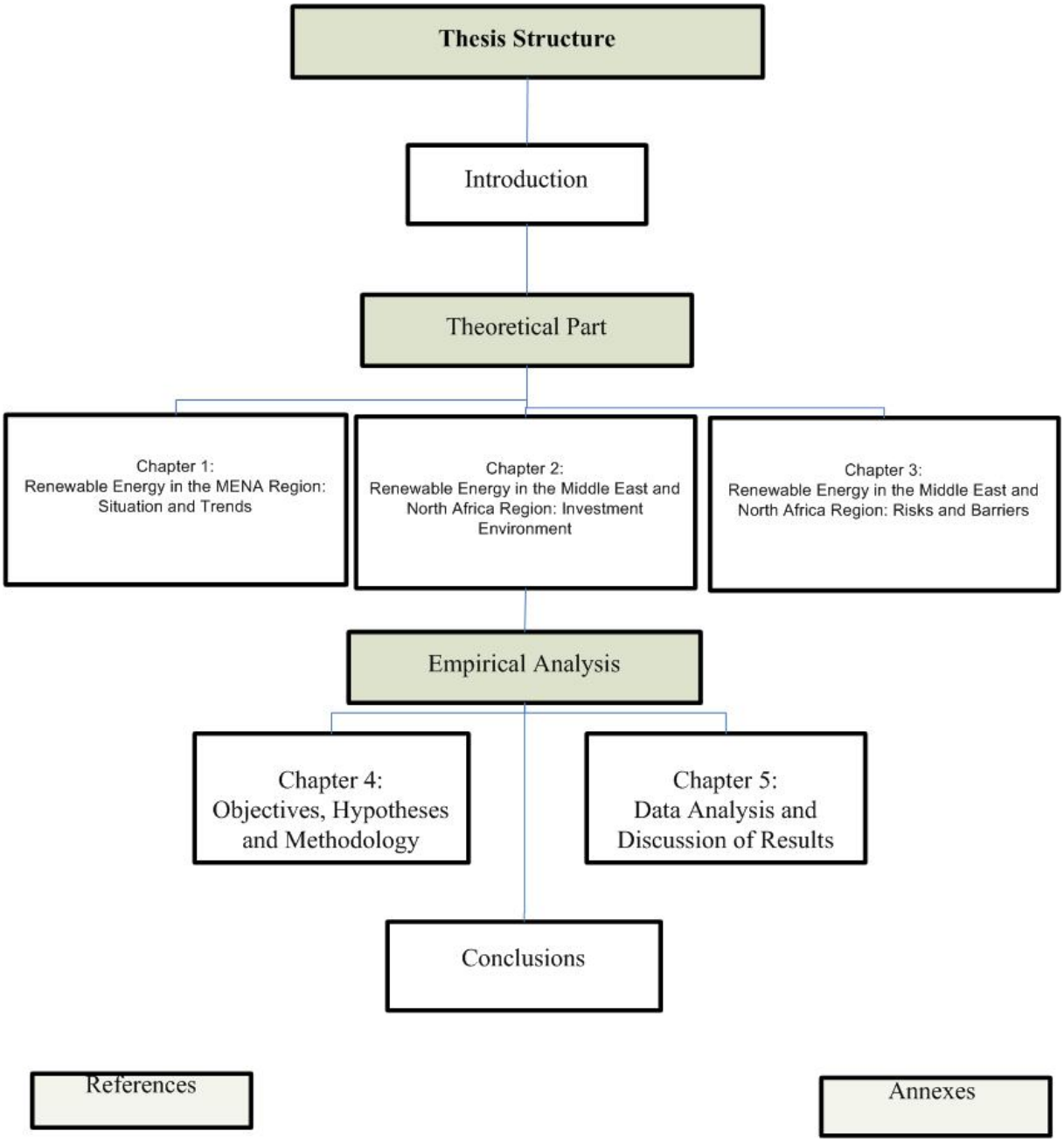
F. RESEARCH STRUCTURE

This research is structured in five chapters, apart from the introduction, conclusions, references, and annexes. The thesis is divided into main parts: the theoretical approach and the empirical analysis. The introduction presents the motivation, contribution, objectives, methodology and structure of this thesis.

The first part, the theoretical part, consists of three chapters. The first chapter analyzes the situation of renewable energies in the MENA region that allows for an understanding of the nature of the sector, its situation, evolution and recent trends. It deals with the renewable energy landscape in the MENA region, the available resources and the potential of the region, the renewable energy market structure, the policy frameworks, and energy subsidies implemented in the region. The second chapter approaches the global investment trends in the renewable energy sector and the forecasts, focusing on the financing and investment issues in the renewable energy sector in the MENA countries. The third chapter analyses the barriers and risks associated with renewable energy investments, with a particular focus on the private investors overview. It tackles the different kinds of risks, such as political, regulatory, institutional, business environment, operational, social, and environmental ones. The identification and understanding of the nature of these risks help to know how they affect the ability of private investors to participate in renewable energy deployments.

The second part of the thesis focuses on the empirical analysis and consists of two chapters. The fourth chapter describes the methodology of this research, its objectives, as well as the proposed research questions and hypothesis of this thesis. Given that this empirical research is based on questionnaires, the specific methodology and the sample are explained. The fifth chapter analyses the information collected by the questionnaire and tests the hypotheses. Finally, the conclusions present the main results of the analysis, as well as provide recommendations and policy advices to face the main challenges and risks faced by renewable energy investments in the MENA region. Finally, this thesis includes two annexes. Annex I presents the profiles that test the pilot questionnaire. Annex II includes the questionnaire that is used to conduct the survey. Figure I.1 summarizes the thesis structure.

Figure I.1: Structure of the thesis



Source: Own elaboration

PART I: THEORETICAL PART

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CHAPTER 1:

RENEWABLE ENERGY IN THE MIDDLE EAST AND NORT AFRICA REGION: SITUATION AND TRENDS

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1.1. INTRODUCTION

The Middle East and North Africa region includes the following countries: Algeria, Bahrain, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, the United Arab Emirates (UAE), and Yemen. Three countries, which are part of MENA region according to the World Bank, were excluded from this research, due to several factors including the shortage of information or the existence ofvery different energy sector mechanisms. These three countries are Iran, Israel, and Turkey. The MENA area is rich in renewable energy resources; however, the area does not underline in the share of renewable energies.

Nowadays, economic development involves a sustainable model. The deployment of renewable energies is a goal included in regional, national and international strategies. The achievement of that target requires significant public and private efforts. In this sense, government support is needed in the promotion of new activities, such as in the case of renewable energies, in order to reduce risks and uncertainty and to assume high investments and long maturing period (Rodrik, 2004; Mazzucato, 2015; Mazucato & Semienuk, 2018; Varela-Vázquez & Sánchez-Carreira, 2018; Borrás & Edler, 2020; Sánchez-Carreira, Vence & Rodil-Marzábal, 2020). The role of the private sector and in particular of investors is crucial. Due to the nature of renewable energies, the private sector requires an environment that favour and promote this kind of investments. Thus, the existence of a reliable policy framework is advisable to deploy renewable energies, in particular, when there are the resources, such as the case of MENA region.

This chapter provides an overview on the renewable energy sector in the MENA region, focusing on available renewable energy resources, energy market structure, policy framework, institutional framework, potential of renewable energy development in the region, benefits from the development of renewable energies in MENA countries, and finally a brief of the last trends in the renewable energy sector in the region.

1.2. RENEWABLE ENERGY FROM A WORLDWIDE PERSPECTIVE

Nowadays, the use of renewable energy has become one of the main axes towards the transition to a sustainable energy system. The interest in generating electricity from renewable energy sources has increased in the world. In addition to its predominant role, renewable energies are one of the elements of the national energy mix in most countries, especially considering that it is one of the three goals of the seventh goal on energy from the 2030 Agenda Sustainable Development Goals adopted by the United Nations in September 2015. To preserve the environment and reduce harmful emissions, the Paris Agreement on Climate Change (adopted at the 21st session of the United Nations Conference of the Parties, on December 12, 2015) (UN, 2018) should be taken into account. This agreement includes the provision of 100

billion dollars per year until 2025 to help developing countries in emission reductions and adaptation to the effects of climate change.

The widespread use of renewable energy applications has resulted in a remarkable reduction in the cost of the produced electricity, especially from sources of direct solar energy (based on photovoltaic solar cell technology) and wind energy, while its use in the areas of heat production or in the transportation sector is still much lower. According to the IEA website, it is expected that by 2022: (1) the rate of electricity generation from renewable energy sources will increase by about one third, and with a limited percentage in the heat production sector, and a slight degree in the road transport sector, (2) the increase in installed capacity of renewable energy in China, the United States and India combined two-thirds of the total global capacity, (3) Denmark leads the world in the contribution of renewable energy to the national energy mix by 70% in the electricity produced, and (4) many countries adopt a policy of competitive bidding with the signing of long-term energy purchase agreements for public utility projects, rather than feed- in tariff policies set by governments.

With regard to electricity, the total installed capacity from the main sources reached 2,195 gigawatts in 2017, including water (1114 gigawatt installed capacity), meaning an increase of about 9% over the year 2016, with steady growth in the use of renewable energy, especially solar systems. Thus, photovoltaic reached 402 gigawatts, which is an increase of nearly 33% in 2017, compared to an increase of approximately 11% in wind farms. Whereas, a negligible increase occurs in the field of thermal solar energy plants (4.9 gigawatts) and other slight ones in the field of geothermal (12.8 gigawatts) for electricity generation, with companies continuing to commit to purchasing electricity generated from these sources (REN21, 2018).

The contribution of renewable energy to produce heat is still modest, due to the low prices of fossil fuels and the lack of supportive policies. The use of solar thermal systems in water heating in the domestic sector is one of the most important applications of renewable energy commercially widespread in the world, due to the simplicity of technology, reasonable cost and national policies that encourage its use. The total capacity of solar thermal water heating systems reached 472 GW in 2017, an increase of about 54% over 2016. The rate of using solar thermal systems for heating in industrial processes increased by 21% over the year 2016, bringing the total to around 135 GW in 2017.

Regarding the transportation sector, liquid biofuels play a growing role in the road transport sector in a number of countries, especially on the developed ones. The global increase in production reached 2.5% in 2017 over 2016. The ethanol production, which is the most relevant, amounted to 106 billion litres in 2017, compared to 103 billion litres in 2016; while biodiesel production was 31 billion litres in 2017, equal to the value of 2016. The amount of processed vegetable oils produced increased from 5.9 billion litres in 2016 to 6.5 billion litres in 2017. The use of renewable energy in electric cars is still simple (about 2 million cars at the end of 2016), depending on the availability of the related infrastructure (IEA, 2017).

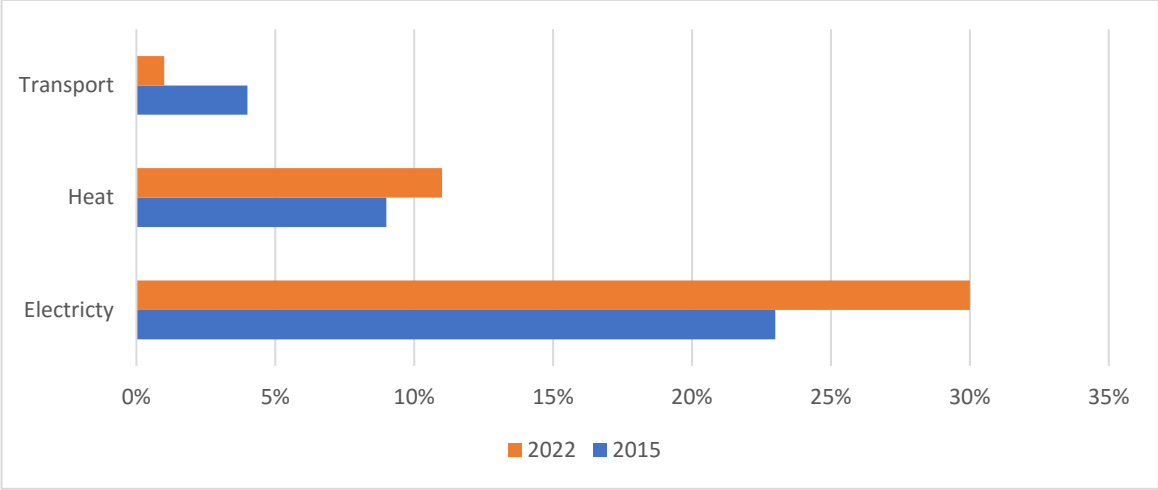
Concerning the international trends for renewable energy policies, the 2015 Paris Agreement, as the most important outcome of the United Nations Conference on Climate Change No. 21, had a great impact on many countries of the world. On the specific case of developing countries, they have shown from 2016 a growing interest in specific voluntary national contributions to limit the effects of climate change and achieve sustainable development goals, including the seventh goal on energy. This can be checked through the

inclusion of renewable energy goals in their national plans to diversify the energy mix and develop and implement related policies.

The forms of interest in adopting renewable energy goals vary according to national priorities, through official announcements issued by governments or heads of state to develop plans and programs accompanied by standards and application mechanisms or focus on specific renewable energy technologies. The enactment of legislation and the adoption of plans, action programs and incentive policies have led to more technological progress, lower costs, accelerated use of renewable energy, and an increase in its share in the national energy mix in many countries (developed and developing). There were 179 countries that have renewable energy targets by the end of 2017, 87 of which have set targets in the form of a share of primary and/or final energy (produced/consumed), while 146 countries have set targets for the contribution of renewable energy to the electricity sector. Renewable energy targets in the areas of heating and cooling were included in the plans of 48 countries, and in the transport sector in 42 countries.

In general, renewable energy policies implemented in many countries aim at (UNESCWA, 2019): (1) disseminating appropriate renewable energy technologies with a focus on electricity production, (2) developing the necessary infrastructure, (3) developing legislation and adopting standards and specifications for networks, equipment and related systems, (4) improving the business environment to attract private investment and encouraging small and medium renewable energy projects at the local level, and (5) supporting research and development activities linked to national industrial capabilities. In general, policies that target environmental issues are general and broader and have a positive impact on renewable energy markets, in terms of the efficiency of natural resource management and the interconnectedness among energy, water and food, spreading the use of cleaner production technologies and reducing harmful emissions. Nevertheless, traditional energy subsidy policies are still followed in many countries, especially in developing countries. Thus, policies to support renewable energy technology in the heating, cooling and transportation sectors have not clearly developed (REN21, 2018). Figure 1.1 shows a prediction of global renewable energy demand by sector between from 2015 until 2022.

Figure 1.1: Forecast of global renewable energy demand by sector 2015-2022



Source: IEA Renewables website

1.3. THE POTENTIAL OF RENEWABLE ENERGY DEVELOPMENT IN THE MIDDLE EAST AND NORTH AFRICA REGION

Once described the general situation of renewable energy worldwide, this section deals with the potential of development of renewable energy in the MENA region, focusing on two main elements: the competitive advantages and the potential markets.

1.3.1. Competitive advantages of the Middle East and North Africa region

The geographical location of the MENA region is an important reason for renewable energy development for power generation. This area receives one of the longest periods of continuous sunshine in the world. According to IEA, the concentrated solar power (CSP) plants can be able to generate around 100 times the combined current consumption of electricity in Europe and the MENA region (IEA, 2010).

The coastlines near the Red Sea and the Atlantic Ocean and certain parts of the Sahara are the prime targets for wind energy generation. The wind speed in these regions is usually above 6.9 m/s, which is the theoretical threshold for wind power plants (GWEC, 2013). Several countries located in the region have the opportunity to shift the total energy mix to wind energy. Thus, solar and wind energy can potentially shift the major mix of energy to renewable energy. This will strengthen the sustainability and reliability of the supply of energy.

Another important factor that can increase the share of renewable energy in the total energy mix is a coordinated regional scheme. This scheme could spread from Morocco in the west to Oman in the East that will considerably increase the number of hours of sunshine per day.

Renewable energy development will greatly increase the energy efficiency. Less energy will be required to produce electricity for a unit of an economic unit, i.e. energy used per GDP unit. Despite the high potential and benefits of renewable energy development, the sector of renewable energy accounts for only 6% of the total power generated in the MENA region (IEA, 2016). In this regard, renewable energy represents 12% of the generated electricity in Egypt, 7% in Syria, 6% in Morocco and 3,5% in Lebanon. These are the most proactive countries in renewable energy in the MENA region, while the share of renewable energy generation is less than 2% in the other countries in the region. Moreover, if a large hydro project is excluded, the share of renewable comes down to just 1.3% in the MENA region. Despite being renewable, large hydropower projects, such as the Aswan High Dam, have a significant environmental impact.

The positive insight is that countries in the MENA region have taken considerable progress in developing renewable energy. Seven countries in the region, namely Egypt, Libya, Algeria, Morocco, the UAE, Jordan, and Tunisia, have adopted national plans with targets to increase the share of renewable energy in the power generation in the upcoming years. These countries have set up national agencies to promote and monitor the development of renewable energy. For instance, Morocco introduced the National Renewable Energy Efficiency Plan in 2008. The

national policy intends to increase the share of renewable energy in power generation to 15% by 2020. This plan is projected to create additional 40,000 direct and indirect jobs in the country, as well as attract investment of around USD550 million (Ministère de l'Energie, des Mines, de l'Eau et de l'Environnement, 2011).

There are many reasons for the slow adoption of renewable energy in the MENA region. One of those different reasons is that innovative renewable energy technology remains costly for most countries in the region. In addition, the government energy subsidies create an uncompetitive and rather distorted market for renewable energy development, as it is shown in section 1.6. A wide range of opportunities can be created for the development of large-scale power projects through cooperation between the public and the private sources. A perfect example of this is the Shams 1 renewable energy power project in Abu Dhabi.

1.3.2. Potential markets for the renewable energy generated in the Middle East and North Africa region

Concerning the potential markets for the renewable energy generated in the MENA countries, Europe outstands. The demand for energy in Europe is expected to increase at a lower rate than the global demand. However, European consumption is significant, because it accounts for 14% of the total worldwide energy consumption.

The IEA forecasts show that the primary demand will increase from 1,777 Mtoe in 2009 to around 1,904 Mtoe by 2035. This represents an increase of about 8% in energy demand. This optimistic projection of increased energy demand takes into account a number of assumptions concerning energy efficiency improvements. On the one hand, an important factor is the EU 2020 Vision that targets providing about 20% energy demand through renewable energy sources by 2020 (OECD, 2013b). On the other hand, the European Commission projection is that power consumption will increase between 5 to 9% by 2020. This depends on the oil price, estimating a larger increase in case of moderate oil price levels (Commission of the European Communities, 2008). The demand for fuel used in the transport sector is expected to increase by about 17% to 21% by 2020 in comparison to 2009.

The closeness of the MENA region to Europe means that energy transfer can take place between the two regions. This will contribute to increase energy security and reduce greenhouse gas emission (GHG) emissions in Europe (OECD, 2013b).

The EU energy strategy aims at achieving a series of targets for 2020, 2030, and 2050 concerning GHG, energy efficiency, and renewable energy. To address these targets, a series of measures have been implemented or taken under consideration. Some of the initiatives regarding power generation include improvement in the power market design in the region, a new renewable energy directive for the period 2020-2030, and improvements in the effectiveness of the Emissions Trading System that governs emissions in the industry, aviation, and power sectors. Table 1.1 shows the national targets concerning renewable energy in the EU region (OECD, 2013b).

The price of carbon has decreased to about €4 to €7 per tonne of CO_2 at present. By modifying the allowances for energy supply, the EU projects increase in carbon prices that will provide an incentive for switching from large scale fuel power projects to small scale projects. However, it is still not clear whether the proposals will have an effect.

Table 1.1: National targets concerning renewable energy in the EU region

Country	Renewable energy %[a]		
	2006	2010	2020 target
Austria	26.6	30.1	34
Belgium	2.7	3.8	13
Bulgaria	9.6	13.8	16
Cyprus	2.5	4.8	13
Czech Republic	6.5	9.2	13
Denmark	16.5	22.2	30
Estonia	16.1	24.3	25
Finland	29.9	32.2	38
France	9.6	12.4	23
Germany	6.9	11.0	18
Greece	7.0	9.2	18
Hungary	5.1	9.5	13
Ireland	2.9	5.5	16
Italy	5.8	10.1	17
Latvia	31.1	32.6	40
Lithuania	16.9	19.7	23
Luxembourg	1.4	2.8	11
Malta	0.2	0.4	10
Netherlands	2.7	3.8	14
Poland	7.0	9.4	15
Portugal	20.8	24.6	31
Romania	17.1	23.4	24
Slovak Republic	6.6	9.8	14
Slovenia	15.5	19.8	25
Spain	9.0	13.8	20
Sweden	42.7	47.9	49
United Kingdom	1.5	3.2	15
EU27	9.0	12.4	20

[a]. This represents a share of the gross net consumption of energy. The figures for France, Belgium, and Hungary are from 2009.
Source: OECD (2013b, p. 34)

The renewable energy target in the EU region as a whole is expected to increase from 29% at present to about 45% by 2030. The increase in the pace of renewable energy development has created challenges for the electric system in the EU. Thus, the electricity system in the region has to adapt to the increasing volumes and capacities of variable and decentralized production from solar and wind plants (IEA, 2016).

After reaching a pre-recession demand peak of about 3,000 TWh in 2008, the energy demand as well as supply in the EU region has significantly changed. This shift in demand was mainly due to demographic, economic, and policy factors (IEA, 2016). The total demand had fallen by around 6% from 2008 to 2014, before increasing a little in 2015. The slow growth estimation in demand means that the consumption of power will reach 2008 levels no earlier than 2020. The growth in demand by the industrial sector has decreased by 13% during the period 2007-2014. The decrease in industrial demand continues to inhibit the growth in overall electricity demand in the IEA Outlook.

The EU cement and steel production are expected to remain at the present levels. One of the largest power consumers in the region is the chemical sector that faces strong competition from chemical facilities in the US, which have relatively cheaper access to ethane and natural gas. For this reason, the production of propylene and ethylene is expected to fall significantly by about 25%, which will result in decreasing electricity consumption by about 33% (IEA, 2016). Gains in efficiency in most sectors also inhibit demand. The share of power used by the industrial sector remains flat in general even though electricity consumption by the sector accounts for 35%. The energy demand currently remains well below the 2007 levels.

The policy regarding energy efficiency has also resulted in a slight increase in the electricity demand in the building sector. The annual increase in electricity consumption of about 0.6% is half of that observed from 2000 to 2014. Furthermore, electricity used by the transport sector has nearly doubled, but only accounts for 5% of the total energy consumption at present (IEA, 2016).

The EU MENA cooperation concerning renewable energy projects is estimated to have a strong contribution to meeting the GHG emissions targets of about 80% to 90% below the levels in 1990. The targets for the EU region are set in the Energy Roadmap 2050.

The Article 9 of the European Commission Directive 2009/28/EC on the Article 9 on the promotion of renewable energy development has set the roadmap for implementing joint projects that can help member states achieve the targets in a more cost-effective manner via import of electricity. Nevertheless, joint projects represent many challenges. The *MENA-OECD Task Force on Energy and Infrastructure* has indicated the main challenges based on the delay of joint projects between Morocco and the EU member states (OECD, 2013b). They include the following ones:

- Absence of incentives since the 2020 energy targets do not help some EU members such as Spain and Italy to use co-operation mechanisms;
- Challenges related to infrastructure since importing electricity in the EU states results in pressure on the existing systems;
- Lack of support schemes since Article 9 does not concern with the latest support schemes;
- Lengthy bureaucratic process in the MENA region;
- Political obstacles since the joint projects require agreements between MENA and the EU member countries;
- Uncertainty regarding regulatory changes since Article 9 has not been adopted in the national laws of member countries.

Various measures have been taken by the EU region to overcome the abovementioned obstacles. The steps taken to ensure that joint projects are more functional refers to the legal and institutional support for these projects. The aim is to help trade and investment in renewable energy among the member states. There is still a need for increased cooperation between the EU-MENA states in the long run for the development of renewable energy. Nowadays, the countries in the northern Mediterranean have a surplus energy capacity, while the southern Mediterranean countries have a deficit. This increases the obstacles to establish joint power project in the short term. In addition, the current economic position in the northern Mediterranean countries does not allow subsidies to the public sector.

1.4. BENEFITS FROM THE DEVELOPMENT OF RENEWABLE ENERGY IN THE MIDDLE EAST AND NORTH AFRICA REGION

Concerning the MENA region, estimates show significant economic benefits due to renewable energy development. The countries in this area have great potential for the development of solar and wind energy, as it was shown in the previous sections. In addition, the proximity of the region to Europe means that the market of surplus energy is nearby.

Developing the renewable energy power will result in the generation of additional jobs, and IRENA estimated that global renewable energy employment increase by 5% in 2015 to reach 8.1 million, including 1.3 million people employed in large hydropower (IRENA, 2016b). Moreover, support and development of energy projects will have a significant impact on the public finance and balance of payments of the local economies. For instance, Morocco relies on coal and oil imports to meet 95% of the energy needs. Its government allocates about 4.4 billion euros for import of oil in the annual budget (IEA, 2013a). The import of oil costs the country nearly 5% of the GDP, while the budget deficit amounted to 2.2% of GDP in 2009 (IEA, 2013b). Thus, renewable energy development can help in improving the balance of payments in Morocco and other countries in the MENA region, including the specific cases of Oman, Egypt, Yemen, and Tunisia. The domestic hydrocarbon resources in these countries are limited. If renewable energy resources are developed, the countries will have to import less oil and export surplus energy. This can result in a positive balance of payments thereby greatly improving the public financial position. About 80% of the average revenues of the oil-exporting countries and 40% of the GDP are associated with oil export (CIA, 2017). The development of renewable energy can help oil-exporting countries in the MENA region to diversify their economies. The transfer of skills and technology can greatly improve the local economy and result in less dependence on hydrocarbons.

The development of renewable energy presents several benefits in different fields, including economic and social issues. The development of renewable energy can influence the overall economy of a country. Thus, investment in renewable energy will directly and indirectly affect the economy of the country. There is a correlation between the development of renewable energy and the creation of employment (Ragwitz et al, 2009; OECD, 2013b). Employment is particularly pertinent to the MENA region.

The policies aimed to promote the development of renewable energy lead to the following changes in the economy (Ragwitz et al., 2009):

- Investment demand in the energy sector is affected. It influences the employment in a country depending on the efficiency of the sector.

- Changes in the energy prices affect the personal income, production costs, and consumption of intermediary inputs.

- Improvements in productivity due to additional investment and transfer of technology that leads to additional competition.

All the above changes directly affect the economic output and the employment levels within a country (Ragwitz et al., 2009).

The development of renewable energy technologies provides many economic advantages in the MENA region. Renewable energy development is considered as the best long-term alternative for countries that lack natural oil resources. Some countries in this region, such as Jordan and Morocco, can benefit from improved energy security and reduced dependence on import. Renewable energy development is expected to result in improved trade balances for countries that are net oil importers. Oil producers in the MENA region will also benefit from renewable energy development. The oil-rich countries will be able to diversify their economies and benefit from the resulting transfer of technology to the local economy. Furthermore, renewable energy development will help the oil-exporting countries to boost export revenues.

Despite the clear advantages of developing renewable energy, development on a large scale has been hampered due to the imperfect market position. Moreover, A large share of the infrastructure required for renewable energy development is still not built. Due to the need for scaling up investment in the infrastructure in the next few years to support and diversify the economy, there is an increased opportunity to accelerate the development of renewable energy by introducing efficient and greener infrastructure (Corfee-Marlot et al., 2012). There is a need for the government to offer subsidies as well as provide investment incentives and support mechanisms to promote large scale development of renewable energy.

A significant advantage of renewable energy development is that the sector is labour intensive. Therefore, investment in renewable energy development can lead to the creation of additional local jobs, as it is shown in this section. Moreover, a social effect is tackled, namely poverty alleviation in rural areas.

1.4.1. The employment impact of renewable energy development

The development of renewable energy has an impact on employment. The gross employment comprises of the positive effects of the development of renewable energy. On the contrary, the effect on net employment consists of the approximate difference between the positive and negative effects on the economy (Ragwitz et al., 2009).

The quantitative examination of the influence of renewable energy on the labour markets shed light on the fact that renewable energy is highly labour intensive (ILO, 2008). The renewable energy sector is more labour intensive than the traditional fuel oil sector.

Table 1.2 shows the findings of a study conducted by the green job initiative members[1] regarding the estimated employment needed in the energy sector per megawatt and technology type (UNEP et al., 2008). It depicts that that solar power plants use more labour compared to traditional fuel oil plants per unit of power generated, per unit of installed capacity, and per dollar investment. About seven times more labour is required on average for PV plants as compared to coal power plants. Wind power plants also use on average 1.83 times more labour than natural gas plants.

The renewable energy development had led to the employment of 1.4 million people in Europe; thus, the sector had contributed around 0.6% to employment. A significant share of employment, which is estimated at 0.9 million, was attributed to small and medium sized companies. The renewable energy sector is expected to create new 115,000 to 201,000 jobs up

[1] The members of this initiative are the following ones: United Nations Environment Programme (UNEP), International Labour Organisation (ILO), International Organisation of Employers (IOE) and International Trade Union Confederation (ITUC).

till 2030 in the EU region. The estimation is based on the figures released by the European Commission DG Energy and Transport (Ragwitz et al., 2009).

Table 1.2: Estimated employment per megawatt: fuel oil and renewable power

	Average employment over life of facility (jobs per megawatt of average capacity)		
	Manufacturing, construction, installation	Operation and maintenance/fuel processing	Total
Solar PV	5.76-6.21	1.20-4.80	6.96-11.01
Wind power	0.43-2.51	0.27	0.7-2.78
Biomass	0.40	0.38-2.44	0.78-2.84
Coal-fired	0.27	0.74	1.01
Natural gas-fired	0.25	0.7	0.95

Source: OECD (2013b, p. 37)

The *Climate Change and Energy in the Mediterranean* study that was developed by Plan Bleu in coordination with the European Investment Bank (EIB) shows that the renewable energy will become the second major source of power generation in the south and east Mediterranean countries by 2030 (El Andaloussi & Costes, 2012). The potential job creation in the region through renewable energy development is projected to be between 1.9 million and 2.5 million by the end of the next decade. According to the same study, the demand for power will increase due to sustained population growth. Thus, the growth of population will lead to an increased need for housing and electronic goods, which will result in increased energy demand. In addition, the Plan Bleu estimates that about 42 million new housing units will be required by 2030. The construction of energy efficient building will result in the creation of additional 1.5 million jobs by the end of the next decade.

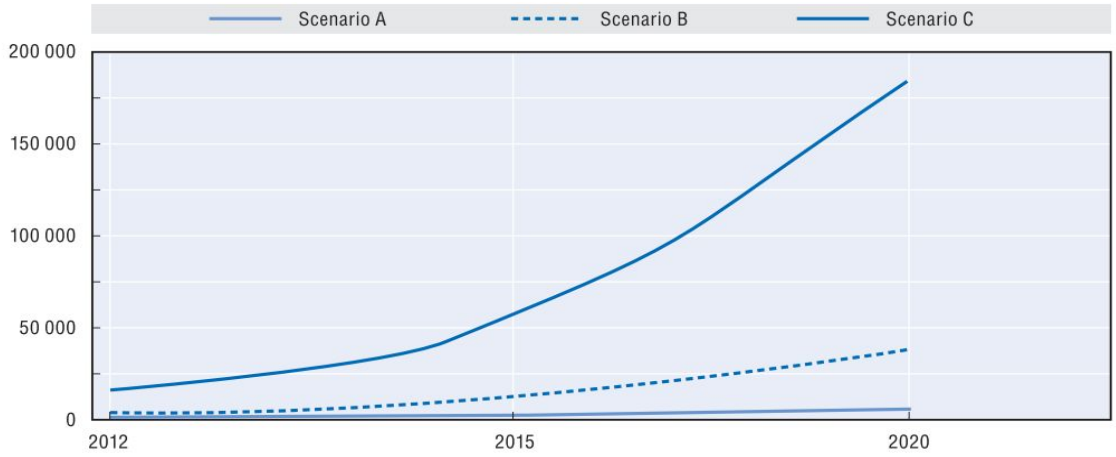
Renewable energy is based on a relatively new technology, which is in the early stages of development, although the level of maturity depends on the specific technology. This can partly explain the abovementioned gap. The fuel oil sector was able to increase the output and reduce labour inputs between 2000 and 2009, due to better technology, improved automation, and recovery techniques. In general, the employment in extraction, electric and gas activities tend to decline. For instance, the production of electricity continued to increase in Saudi Arabia between 2001 and 2009, but the employment in the electric and gas sectors decreased by 13% during the same period, according to the labour statistics (Laborsta) of the International Labour Office (ILO). Employment in the extraction industry was just 1% of the total labour force in 2008. In Egypt, the employment in the mining and quarrying sector had declined by 40% from 595,000 to 355,000 during the period 2001-2009. Employment in the UAE had decreased by 13% from 407,640 to 359,280 between 2000 and 2008. These data clearly show that the hydrocarbon power plants are capital-intensive instead of labour-intensive. Job creation will remain minimal in this sector. For this reason, the transition to the renewable energy sector is important as it will lead to the creation of jobs in the short and medium term (UNEP et al., 2008).

Renewable energy development will result in increased employment in various sectors. The manufacturing activities, including fabrication and design as well as R&D of renewable

energy technology will lead to the creation of jobs. These activities require different skills that range from low skills, such as maintenance of the premises to specialised skills (World Bank, 2011). Furthermore, all the jobs that are related to renewable energy power plant installation are local. In the case of renewable energy technological components, they can be developed locally; thereby more local jobs can be created. The local manufacturing of the components will also result in reduced transportation costs that are associated with bulky wind turbines and solar panels. However, the local manufacturing of renewable energy components and the resultant addition in jobs is only possible if the barriers to local manufacturing are reduced and the requirements of the contract are flexible.

Furthermore, while the government usually buy large shares in the shareholding to protect natural resources, such as natural gas and oil, renewable energy development requires a totally different approach. A large number of foreign investments will likely lead to increased transfer of technology. This is rarely the case in the MENA region for renewable energy projects. These countries, in particular in North Africa, lack the technological know-how of cost-effective manufacturing of renewable energy components. Therefore, the transfer of technology will greatly benefit the countries in the local development of renewable energy components. The required skills will be developed by extending the value chain and carrying out training and education programs. This is only possible in the case of increased foreign investment in renewable energy development. In addition, one study conducted by the World Bank (2011) found that more than 48,700 new local jobs can be created for manufacturing CSP components by 2025 in five countries in the MENA region, namely Egypt, Algeria, Jordan, Tunisia, and Morocco. This projection was based on a conservative calculation with the basic assumption that the manufacturer uses the same number of employees as in comparable plants in Europe. Another study commissioned by the World Bank and conducted by Ernst and Young analysed the potential of new job creation due to renewable energy components manufacturing in five regions in the MENA region (World Band, 2011). This study assesses direct and indirect job creation regarding the construction of CSP plants, maintenance, and operation. Figure 1.2 reflects the effects of different stages of the CSP sector on employment from 2012 to 2020. Scenario A refers to stagnation, scenario B to small scale deployment and scenario C to high scale development (World Bank, 2011).

Figure 1.2: Total number of annual jobs created by CSP deployment in five MENA countries



Source: OECD (2013b, p. 38)

1.4.2. The social impact of renewable energy development

Apart from a positive impact on direct and indirect employment opportunities, the development of renewable energy can present social effects. In this regard, the technology development of renewable energy can lead to rural electrification, an outstanding effect in the MENA region. This can have a beneficial impact on the local economy.

Renewable energy makes it possible to combine small plants in rural areas that will result in the creation of new jobs at the local level (OECD, 2013b). The lack of power supply in the rural area constrains local development of the economy and prevents active participation of women (ILO, 2008)[2]. Moreover, women are mostly affected by the lack of power supply in a region since they are responsible for cooking, cleaning, and heating in most homes. Much time is spent collecting manure and firewood for burning. The same study found that workload prevents girls from attending school and thus it limits their participation in the economy. They cannot find skilled jobs and contribution to the economy, due to the lack of education. In fact, the lack of education makes them a liability for the country.

Energy supply to the poor areas will trigger increased contribution from the local people. It will enable local entrepreneurs to set up small businesses, such as the repairing of electronic devices and equipment. Both existing and future generation can benefit from the supply of electricity in the region. It will release time of the women and children that can be utilized in gaining education. This will lead to improve standard of living of the poor people. In this regard, Grameen Sakti microloans solar PV programme in Bangladesh has helped in bringing light to thousands of homes. This programme has contributed to the installation of more than 100,000 solar home systems in a poor region. Moreover, more than 1,000 women have been trained through this program as technicians to maintain solar systems (Grameen Shakti, 2009).

1.5. RENEWABLE ENERGY RESOURCES IN THE MIDDLE EAST AND NORTH AFRICA REGION

The MENA region as a whole has been richly endowed with renewable energy sources, in particular concerning wind and solar. The conditions in the region are favourable for renewable energy development that will make the transition to a renewable-based power generation more economically feasible and attractive in comparison with other regions in the world (Desertec Industrial Initiative, 2013).

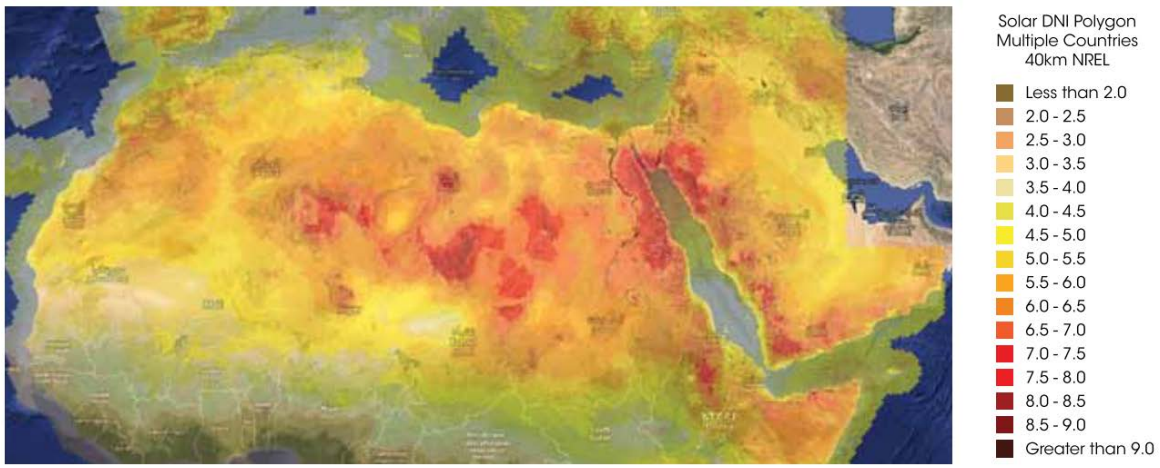
The main measure of the suitability for a solar thermal project is Direct Normal Radiation (DNR). This figure ranges between 2,050 to 2,800 kWh-per-meter square-per-years in the MENA region, as depicted in Figure 1.3, with minimal cloud cover that lasts for less than 20%

[2] An illustrative example of this relationship is shown in the brochure *Green jobs: Improving the climate for gender equality too!* elaborated by ILO in 2009.

in a year (League of Arab States, 2013). These rates are among the best in the world, which means that the MENA region is suitable for Solar Concentrated Photovoltaic (CPV), Concentrated Solar Power (CSP), and solar cooling and heating purposes. According to the 2010 report by the International Energy Agency (IEA), CSP alone can generate power that is 100 times more than the combined demand in Europe and the MENA region (IEA, 2010).

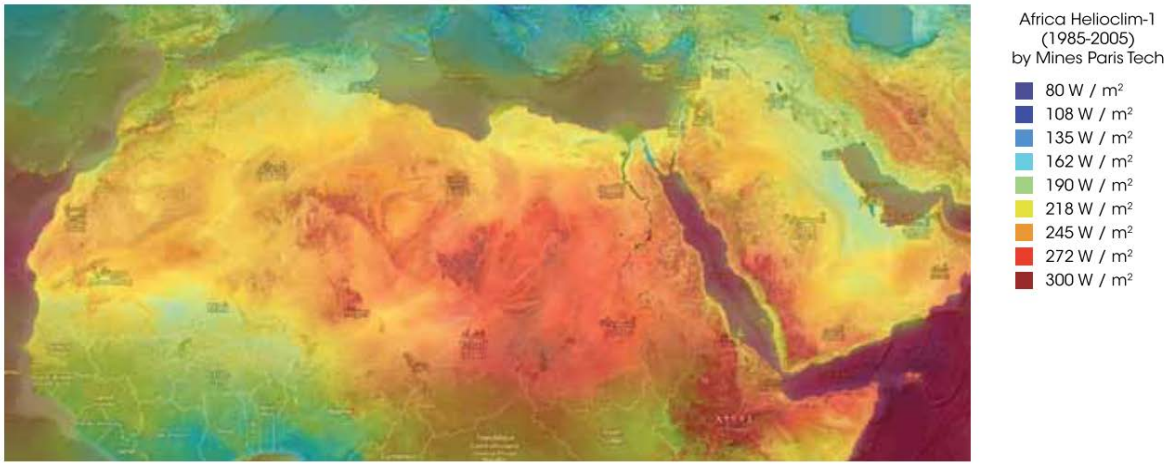
As Figure 1.4 shows, the conditions in the region are favourable for CPV application as the global horizontal irradiance (GHI), which is a measure of the suitability of PV generation, lie in the range of 1,920 and 2,450 kWh/m^2/year. These values are some of the highest in the world. The lowest value is found in Lebanon, while Egypt presents the highest value.

Figure 1.3: Map of direct solar radiation in the MENA region in 2005



Source: IRENA (2014, p. 25)

Figure 1.4: Map of global solar radiation in the MENA region in 2005



Source: IRENA (2014, p. 25)

The examination of temporal and spatial variability and availability of the position for solar energy is important for the selection of site, optimum design, and technology selection for solar power plants. Solar Atlas for the Mediterranean (Solar-Med-Atlas) has developed high-resolution solar images for the MENA countries. The company has developed a web portal of direct and horizontal normal irradiance data[3]. The online portal provides 1x1 km high-resolution images 20-year (1991-2010) data for the entire region. This project was headed by the German Aerospace Centre that cooperated with a number of different firms including the Regional Centre for Renewable Energy and Energy Efficiency (RCREEE) that had the financial support of the German International Climate Initiative (GICI). Planners and installers of small renewable energy projects, such as solar water heating and rooftop PV, as well as large project development companies could use the information as a first estimation to initiate project development.

The Global Atlas for Renewable Energy is another wide-spectrum resource that was headed by the International Renewable Energy Agency (IRENA) and supported by well-known international companies (IRENA, 2017). The project was developed in collaboration with the Solar-Med-Atlas. It is also an online portal that offers homogeneous wind and solar data for different countries in the world. These data allow users to obtain information related to roads, protected areas, and infrastructures. The additional information allows users to identify areas of opportunity for developing projects and support planning, policy formulation, and evaluating the investment in solar and wind projects. The Global Atlas for Renewable and the Solar-Med-Atlas projects offer invaluable basic information to the companies based on which it can evaluate specific sites. These online resources allow companies to focus on value added and personalized service based on specific commercial data and consultancy for specific projects.

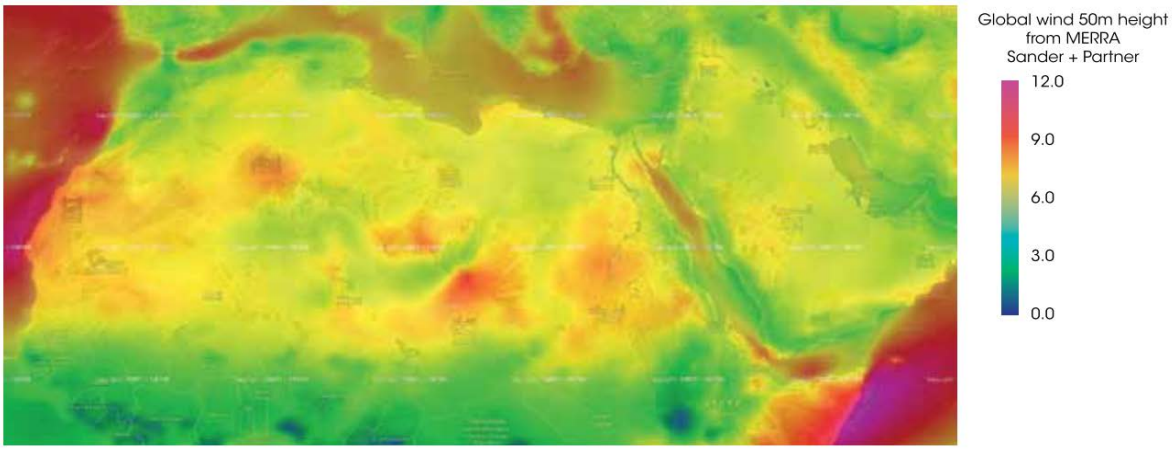
The wind energy resources are also abundant in the MENA region, as can be seen in Figure 1.5, albeit it is concentrated on specific geographical areas. In particular, the Red Sea and the Atlantic regions are an attractive place for solar wind farms. The wind in the region exceeds the speed of 6.9 m/s, which is more than the feasible economic limit (OECD, 2013b). For instance, the annual average wind speed in the Gulf of Suez ranges from 7 m/s to 10 m/s, which is again well above the minimum threshold of about 6 m/s required for utility-scale wind power plants according to Hill Country Wind Power website. There is also significant wind potential with speeds that meet and exceed the minimum limit and full load wind hours of 2,463 and 2,708 in Oman and Morocco, respectively. The average wind speed in Mauritania is around 7.5 m/s in the coastal points and 5 to 6 m/s in other regions.

IRENA had developed the Global Atlas online portal and it had advised RCREEE in 2012 to prepare case studies to assess resource potential and recommend policies in Morocco and Egypt (IRENA, 2016a). These case studies shed light on the development of national wind map and atlas, as well as explaining the specific renewable energy programs in the respective countries. The report delves light on how information relating to renewable energy project was gathered and examined, and how policy-makers used the information for introducing energy policies, identifying areas that are ripe for exploration, and allocating land for specific power projects. In certain parts of the MENA region, there is also good potential for biomass, geothermal, and waste-to-energy power projects. Areas such as Saudi Arabia, Morocco, Algeria, and Yemen experience annual temperatures of more than 200 degrees Celsius at the depths of 5000 meters, making them an ideal site for alternative renewable energy generation. Moreover, countries such as Sudan with adequate agricultural activities have a great

[3] www.solar-med-atlas.org/

opportunity for biomass renewable energy generation. Table 1.3 lists some of the indicators of renewable energy resources that reflect the great potential for the countries in the MENA region.

Figure 1.5: Map of wind speeds at 50 metres height in the MENA region



Source: IRENA (2014, p. 27)

Table 1.3: Renewable energy resource indicators in the MENA countries

Country	Global Horizontal Irradiance (kWh/m²/year)	Direct Normal Radiation (kWh/m²/year)	Wind - Full Load Hours/year	Geothermal - Temperature (°C) at 5 000 m
Algeria	1 970	2 700	1 789	213
Bahrain	2 160	2 050	1 360	100
Comoros	N/A	N/A	N/A	N/A
Djibouti	N/A	N/A	N/A	N/A
Egypt	2 450	2 800	3 015	180
Iraq	2 050	2 000	1 789	100
Jordan	2 320	2 700	1 483	100
Kuwait	1 900	2 100	1 605	100
Lebanon	1 920	2 000	1 176	100
Libya	1 940	2 700	1 912	100
Mauritania	N/A	N/A	N/A	N/A
Morocco	2 000	2 600	2 708	281
Oman	2 050	2 200	2 463	100
Palestine	N/A	N/A	N/A	N/A
Qatar	2 140	2 200	1 421	100
Saudi Arabia	2 130	2 500	1 789	275
Somalia	N/A	N/A	N/A	N/A
Sudan	N/A	N/A	N/A	N/A
Syria	2 360	2 200	1 789	100
Tunisia	1 980	2 400	1 789	188
UAE	2 120	2 200	1 176	100
Yemen	2 250	2 200	1 483	295

Source: IRENA (2014, p. 28)

1.6. ENERGY MARKET STRUCTURE IN THE MIDDLE EAST AND NORTH AFRICA REGION

The openness of the markets to the private generation of renewable energy is an important consideration regarding to renewable energy generation in the MENA region. The power sectors in the majority of the countries in that region are characterized by state control and vertical integration at a large scale. Concerning the first feature, the power sectors have been under the control of the state in the MENA region, as it happens in other developed countries, such as in most of the European countries, at least at the initial stages (Millward, 2005). The sector in the MENA region has also been characterized by vertical integration and monopoly. A high level of vertical integration refers to a situation where every stage of the power generation value chain including power generation, distribution, transmission, and retail are operated and owned by one actor. In this context, this section covers the key elements that make one market more attractive than others. This is required for a better understanding of the potential of private sector participation in renewable energy generation.

1.6.1. Unbundling in the Middle East and North Africa region

The separation of diverse segments of the value chain in the energy sector is referred to as unbundling[4]. It is one of the most important requirements for eliminating conflicts among the actors and increased competition in the market. The electricity segment can be unbundled in many different ways depending on the extent of vertical separation. It allows differentiation between legal, ownership, accounting, and functional separation. The highest level of unbundling is achieved in the ownership separation stage, where the distribution and transmission of the infrastructure are entirely separated from the power generation stage. In most cases, the power sector operates under the same ownership for other types of unbundling with separations mainly occurring at the lower levels.

The majority of the countries in the MENA region have put forward reforms in the power sector to open the electricity market and achieve more integration of the private sector. In this context, six countries in the region have taken the steps towards unbundling of the power generation, distribution, and transmission activities. These countries are currently implementing a functional and transparent organization to prepare for the transition which will last for about a decade.

Regulations are important in the renewable energy sector. The independent regulators play an important role. They are tasked with enforcing legal laws that will be the basis of an unbundled and open market. Every country in the MENA region has taken the step to establish regulatory authorities.

4 Unbundling is the separation of energy supply and generation from the operation of transmission networks. If a single company operates a transmission network and generates or sells energy at the same time, it may have an incentive to obstruct competitors' access to infrastructure. This prevents fair competition in the market and can lead to higher prices for consumers. https://ec.europa.eu/energy/en/topics/markets-and-consumers/market-legislation

A full ownership separation in the power sector has been achieved in Jordan. The country has adopted the Jordanian General Electricity Law in 2003 and taken initiatives for a fully unbundled power sector, where the ownership of generation, distribution, and transmission of power is separate. The National Power Electric Company (NEPCO) is a government managed agency in the country that regulates the electricity and owns and manages transmission lines in this country. Three private companies also own and manage the distribution networks in the country. Both the sectors have made a significant contribution to power generation, with the privately owned companies producing about 75% of the total electricity (National Electric Power Company of Jordan, 2015).

A number of countries in the MENA region have made unbundling and privatization of the energy sector a priority. These countries have taken functional and legal steps in this regard. One of the most common methods employed to achieve legal separation is to create a state-owned holding company having a number of subsidiaries that separately manage different activities related to the power generation value chain. This is the case of countries such as the UAE, Egypt, Algeria, and to some extent, for Saudi Arabia and Bahrain. Table 1.4 shows the status of power sector unbundling, incorporation, and privatisation in the MENA countries.

Table 1.4: Status of power sector unbundling, incorporation, and privatization in the MENA countries

	Reference to the policy	Status of unbundling
Algeria	Law 02-01 on Electricity and Gas Distribution	Functional or legal separation
Egypt	Law 87 2015, Article 13	Functional or legal separation
Jordan	General Electricity Law No. 64.	Ownership separation
Palestine*	General Electricity Law No. 13.	Ownership separation*
Saudi Arabia	Electricity Law of 2005	Functional or legal separation
Sudan	Electricity Law of 2001 and Cabinet Decree 169 of 2010	Functional or legal separation
UAE (Abu Dhabi)	Law 2-98 of 2008	Functional or legal separation
* Palestine's current status of separation is naturally high since almost no generation or transmission takes place in the country. Distribution companies are private or owned by a municipality.		

Source: RCREEE (2016a, p. 26)

1.6.2. Independent Power Producers in the Middle East and North Africa region

The participation of the private sector in renewable energy development can take different forms. It depends on the type of party to which the electricity is transmitted, i.e. third-party sales, utility suppliers, direct expert, and exclusive and partial self-consumption. Apart from exclusive self-consumption, different types of private power generation are categorized as Independent Power Producers (IPPs). IPPs generally establish, own, and manage power plants and sell the electricity either to the utility providers or to a third-party through a power purchase agreement (PPA). While the former is a common and more convenient option for the private sector, the latter provides greater incentives to private investors. Selling to the third-party is an

especially attractive investment option for large commercial and industrial enterprises that do not want to become producers of electricity despite the demand in the country.

The majority of the MENA countries allow private sector participation to some extent. However, only one country in the region has established legislation that authorized IPPs. Libya, which had closed the electricity sector for the private sector in the past, is now getting ready to open the market through legislations. The Renewable Energy Authority of Libya (REAOL) has started to work on a plan to establish a fund at the national level that is intended to cover about 70% of the total cost incurred by the state to encourage private sector participation.

Although several countries in the MENA region have IPPs producing electricity, only a few countries participate in renewable energy generation, as table 1.5 shows. Algeria, Morocco, Egypt, and the UAE were the only countries in this region where private sectors contributed to renewable energy development by the end of 2015. A number of PV plants were also operating in Egypt and Algeria in that year under the feed-in tariff schemes that were adopted by both countries. Noor-1 CSP farm has been in operation in Morocco since 2016, and the Tarfaya wind farm has also been in operation since 2014. The 100-MW Shams-1 CSP has been operating in Abu Dhabi since 2013. However, the number of renewable energy IPPs projects is in the pipelines in Jordan, Egypt, Abu Dhabi, Morocco, and Palestine.

Table 1.5: Status of independent power producers in renewable energy in the MENA region in 2016

Country	RE Utility Supply		RE Third Party Supply		RE Direct Export	
	Legal basis to operate as IPP and sell power to utility	MW	Legal basis to operate as IPP and engage in third- party supply	MW	Legal basis to operate as IPP and engage in direct export	MW
Algeria	Law No 02-01 (2002) on Electricity and Distribution of Gas, Article 26; Decree No 13-218 (2013) on Feed-in tariffs for Renewable Energy	270	Law No 02-0 (2002) on Electricity and Distribution of Gas[5]	-	Law No 02-01 (2002) on Electricity and Distribution- of Gas[6]	-
Bahrain	Legislative Decree No. 1 of 1996 with respect to Electricity and Water	-	No	-	No	-
Djibouti	Law No 88 (2015) on Regulation of the Activities of the Independent Electricity Producers	-	-	-	-	-
Egypt	Law No 100 (1996); Law No 89 (1998) on Competitive Bidding; Renewable Energy Law No 203 (2014)	70	Decree No. 326 (1997) establishing The Electric Utility and Consumer Protection Regulatory Agency	-	No	-
Iraq	Economic Affairs Commission Decree No S.L. 614, August (2008)	-	-	-	No	-

[5] The Law 02-01 (2002) does not specify the procedure for getting approval to export renewable energy.
[6] The Law 02-01 (2002) does not differentiate between export of power produced from conventional sources and renewables.

Country	RE Utility Supply		RE Third Party Supply		RE Direct Export	
	Legal basis to operate as IPP and sell power to utility	MW	Legal basis to operate as IPP and engage in third- party supply	MW	Legal basis to operate as IPP and engage in direct export	MW
Jordan	Law No 13 (2012) on Renewable Energy and Energy Efficiency Law, Article 5 (competitive bidding), Article 6 (Direct Proposal Submission)	-	No	-	General Electricity Law 64[7]	-
Kuwait	IPP Law No 39-10 (2010)[8]	-	No	-	No	-
Lebanon	Law 463 and its amendments	-	No	-	No	-
Libya	No legal basis in place yet	-	No	-	No	-
Morocco	Law No 13-09 (2009) on Renewable Energies	700	Article 26 of the Law 5815 (2015) revision Law No. 13-09 (2009) on Renewable Energies	200	Law 13-09 (2009) on Renewable Energies	-
Palestine	General Electricity Law No 13 (2009) Renewable Energy Efficiency Law No 14 (2015)	-	Renewable Energy Efficiency Law No 14 (2015)	4	No	-
Qatar	Law No 10 (2000) on the Establishment of KAHRAMAA[9]	-	No	-	No	-
Saudi Arabia	Royal Order A/35 of H.M. King Abdullah bin Abdulaziz Al Saud on17th April 2010 on the establishment of KACARE[10]	-	No	-	No	-
Sudan	Electricity Act (2001) Chapter II Article 3.2	-	No	-	No	-
Syria	Law No 32 (2010), Article 30	-	Article 30 of Law 32(2010)	-	No	-
Tunisia	Law No 1996-27 (1996); Decree1996-1125 (1996)	-	Law No 74/2013 (adopted in April 2015)[11]	-	Under preparation: overall exporting conditions specified in the new Renewable Energy Law	-
UAE	Article (3) of the Decree No. (1) (1992), amended by Article (1) of Decree No. (9) (2011)[12]	100	No	-	No	-
Yemen	Electricity Law No 1 (2009)	-	No	-	No	-

Source: RCREEE (2016a, p. 27)

In light of the renewable energy and energy efficiency law No. 14 in the Palestine that went into effect on October 2014, a plan was announced in March 2016 to generate about 30 MW solar power. This project will involve solar power tenders related to 11 governorates that will

[7] The General Electricity Law No 64 regulates issues of export and import, but it does not specify the situation for renewables.
[8] The IPP Law No 39-10 (2010) does not specify situation for renewables.
[9] The law authorizes KAHRAMAA to formulate and enter into power and water purchase agreements and provide necessary technical and corporate support for establishment of generation and desalination ventures.
[10] The Royal Order authorizes KACARE to develop, lead and implement clean energy projects in the country.
[11] The Law 74-2013 on electricity production from RE was adopted by the Tunisian Parliament in April 2015. This law aims at promoting private sector integration, opening RE market, and promoting the export of electricity generated from renewable. This law was amended at the end of 2015, but still not announced.
[12] Authorizes Dubai Water and Electricity Authority to purchase electricity from any entity at the prices and under conditions it deems appropriate.

be added in the coming four years. In addition, two other 50 MW projects are in the pipeline in the country (RCREEE, 2016a). Another noteworthy development has occurred in Tunisia, where the local Assembly of the Representatives of the People (ARP) put forward the law No. 74/2013 in April 2015 that governs renewable energy development. The aim of this law is to encourage the participation of the private sector and create more openness in the renewable energy market. It also aimed at promoting the export of renewable energy in the market.

1.6.3. Utility supply in the Middle East and North Africa region

A large number of countries in the MENA region allow private power companies to operate in the region. These private companies are allowed in utility supply, as well as in a large number of renewable energy projects. In fact, a large number of projects are made possible by inviting bids for the power projects. Long term power-purchase agreements (PPAs) with a single company have also contributed to the development of green energy in the region.

Direct submission of projects for supply of power is allowed in only three countries, which are Egypt, Palestine, and Jordan. However, public competitive bidding is allowed under engineering, production, and construction (EPC) or Independent Power Corporation (IPC) procedure in about 14 countries in the MENA region. Moreover, feed-in tariff (FiT) schemes have been put forward in four Middle Eastern countries, including Syria, Palestine, Algeria, and Egypt.

The MENA region is characterized by a lack of coherent signal from the government. This has served as an obstacle in the region for the private sector to play its role in the development of electricity. The private segment depends on the tender announcement by the government. In general, the bidding has been announced only for a few projects. The only countries in the MENA region that has set targets are Saudi Arabia, Egypt, and Morocco. These targets have established for increasing the capacity for renewable energy through a competitive bidding process. They have been realized with different level of success.

1.6.4. Third party supply in the Middle East and North Africa region

Innovative methods have been introduced to address important impediments to the deployment of renewable energy project on a large as well as small scale, according to Kollins, Speer, & Cory (2010). This allows the emergence of innovative business models in countries that allow sales to third parties. A liberal attitude toward the contribution of the private sector in general, and third-party sales, in particular, is a sensitive issue in the region that has a political bearing.

Six countries in the MENA region have authorized the production of electricity through sales to third parties. These countries are Saudi Arabia, Morocco, Egypt, Algeria, the UAE, and Syria. A law known as 13-09 in Morocco makes possible sales by IPPs for renewable energy. This law became effective at the beginning of 2013 when three wind power projects were commissioned by the NAREVA Holding Company having a net capacity of 200 MW for supply to big customers relating to the energy sector[13]. Nevertheless, the supply by third-party IPPs

[13] Nouvelle, L. (2013). “Nareva veut devenir un des acteurs majeurs de l’énergie au Maroc”, selon son PDG Ahmed Nakkouch—L’Usine Maroc. usinenouvelle.com. https://www.usinenouvelle.com/article/nareva-veut-devenir-un-des-acteurs-majeurs-de-l-energie-au-maroc-selon-son-pdg-ahmed-nakkouch.N202432.

has large been hindered due to non-availability of medium voltage grid for the access by the third-party agencies.

A MENA country that is close to allowing access to the voltage grid by the third party is Egypt. The legislation in this country allow third party companies to supply energy. The government has awarded and announced concessions for lands located in the Gulf of Suez for wind power plants that can generate of 600-MW renewable energy. The project was handed over to the private sector that is interested in selling electricity to IPPs. A similar project is being awarded to IPPs for land concessions in the upper parts of Egypt. The award of projects to third parties is being done in parallel to the introduction of the competitive bidding scheme. In the case of Algeria, the law 02-01 allows sales of renewable energy by third-party IPPs. Projects under this legislation are not introduced at present. Moreover, the sales to third party are certainly possible in Saudi Arabia.

1.6.5. Direct export of renewable energy in the Middle East and North Africa region

The exports of renewable energy from the MENA region, mainly to Europe, have been a controversial issue in the past five years. Existing private IPPs have limited capacity to export renewable energy. Most of the export related activities have been organized by national electricity production companies. However, the expansion of renewable energy in the short and medium term has been largely to meet increasing local power needs.

Only a handful of countries have made the export of renewable energy an option through passing legislations. The majority of the countries have not passed laws relating to the export of renewable energy. In fact, most of the countries in the MENA region have implemented restrictions on the export of renewable energy.

The export of renewable energy is allowed in Morocco, according to law 13-09. This law allows the export of electricity through the national power network and interconnected lines. A private sector independent company that aims to export renewable energy will have to get approval from the public utility company ONE. The government of Tunisia has mentioned the conditions for the export of renewable energy in a recent electricity law. However, the process of granting approval and other details has not been specified. Law 02-01 in Algeria gives the green light to companies to export renewable energy. However, it does not specify the procedure for getting the corresponding approval. The General Electricity Law in Jordan states that export and import request will be handled on a case-by-case basis. The authority to grant approval rests on the Council of Ministers. The remaining countries in the MENA region do not consider the export of renewable energy as a cost-effective option.

1.6.6. Grid access in the Middle East and North Africa region

1.6.6.1. Priority access and dispatch in the Middle East and North Africa region

The private sector can play an important role in renewable energy generation in the MENA region. However, this can only be possible if the private sector has access to the transmission lines under transparent and non-biased conditions. The private sector companies need to be provided assurance that the power generated through solar PV and wind power can be fed into the transmission lines immediately after generation. This is because the existing technologies allow limited storage of fluctuating power generated through wind turbines and PV cells. Apart

from providing assurance for access to grid lines, the private sector needs to be given precedence when it comes to access and dispatch of renewable energy. This condition is necessary to ensure that renewable energy technologies remain competitive.

Providing priority access will help renewable energy companies compete with traditional power producers. The rationale for giving priority access to renewable power producing companies is that they are more geographically dependent than traditional power producing companies. It also minimizes the constraints related to the selection of the site. In general, offering priority access will allow the traditional power companies to reduce their power generation in case of congestion in the grid lines.

To support investment in renewable energy power generation, it is key that the government set up transparent and consistent policies for access to the grid lines. In this regard, one effective approach is to establish details of grid access in the legislations and grid codes that are referenced in the PPA. Avoiding case-by-case negotiations is also important to encourage higher private sector participation in energy generation. Furthermore, it is crucial that there are no biases between the IPPs regarding providing access to the grid. A non-biased treatment of the private power producing countries can be ensured by regulating the tariffs for grid transfer.

Table 1.6 shows that only a few countries have been specified the details concerning grid access. Thus, nowadays only Algeria and Jordan have specified these details in their legislations. They have established preferential treatment of grid access for renewable energy projects. Preferential access to the national grid is guaranteed for renewable energy companies in Algeria, where the companies that produce renewable energy operate as a single distribution company (Décret exécutif nº 06-429 du 2006). The General Electricity Law in Jordan provides non-biased preferential access to grid lines. Moreover, the 2012 Renewable Energy Law further makes obligatory for the state electric company NEPCO to buy all the electricity produced by the traditional and renewable energy companies, albeit without any priority dispatch (Law 13 of 2012). The regulators of electricity in Jordan have established tariffs that are regulated by the state.

An interesting point to note is that only a few of the countries in the MENA region offer a guarantee of priority access through legislations. One of the major impediments relating to grid access for renewable energy projects has been the traditional power distribution companies. The distribution companies knowing that they would be obligated to buy renewable energy electricity once the IPPs have access to the national grid try to delay approvals of the renewable energy project. That is why it is critical for renewable energy investors to ensure that priority access and dispatch are overseen by government legislation.

Most countries in the MENA region do not possess detailed legislations that guarantee priority access to renewable energy companies. The Law 13-09 in Morocco was modified to establish the conditions for grid access for different levels of voltage grids. The legislations clarified that the renewable energy companies could gain access to the grid, but it is limited to the technical capacity of the networks. Grid operators in Palestine and Egypt are required to purchase all renewable energy electricity, despite the lack of detailed regulations regarding a access to the grid. The conditions regarding priority dispatch of renewable energy in Egypt have been established by the Egyptian Electricity Transmission Company (EETCC). Recently, a new renewable energy law has been established in Tunisia. However, this law is not clear regarding priority access to the grid by the renewable energy companies. The UAE and Saudi Arabia have also established comprehensive grid codes. However, these regulations do not specify the

conditions for access to the grid lines. In addition, the government of Abu Dhabi has suggested changes in the grid codes for giving priority access to renewable energy projects.

Table 1.6: Renewable energy grid access conditions in the MENA countries

	RE Guaranteed Access to the Grid	RE Priority Access	RE Priority Dispatch
Algeria	Executive decree No. 06-428 of 26 November 2006, executive decree No. 06-429 of 26 November 2006, and the order of 21/02/2008.	No priority access.	Priority dispatch once a RE system is connected.
Bahrain	No.	No.	No.
Egypt	Article 6, Renewable Energy Law No 203 (2014) "EETC and distribution companies are committed to connect RE to the grid."	No.	No.
Iraq	No.	No.	No.
Jordan	Non-discriminatory guaranteed access foreseen by the Law No 13 (2012) on Renewable Energy and Energy Efficiency, Article 8C.	No priority access	No priority access
Kuwait	No.	No.	No.
Lebanon	No.	No.	No.
Libya	No.	No.	No.
Morocco	No.	No.	No.
Oman	No.	No.	No.
Palestine	No, but Palestinian electricity distribution companies are committed to purchase all produced electricity.	No.	No.
Qatar	No.	No.	No.
Saudi Arabia	No.	No.	No.
Sudan	No.	No.	No.
Syria	No.	No.	No.
Tunisia	No.	No.	No.
UAE	No.	No.	No.
Yemen	No.	No.	No.

Source: RCREEE (2016a, p. 30)

1.6.6.2. Grid code in the Middle East and North Africa region

Grid codes, which are also known as network codes, refer to technical details regarding the management of grids used for electricity transmission. They specify priority access conditions and cost sharing specifications. Thus, the codes remove confusion regarding technical conditions for the access of grid lines by renewable energy companies. The grid codes specific for renewable energy technology are developed in only a few countries in the MENA region.

They have been introduced to provide support for renewable energy development in general, instead of ad hoc purposes. Table 1.7 shows the renewable grid access codes in MENA countries according to 2016 statistics.

Table 1.7: Renewable energy grid codes in the MENA countries in 2016

	Technical Guidelines Adopted to Connect		
	Small Scale PV Systems to Low Voltage Grid	Medium- to Large-Scale PV Systems to Medium and High Voltage Grid	Medium- to Large-Scale Wind Systems to Medium and High Voltage Grid
Algeria	No	Under preparation	Under preparation
Bahrain	No	No	No
Egypt	Yes	Under preparation	Yes
Iraq	No	No	No
Jordan	Yes	Yes	Yes
Kuwait	No	No	No
Lebanon	No	Under preparation	Under preparation
Libya	No	No	No
Morocco	No	No	Under preparation
Palestine	Yes	n/a	n/a
Qatar	Under preparation	Under preparation	No
Saudi Arabia	No	Under preparation	Under preparation
Sudan	Under preparation	Under preparation	Under preparation
Syria	No	No	No
Tunisia	Under preparation	Under preparation	Under preparation
UAE	No	No	No
Yemen	No	No	No

Source: RCREEE (2016a, p. 31)

The grid codes are the most comprehensive in Jordan, where technical specifications have been established for different sizes of renewable energy projects. Egypt is one of the countries where detailed grid codes have been established regarding renewable energy development. A grid code light scheme has been introduced in Tunisia, providing technical conditions that are required for renewable energy transmission. This country has successfully managed distributed solar PV generation using this scheme. Currently, Tunisia is in the process of introducing

legislation for different sizes of renewable energy projects. Lastly, Sudan and Saudi Arabia have also taken steps to introduce grid codes for the renewable energy power projects.

1.7. THE POLICY FRAMEWORK IN THE MIDDLE EAST AND NORTH AFRICA REGION

This section provides an overview of the policy framework in different MENA countries, including renewable energy targets and commitments, as well as the share of renewable energy, besides main sector characteristics.

1.7.1. Renewable energy commitment in the Middle East and North Africa region

1.7.1.1. Renewable Energy targets in the Middle East and North Africa region

The political commitment is key to promote renewable energy development and creating favourable investment climate. The existence of clear and transparent targets that are officially adopted is critical for renewable energy development. It also provides a basis for generating trust among the investors.

The majority of the countries in the MENA region have announced targets for the deployment of renewable energy projects. Table 1.8 shows the renewable energy targets in MENA countries. Many of them have established and modified targets as result of the Paris Agreement in 2016. Nevertheless, only a few of them have been sanctioned by the government authority. For instance, Djibouti had established an ambitious target of 100% renewable energy by 2020. However, the target for installed capacity is just 1000 MW. Morocco had also previously announced that it intends to produce about 42% of the energy needs through renewable energy by 2020. However, after the COP21 negotiations in Paris, that country had increased the target to 52% of installed electricity capacity by 2030. This represents the strong commitment of the companies in transitioning to renewable energy sources.

Egypt is the leader in the MENA region concerning installed renewable energy capacity target for 2020. This country has established a target of 10 GW electricity generated through solar and wind power in 2015. Saudi Arabia has established a target of 9.5 GW for 2023 as part of the country's Vision 2030 policy. Recently, King Abdullah City for Atomic & Renewable Energy (KA-CARE) has put forward a tender for financial, technical, and legal consultants to offer advice regarding the 3.5 GW power generation project. Algeria has set the largest target in the MENA region for 2030. This country had initially set a target of 12 GW renewable energy by the end of the next decade. However, the target was upgraded to 25 GW in 2015, which represents about 27% of total electricity generated in the country. Jordan has set a target of 1 GW of PV capacity by 2020, a goal that had upgraded to 800 MW. Other countries in the MENA region that have set targets for renewable energy projects are Palestine, Iraq, Yemen, and Tunisia.

Table 1.8: Renewable energy targets in the MENA countries

	RE Strategy/Action Plan/Program	RE Targets							Target Date
		Wind MW	PV MW	CSP MW	Biomass MW	Geothermal MW	Total MW	Total %	
Algeria	National Program for Renewable Energy and Energy Efficiency 2030 adopted in 2011	1,010	3000	-	360	5	4,375	15	2020
		5,010	13,575	2,000	1,000	15	21,600	27[a]	2030
Bahrain	Unofficial target (NERAP under preparation)	-	-	-	-	-	250	5	2030
Djibouti	National Program for Development of Renewable Energy and Energy Efficiency, 2015	300	200		0	500	1,000	100	2025
Egypt	National RE Strategy 2020 adopted in 2008, updated in 2012; Feed-in Tariff Program; target year amended in 2015	7,200	At least 2,300	0	0	0	9,500	20[a]	2022
Iraq	Renewable Energy Plan 2013-2017, adopted in 2012. Master Plan of Energy 2030 adopted in June 2013.	0	300	0	0	0	300	1	2020
Jordan	Master Strategy of Energy Sector in Jordan for the period (2007-2020) adopted in 2007, and updated in 2015.	800	1000	0	50	0	1,850	10[b]	2020
Kuwait	Kuwait Energy Security Vision	700	4,600	5,700	0	0	11,000	15	2030
Lebanon	Policy Paper for Electricity Sector (2010); NEEAP (2011-2015) INDC 2015	400	100-150			0	900-950[c]	12 15	2020 2030
Libya	National Plan for developing RE in Libya (2013-2025).	600	344	125	0	0	1,069	7	2020
		1,000	844	375	0	0	2,219	10[a]	2025
Mauritania	The Poverty Reduction Strategy Paper (PRSP), 2013	30	30	0	0	0	60	20	2020
Morocco	New National Energy Strategy Assessment Report, 2013. Morocco INDC submission to CoP 21.	2,000	2,000				6,000[d]	42	2020
		4,200	4,560		0	0	10,090	52	2030
Oman	Sultan Qaboos bin Said's "Vision 2020"	-	-	-				10[a]	2020
Palestine	National Energy Strategy (2012-2020); Palestinian Solar Initiative.	44	45	20	21	0	130	10[a]	2020
Qatar	-	-	-	-	-	-	1800	20	2030
Saudi Arabia	Saudi Arabia's 2030 Vision	-	-	-	-	-	9,500	10	2023
	Saudi Arabia's Renewable Energy Strategy	9,000	16,000	25,000	3,000[f]	1,000	54,000	30	2040
Sudan	RE master plan is under development	680	667	50	68	54	1,582[e]	11	2031
Syria	The 11th Five-Year Plan for 2011-2015	1,000	2,000	1,300	250	0	4,550	30	2030
Tunisia	The study for energy mix in 2030 is currently under development.	1,755	1,510	460	0	0	3,725	30	2030
UAE - Abu Dhabi	-	-	-	-	-	-	-	7	2020
UAE – Dubai	Dubai Integrated Energy Strategy 2030	-	-	-	-	-	5,000	25	2030
Yemen	National RE and EE Strategy adopted in 2009	400	8.25	100	6	200	714.25	15	2025

[a] Electricity generation. [b] Primary energy. [c] Including 400 MW hydro. [d] Including 2,000 MW hydro. [e] Including additional 63 MW hydro. [f] Waste to energy

Sources: RCREEE (2016a, p. 35)

1.7.1.2. Sustainable Development Goals and the Paris Accord

Sustainable Development Goals (SDGs) and Conference of Parties (COP21) have paved the way for achieving renewable energy (RE) targets in the Middle East and North Africa countries. The year 2015 was considered a landmark for the development of a global action plan for renewable energy. The 2030 Agenda for Sustainable Development was established in September and the COP21 Paris Agreement later that year. Since the conventional energy sector is the main contributor to greenhouse gas emission (GHG), renewable energy can play a pivotal role in fighting the adverse effects of climate change. Around 60% of GHG emissions results from power generation using fossil fuels. A report prepared by International Renewable Energy Agency (IRENA) in 2018 had shed light to the fact that increasing the global share of renewable energy to 36% can halve the carbon dioxide emissions and maintain pre-industrial temperatures (IRENA, 2019).

The SDGs adopted by United Nations members aim at making renewable energy reliable, affordable, and sustainable by the end of 2030. To achieve these goals, the countries should accelerate the shift to clean energy sources, including wind, solar, and geothermal. Renewable energy sources accounted for more than half of the global power generation capacity in 2014 (IEA, 2014). Investments in the sector have been increasing due to the decreasing price of renewable energy technologies. This fact has made the transition to renewable energy practical and cost-effective.

The MENA countries have produced Intended Nationally Determined Contributions (INDCs) with different levels of commitment related to reducing GHG emission and promotion of renewable energy technologies. Morocco has taken the lead concerning the promotion of renewable energy and reduction of carbon dioxide gases. This country has committed to generate more than 52% of its electricity through renewable energy sources. It has also engaged in reducing GHG emissions by 13% below business-as-usual (BAU) baseline by 2030. Djibouti is another country in the MENA region that has made a pledge to reduce GHG emissions. The country INDCs consist of the commitment to decrease the emission levels by 40% by the end of next decade, as well as a conditional pledge to decrease the emissions by an additional 20%. Jordan INDC contains a commitment to reduce emissions by 1.5% below BAU levels by the end of the next decade. This figure could increase to 14% in the case of international financial assistance. Jordan has shown the intention to promote the generation of renewable energy. It attempts to increase share from wind, solar, and hydropower by 11% by 2025. This country also aims at boosting its energy efficiency by 20% by the end of the current decade.

The INDC of Lebanon has updated its National Energy Efficiency Action Plan (NEEAP) as well as planning to launch the National Renewable Energy Action Plan (NREAP) 2016-2020. The aim of these plans is to target 12% renewable energy share in the overall energy generation. This will allow a considerable decrease in carbon emissions by reducing the dependence on diesel and fuel oil in power generation, and later in other sectors of the economy. Furthermore, this country is currently in the process of developing a sustainable development strategy that relates to different sectors of the economy. Sudan has announced its INDC plan addressed to increase the share of renewable energy in the total electricity mix to 20% by 2030. This country intends to increase the forest coverage to 25% by the end of the next decade. Yemen has announced to reduce GHG emissions to 1% below the BAU, which would raise to 14% in case of foreign assistance by the year 2025.

An IRENA report published in 2016 has drawn attention to the benefits of scaling up the renewable energy installation in the countries belonging to the Cooperation Council for the

Arab States of the Gulf (GCC) (IRENA, 2016d). The GCC includes the following countries: the UAE, Saudi Arabia, Kuwait, Qatar, Oman, and Bahrain. This report stated that these countries in the region would greatly benefit from achieving the target for renewable energy installation. Thus, they could save 400 million barrels of oil and 11 trillion litres of water that is used to generate electricity. In addition, it would allow the countries to generate about 200,000 jobs and reduce the capita carbon footprint by 8% by the end of the next decade. Moreover, due to the desalination plants take a lot amount of power, using solar power for the plant can be cost-effective, reliable, and sustainable for meeting future water demands. The UAE attempts to boost the share of clean energy to 24% of the total mix by the year 2021, an increase of about 0.2% from 2014. Saudi Arabia has also established the goal to decrease the 130-metric tons of CO_2 emission with the condition that the Paris agreement does not cut through its profit. The INDC of Oman includes a cut of 2% in GHG emissions by 2030. This country intends to achieve this aim by decreasing reliance on gas flaring and increasing the reliance on renewable energy. Similarly, Bahrain has put forward Economic Vision 2030 with the aim of diversifying its economy and decreasing reliance on oil and gas. Qatar also announced a similar approach to diversifying the economy and reducing its reliance on fuel oil.

In North Africa, Mauritania has announced that it plans to reduce emissions by 2.3% below the BAU levels. This country INDC states that 88% of the pledge depends on foreign assistance, including technology transfer and climate finance flows. Algeria has stated that it will target a reduction in carbon emission between 7 to 22%. The lower end is unconditional, while the upper end depends on access to international assistance and foreign technology.

1.7.1.3. Renewable energy share in the Middle East and North Africa region

One way to know the renewable energy development in a country is to examine the share of renewable energy in the total electricity generation. The different volume of the installed power generation capacity is an indicator of the commitment of the government towards renewable energy development. It also allows evaluating the effectiveness of renewable energy development. This subsection describes the situation in several MENA countries that are making a lot of progress in their renewable energy plans and projects.

Table 1.9 shows that the aggregate share of renewable energy in the MENA region is about 6% of the installed capacity. Hydropower represents 4.73% of this, wind power represents 0.9%, and solar power represents 0.4% of the installed capacity.

Available official statistics show that wind generation is the main source of renewable energy in Morocco, Egypt, Algeria, and the UAE. The share of renewable energy in the power mix is the highest in Sudan with around 51% share. The majority of the renewable energy source is attributed to hydropower. If hydro is excluded[14], Mauritania will have the highest share of renewable energy source with 12.4% of installed capacity. Morocco has the next highest share of renewable energy power source, whose share of renewable energy is slightly less than Mauritania. Recently, this last country has installed two wind power plants Nouadhibou and Nouakchott that has installed capacity of 4.4 MW and 30 MW, respectively.

[14] Arab Future Energy Index (AFEX) excluded hydro in terms of installed capacity. Although hydro is considered a renewable source of energy, it is excluded from further evaluation due to the maturity of the industry and its limited potential for further development.

Table 1.9: Renewable energy installed capacity in the MENA region in 2016

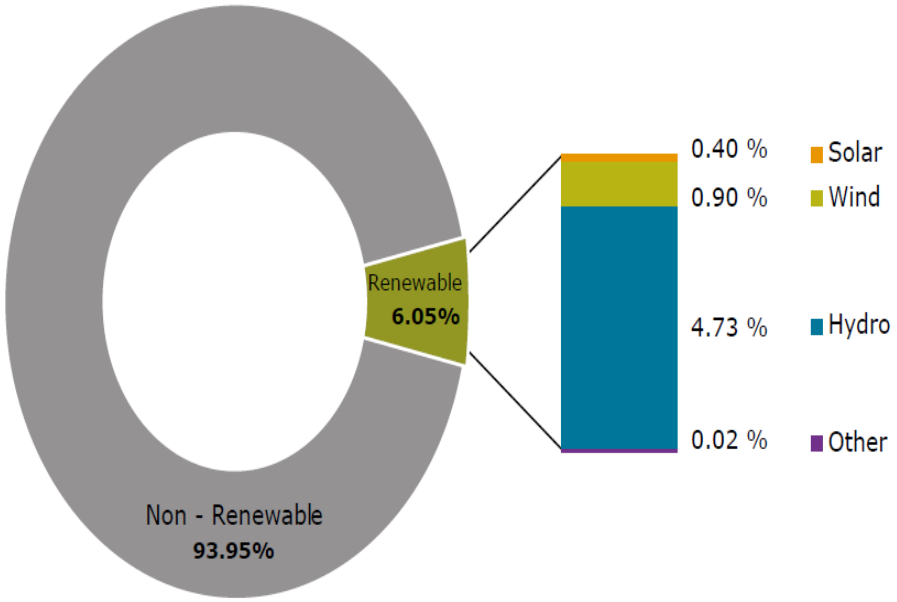
	Wind MW	PV MW	CSP MW	Other MW	Total RE in 2016		Total RE in 2014	
					MW	% of total installed capacity	MW	% of total installed capacity
Algeria	10	270	25	0	305	1.89	42.1	0.37
Bahrain	0.675	5	0	0	5.675	0.14	5.5	0.14
Egypt	810	90	20	0	920	2.63	645	2
Iraq	0	3.5	0	0	3.5	0.01	0	0
Jordan	197	50	0	3.5	250.5	5.65	18.55	0.59
Kuwait	0	14.7	0	0	14.7	0.09	1.8	0.01
Lebanon	0.5	20	0	0	20.5	0.76	2.1	0.09
Libya	0	5	0	0	5	0.05	5	0.05
Mauritania	34.4	18	0	0	52.4	12.38	-	-
Morocco	787	15	183	0	988.5	12.05	785	10.9
Oman	0	0	7	0	7	0.08	-	-
Palestine	0.7	4	0	0.2	4.9	3.38	4.9	3.38
Qatar	0	1.2	0	40	41.2	0.47	41.2	0.46
Saudi Arabia	0	23.2	0	0	23.2	0.05	19	0.03
Sudan	0	12	0	0	12	0.38	0	0
Syria	0.15	2	0	0	2.15	0.02	2.15	0.02
Tunisia	245	20	0	0	265	6.21	265	6.63
UAE	0	33	100	1	134	0.49	134	0.49
Yemen	0	3	0	0	3	0.20	3	0.20
Arab Region	**2085**	**590**	**335**	**45**	**3055**	**1**	**1974**	

Note: Hydropower is not included.
Sources: RCREEE (2016a), IRENA (2016c), Arab Union of Electricity (2015), and Global Wind Energy Council (2015)

Morocco had raised the installed capacity of solar power from 35 MW to 198 MW in 2016. This country had also increased the wind power capacity from 290 MW in 2009 to 787 MW in 2016. This has been made possible due to long term successes in achieving the goals of the renewable energy action plan. Egypt became the country with the most wind energy capacity

in the MENA region in 2016, after the launch of a 200 MW wind energy project in Gulf al Zayt. Other wind power projects that are in the pipeline will make the country to maintain its dominating position in the wind power generation in the MENA region. Jordan is another country in the region that has displayed remarkable development in the renewable energy sector with the inauguration of 212 MW PV and wind power projects. Similar is the case of Algeria, a country that increased the PV grid capacity to 270 MW by adding above 24 power plants, each ranging between 1 to 30 MW. In addition, other small-scale roof top systems had increased the renewable energy share in the total generation capacity to 2.2% excluding hydro and 4.1% if hydro is considered. In Egypt, the installed capacity of PV power plants reached about 90 MW. This is a significant achievement of the rural renewable energy programs that were supported by the UAE. The feed-in tariff system has also contributed to the development of renewable energy systems. Finally, the UAE has also maintained a prominent position in renewable energy development. This country has a combined installed capacity of 123 MW from PV and CSP power plants. Almost every country in the MENA region has utility and distributed scale PV installations. Figure 1.6 shows the regional share of the installed capacity of renewable energy in 2016.

Figure 1.6: Regional share of installed capacity of renewable energy in 2016



Source: RCREEE (2016a, p. 39)

The renewable energy projects under development are an indicator of the extent of renewable energy developments in a country. It also provides information about to which extend a country will achieve its targets. Regular follow up of the outcome of the renewable energy efforts is a strong indicator of whether a country will be able to significantly reduce the GHG emissions on a continuous basis. Table 1.10 shows the renewable energy projects that were in the pipeline in 2016. It includes both private and public renewable energy power projects under construction.

Table 1.10: Examples of renewable energy projects under construction in the MENA region in 2016

	RE Technology	MW	Project	Total
Algeria	Wind	20	Khenchela	98
	PV	73	Distributed projects in different sites	
	Geothermal	5	Guelma	
Bahrain	Wind	2	Addur Wind Pilot Plant	5
	PV	3	Addur PV Pilot Plant	
Djibouti	PV	50	Grand Bara Phase I	50
Egypt	Wind	220	Gabal Al-Zayt	340
	Wind	120	Gulf of Al-Zayt	
Jordan	PV	200	10 projects in Maan area, 1 in Aqaba and 1 in Mafraq	200
Kuwait	Wind	10	Shagaya RE Complex I	70
	PV	10	Shagaya RE Complex I	
	CSP	50	Shagaya RE Complex I	
Lebanon	Wind	60-100	Under contracting	90-130
	PV	15	Systems under the National Energy Efficiency and Renewable Energy Action (NEEREA)	
Libya	Wind	60	Darnah	328
	Wind	80	Al-Magron I	
	Wind	120	Al-Magron II	
	PV	14	Al-Jofra	
	PV	14	Houn	
	PV	40	Sebha	
Mauritania	PV	30	Nouakchott	30
Morocco	Wind	150	Taza	720
	Wind	100	Tanger II	
	Wind	120	Jbel Khalladi	
	CSP	200	Noor II	
	CSP	150	Noor III	
Oman	CSP	50	Amal Oil Field Phase I out of 1021 MW plan	100
	Wind	50	Dhofar Wind farm	
Palestine	PV	470 kW	Tubas	1.17
	PV	700 kW	Jericho	
Qatar	PV desalination	10	Duhail	10
Saudi Arabia	PV desalination	15	Al Khafji	165
	PV	100	Mecca	
	CSP	50	Green Duba ISCC (Integrated Solar Combined Cycle)	
UAE	PV	200	Dubai MBR Solar Park Phase 2	550
	PV	350	Abu Dhabi Solar Park (including Noor 1 project)	

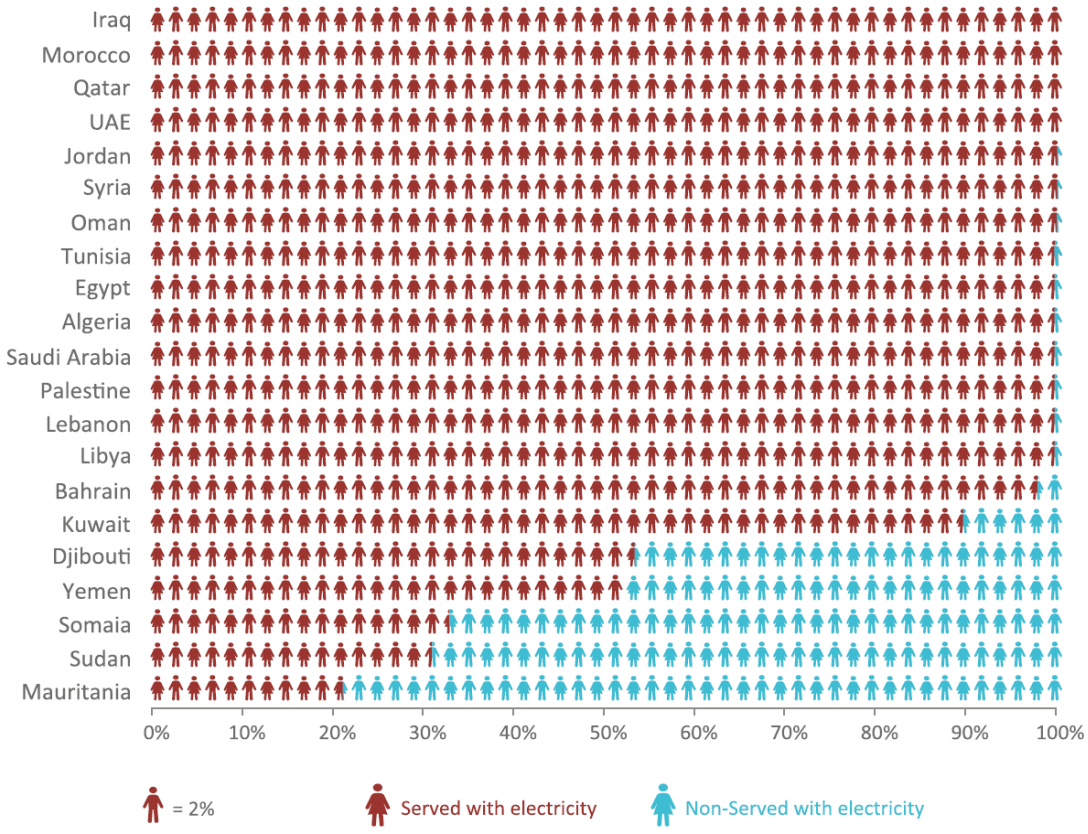
Source: RCREEE (2016a, p. 41)

1.7.1.4. Off-grid decentralized renewable energy projects in the MENA countries

The previous sections focus on centralized grid renewable energy systems. This section focuses on off-grid systems in the MENA region. More than 49% of electricity is generated through fuel oil, while 41% of electricity is generated through natural gas.

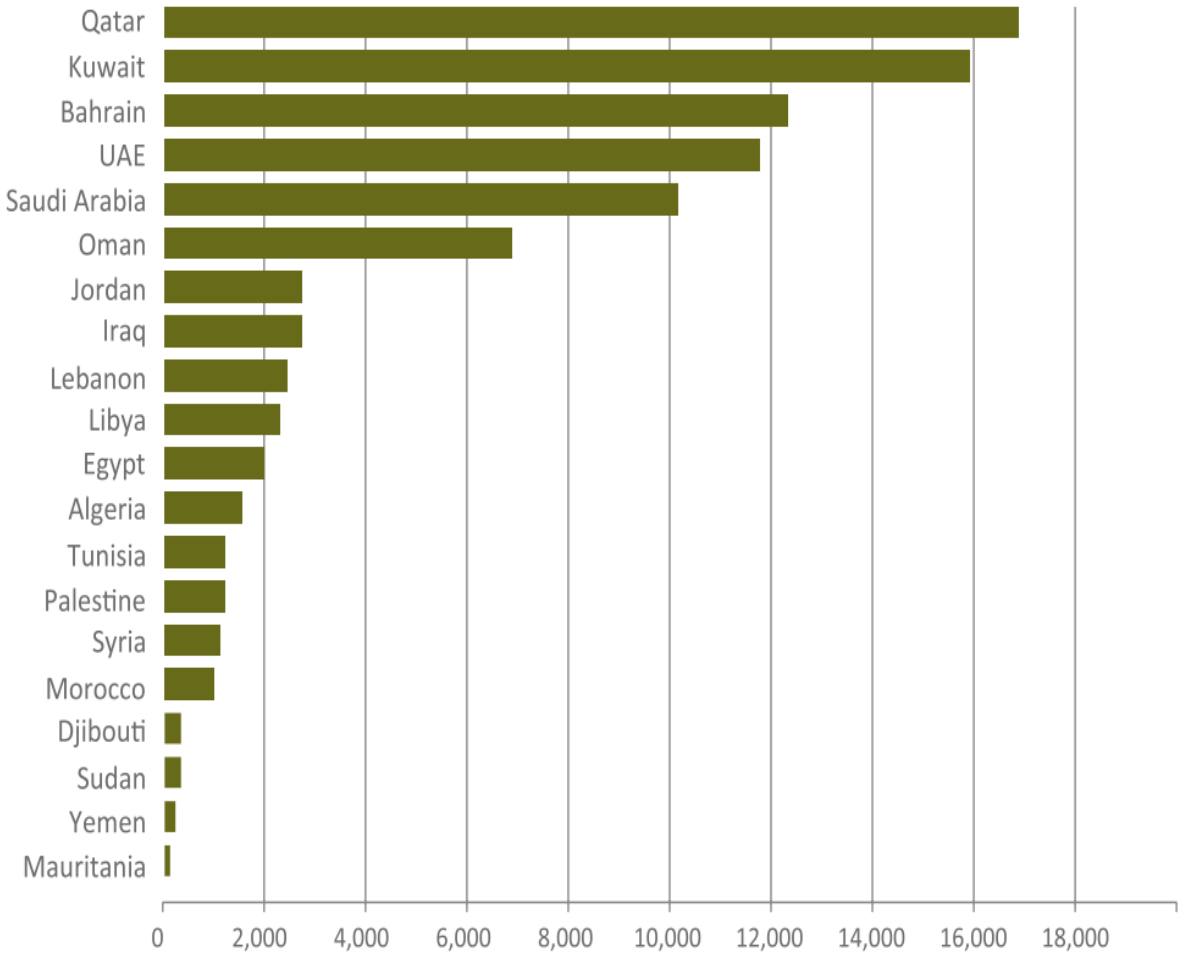
A large number of people in the MENA region lack access to reliable energy. This situation affects mainly to rural remote areas that are not provided electricity through the electricity grids. While around 98% of the people have access to electricity, the number drops to 78% when only rural areas are considered. Figure 1.7 shows the percentage of the population served with electricity in 2016. Oil-rich countries, such as Kuwait, Jordan, Bahrain, and the UAE, have been able to meet the electricity needs of the majority of the rural and urban populations. However, this does not happen with Yemen, Sudan, and Mauritania. Only 29% of the rural population has access to electricity in Yemen. The percentage of rural and urban population having electricity access in Mauritania is just 35%. Although 99.6% of the population in Egypt have access to electricity, given the large population of the country, 0.4% is not negligible as it represents 340,000 individuals. Figure 1.8 shows the share of electricity per capita in kWh in MENA countries.

Figure 1.7: Percentage of the population served with electricity in the MENA countries in 2016



Source: RCREEE (2016a, p. 42)

Figure 1.8: Share of electricity per capita in Kwh in the MENA countries in 2016



Source: RCREEE (2016a, p. 43)

The electricity generation in the MENA region has been centralized in the past. A number of remote and rural areas where the population is dispersed are currently off the main grid. Construction of low and medium wattage extensions is considered costly, particularly for individuals with an average usage of less than 30kWh per month. The investment required to meet electricity demand in the rural sector most often exceeds the existing capacity to mobilize local channels in most of the MENA countries. Off-grid electric systems are generally small in size and capacity. These systems can have only semi-autonomous capacity to meet the demand. Off-grid systems refer to both stand-alone systems and mini-grids. The former type of off-grid systems is generally used for individuals, while the latter are used for a group of individuals.

Biomass, diesel generators, solar PV, wind, and hydro are some of the off-grid systems that are used for mini-grids and standalone systems. In rural areas, the standalone system usually consists of PV solar panels, diesel generators, and small hydropower plants. Nowadays, diesel generators are mostly used at the decentralized off-grid power generation system. They are used for irrigation, lighting, heating, pumping, agro-processing, cooling and powering industrial and personal electrical appliances. Isolated power generation is used for different purposes including mining, agro-processing, television and telecommunication towers, oil and gas and other mineral extraction process.

About 90% of diesel generators in Yemen and Egypt are used for agricultural processing. They are used for drawing groundwater that is utilized for agricultural purposes. Diesel generators are commonly used at the isolated level since they are affordable and installed quickly. However, reliance on diesel generators has certain drawbacks, such as GHG emission and limited energy security for the users. The price of diesel is volatile, and the fuel is sometimes not available in the market. In the coming years, the price of fuel oil is particularly going to rise as the countries in the region have decided to phase out subsidies. This means that individuals have to pay international prices for fuel oil as they are not kept artificially low through subsidies. As a result, at the moment diesel fuel is subsidized and cheap in MENA countries.

Independent off-grid systems do not produce enough power to meet the need of the rural population. As a result, there is a need for increased mini-grid systems in the near future. Mini-grids can be scaled up according to the growing power needs of the rural population. It can effectively stimulate socio-economic development in the rural area.

The decrease in the price of renewable energy systems as well as varying fuel oil prices have spurred the growth of renewable mini-grid systems. The progress in the hybrid renewable off-grid system has made it a cost-effective solution for many countries. The mini-grid consists of interconnected power generation and distribution systems consisting of energy storage devices and generators. The mini-grid system can operate in combination with the utility grid as well as an independent system. The mini-grid can combine both fossil fuels and renewable energy. They are scalable and easily cater to increasing demand without creating a disturbance in the stability of the mini-grid systems. The grids can rely on single power source, such as solar PV, diesel, biomass, hydropower, and wind. They can also use a combination of two or more power sources. The latter is seen as more cost-effective and flexible off-grid power generation system since it combines both non-distributable and distributable sources of power. This results in increased reliability of the system.

Although the development of renewable off-grid systems is increasing in many regions, its extent and growth is difficult to quantify. This is mainly due to the unavailability of reliable data regarding the off-grid system in the MENA region.

The primary mini-grid system models include privately owned, utility, isolated single activity, and water pumping models. These activities differ and depend on the power distribution and generation assets, the institutions that manage and operate the systems, and their relationship with the customers. In general, utility grids are funded by the national treasury. The utility is responsible for operations of the mini-grids in the utility operator model. This model operates similar to the national grid model; thus, power is fed into the grid and is distributed to the end customers. The private entities are responsible for operation, maintenance, and distribution of off-grid systems in the privately-owned models. The funding of the system consists of commercial loans, private equity, and some government subsidies, grants, public sector loan guarantees, and results based on financing.

Literature sources have hardly mentioned community owned and operated diesel generators. A study on diesel to solar transformation (D2S) by RCREEE in collaboration with the UNDP found 30 decentralized diesel power plants in Egypt (RCREEE, 2016b). It is estimated that the power plants consumed about 75,000 tons of diesel. This report also shed light on the fact that the largest consumers of diesel fuel include agribusiness and irrigation. A large amount of fuel is used to activate the power pumps that are used to draw water from

canals. In addition, a large amount of diesel is used to irrigate the fields. Most of the water pump in Egypt is used to extract water from shallow depths. All the pumps are diesel powered. These can be easily retrofitted with a PV component to decrease the vulnerability of farmers to diesel price and shortages. The agribusiness in the country can benefit from up to 2 GWp of PV irrigation.

A study conducted by RCREEE in collaboration with the UNDP in 2015 (RCREEE, 2016b) examined the cost-effectiveness of using hybrid PV power sources in the town of Marsa Allam, which is located near the Red Sea in Egypt. Estimates show that the process of hybridization of power generation at a price of 4 Egyptian Pounds per litre. Around 65 hotels in Marsa Allam are supplied with diesel power systems that have an annual installed capacity of 2 MW. The annual consumption of diesel fuel by one hotel amounts to 1.056 million litres. Combined annual consumption of diesel is estimated to be 68.64 million litres. The fluctuating supply of diesel has badly affected the hotel business. Moreover, the phase out of the subsidies will create extra financial problems for the hotels. As a result, PV systems could achieve 60% penetration in mini-grids based on diesel fuel.

In Egypt, the telecommunication companies operate different off-grid base stations. These stations depend mainly on diesel generators. The D2S report projected that around 800 off-grid systems in this sector could benefit from solar PV installation. Replacing diesel generators with 90 kWp solar system could result in savings of about 1.87 ktoe.

Rural electrification had commenced in Morocco in 1996. Electricity was provided to a large number of households in rural areas. Among 50,000 households residing in villages are provided with electricity generated from solar PV systems. In addition, a number of micro-hydropower stations have been established and are currently operating in the region. The power is used for electrification, potable water generation, and agribusiness. Until now, electricity has been provided to about 98.95% of rural areas in the country.

During the Paris COP21 negotiations in December 2017, one loan guarantee and two loan agreements were approved by the OPEC Fund for International Development. The funds were provided by the OPEC Fund for International Development with the aim of rural electrification in Morocco. The USD 70 million loans will allow around 723 additional villages to have continuous access to electricity. In this respect, a UAE based company named Masdar has announced the installation of 9,000 solar home systems in 940 villages across the country. This represented 50% of the projects to provide access to electricity in the country by the Morocco's Office National de l'Electricité et de l'Eau Potable (ONEE). The installed systems comprise of 290-watt solar panels. Each of the solar batteries also has the installed storage capacity for three days.

The grid system in Algeria is developed in the coastal regions where there is the highest demand for power. However, the coverage is not adequate for the rest of the country. Low economic performance combined with adverse political situations in the Sahara region as well as low population density has led the country to rely on off-grid renewable energy. The renewable energy projects are considered as the perfect solution for providing electricity to rural areas, particularly in the Grand Sud region. The focus is on generating electricity through solar PV system and to a less extent through CSP. The solar PV system has been used to provide electricity in twenty steppe and plateau villages in the country. These villages are spread out on four regions, namely Tindouf, Tamanrasset, Adrar, and Illizi. The price of diesel is relatively high, while the supply is not constant. That is the reason why the state had decided to utilize

the solar power system to meet the based electricity need of the local population. The total installed systems PV in Tunisia are 11,000 and they are dispersed throughout the country. Libya had also initiated a large program 1,000 Roofs program having an installed capacity of 3 MW. The power system consists of both on-grid and off-grid systems. Egypt holds more than 30 decentralized standalone power plants. Most of them are either gas turbines or diesel units that are not connected to the national grid. The agriculture sector can realize the greatest potential from a hybrid system with the water pumps activated by both the solar PV panels and diesel generators. This will solve the problem of fluctuating accessibility and demand for diesel fuel.

The Kingdom of Saudi Arabia is currently focusing on phasing out diesel generators used for off-grid sites. The government is exploring the possibility of using solar power panels in border posts, remote villages, rest stops, and places of worship. While the daily energy need is being met by diesel, the problem is that they incur a lot of costs. The generators do not function properly during the hot summer months. The remote areas can be better served using hybrid systems consisting of diesel and solar powered generators. The hybrid power can be utilized for cooling and desalination purposes. Currently an equestrian resort located near the capital city of Riyadh is being powered by a hybrid 1 MW concentrated PV plant. The solar power is used in combination with the 14 MW diesel generator. The Saudi Electricity Company and Aramco intend to add 300 MW solar power capacity to remote regions.

The rate of electrification in Sudan is low in comparison with other countries in the MENA region. A large number of farms rely on diesel fuel to irrigate the fields and pump water. The fuel price consists of about 40% of the total cost in the agribusiness sector. Most of the pumps in the region rely on hydro-power plants. It should be noted that the pumps have been integrated into the design of the dams in order to control the flow of water. The Roseires Dam that was constructed in the mid-1960s generates sufficient electricity to power the pumps. These pumps deliver water from the Nile to the farmlands that cover an area of 63,000 hectares. The oldest cultivated areas in Sudan are located on large plains having terrains that slope from the south to the north. The slope allows the river water to irrigate the lands through gravity. In general, diesel generators are used for different agricultural purposes near the Nile river. As a result, the Global Environment Fund (GEF) had introduced a project in 2014 to replace water pumps powered by diesel fuels by solar pumps. This is planned to be achieved by providing targeted subsidies, as well as through the design and introduction of micro-finance. The GEF intends to implement about 1,468 PV pumps that will be part of the off-grid system having a capacity ranging from 296 kWp to 312 kWp.

Djibouti is another country in the MENA region that relies heavily on diesel generators. However, over the years, diesel power plants are replaced by hydropower systems that are imported from Ethiopia. This country currently has two small diesel power plants at Obock and Tadjoura. These plants consume around 4,250 tonnes of diesel every year. Nowadays, the country relies largely on aquifers to meet the drinking needs. So, reducing the consumption of diesel fuel is important. In this respect, the government had announced the intention to install solar pumps in rural wells and boreholes. Construction is under way of small solar plants that will supply power to around 25 villages in the country in the next five years. Three of the plants are already completed, but they are not connected to the power grid. Concerning off-grid wind power systems, this country has a great opportunity to scale up the wind farm. The country consists of some of the windiest sites in the world. However, there is limited experience of using wind power to generate electricity, and only a few wind pumps are installed.

Mauritania is a large country that is sparsely populated. Thus, the country does not require an extensive network of electricity. The load centres are spread out that is why there is a need for decentralized power services. Various programmers had been put forward to focus on the rural areas that are off the grid. The local government has introduced a unique funding plan known as the Fund for Universal Access to Services (FAUS). These funds are largely supplied through the revenues of the telecommunication sector. The master plan for generation and distribution of electricity provides a framework for connecting to rural areas. At present, the rural areas utilize diesel power to meet the power needs. There is a need for using hybrid systems to provide cost-effective electricity to the local population. In this regard, one of the first hybrid power plants was built in Kiffa having a 1.3 MWp solar and 4.8 MW thermal capacities.

Yemen has introduced an incentive for solar power plant before the outbreak of the civil war. An interest free loan scheme was introduced for the farmers as a collaboration between the Agriculture and Fisheries Production Promotion Fund and CAC Bank. The plan allows the farmers to buy solar powered pumps to replace the diesel pumps. The government also covers the loans service fees to take the load off the farmers in servicing the loan. In addition, the government offers grants that depend on the repayment period of the loan. Around 170 pumps were purchased through these loans and grants. The Small Enterprises Development Fund of the Ministry of Industry and Trade also helps farmers purchase solar pumps. The loan has to be repaid in three years, but it has an annual interest rate of 12.5%. This is not unlike the 13.5-rates two-year period loans offered by the banks.

1.7.2. Energy subsidies in the Middle East and North Africa region

Government subsidies have a substantial impact on the development of renewable energy technologies. The energy that is generated using fossil fuel and traditional sources of electricity, including fuel oil is subsidized by 50% in the MENA region (IEA, 2014). In contrast, the renewable energy sector does not receive any subsidy from the government.

Regulatory policies changes are not enough to promote renewable energy technology. In order to increase the share of renewable energy, a country needs to phase out fuel oil subsidies. This requires making estimations about the phasing out of the subsidy and designing a strategy to minimize the negative effect on the local population. In addition, there is a need to ensure public acceptance for carrying out the necessary steps for transitioning to the green energy (IRENA, 2014).

This section sheds light on the number of energy subsidies provided in each country. Afterwards, the recently implemented subsidy reforms in the respective countries in the MENA region are analysed. The task of calculating the number of subsidies is difficult in the region, mainly due to the fact that it takes different forms and is applied differently. Other challenges in determining the exact subsidies provided to fuel oil energy producers include lack of transparency, poor quality data, and confidentiality of information.

The retail tariff on electricity in Palestine was taken as a benchmark. Electricity is nearly 100% subsidized in this country. As a result, it can be taken as a true retail cost of electricity production. Prices of electricity are set by the government in the MENA region. So, the main aim of the method is to get an estimate of the subsidies for power generation and not to determine the exact subsidies.

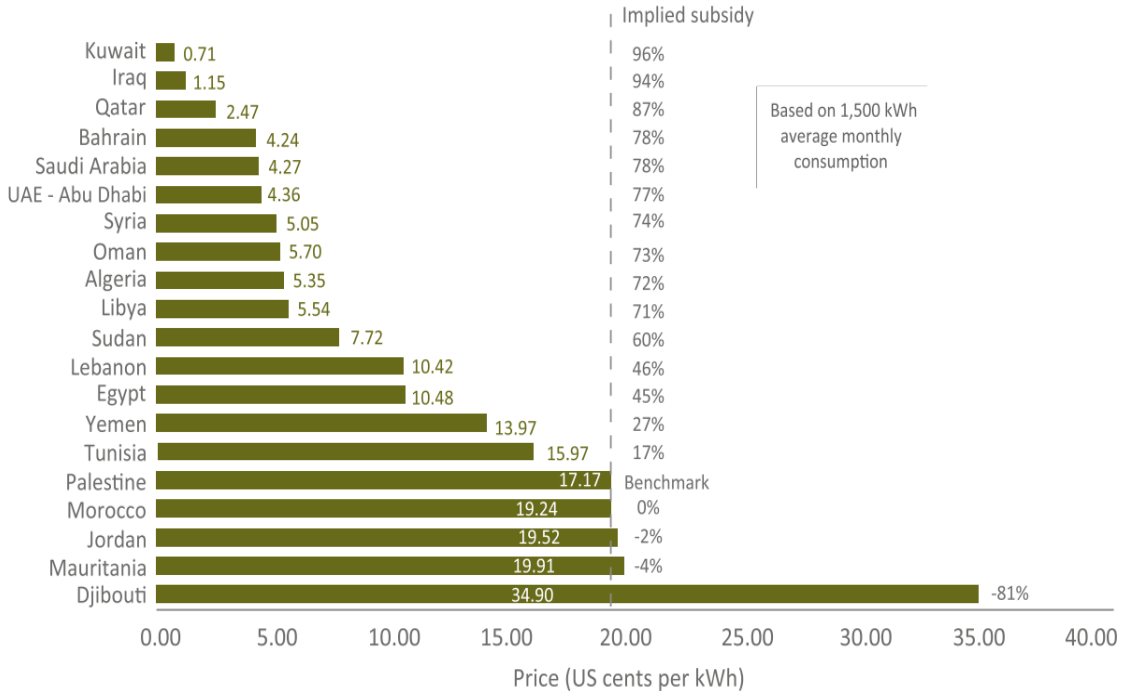
Figures 1.9, 1.10 and 1.11 show implied commercial, residential, and industrial sector subsidies. These figures represent estimated electricity consumption per month on average by varied customer segments in 20 MENA countries. The average consumption for residential consumers is 500 kWh per month. Commercial and industrial consumers consume on average 1,500 kWh and 30,000 kWh per month of electricity, respectively. The majority of the countries included in those figures provide subsidies for fossil fuels and electricity tariffs. The countries in the region have realized in the past several years that providing subsidies to fuel oil power generation companies is problematic. Therefore, they have introduced reforms to modify the subsidies and prices of electricity. Despite taking these measures, the rate of subsidies provided to fuel oil producers remain high. This is the case for both oil-importing and exporting countries.

Within the MENA region, Djibouti has significantly high tariffs for electricity. The electricity tariff for the commercial and industrial sector is about USD 0.3 per kWh. The main reason for this high tariff is that this country relies almost entirely on fuel oil for electricity (Masdar Institute & IRENA, 2015). The situation is similar in Mauritania that uses fuel oil to produce about 75% of electricity. The tariff for both residential and industrial sectors is higher compared to many other countries the region (Masdar Institute & IRENA, 2015). On the contrary, Iraq, Syria, and Kuwait have one of the lowest electricity tariffs. These countries subsidize over 95% of electricity production. The extent of subsidies provided by the government can be realized from the fact that the average residential consumer in Syria has to pay only 3% of the real price of electricity.

The industrial and commercial sectors in the countries are generally offered fewer subsidies than the consumer sector. The exceptions include Qatar, Tunisia, and the UAE. The tariffs in the residential sector in these countries are higher than in the other two segments. Kuwait is the only country in the region where the electricity tariffs are fixed at $0.06 per kWh (2 Kuwaiti Fils per kWh) for all the sectors. It should be underlined that these prices only represent the difference in prices in respective countries at a particular consumption level. These prices do not reflect the actual amount that is paid by the consumers. The reason for this is that the prices are usually linked with the level of consumption and voltage. Furthermore, the data presented in figure 1.9 do not show the different sources of fuel and the supply costs of the fuel for the power generating companies.

Concrete actions need to be implemented to ensure a smooth transition to renewable energy in the MENA region. These actions should be taken at all levels with an emphasis on a system approach. Energy subsidies provided to fuel oil-based system will only increase the dependence on fossil fuel. There is a great need to decrease the energy subsidies provided to companies that produce electricity using fossil fuel. Otherwise, the damage to the environment due to GHG emission will continue without interruption. Figures 1.9, 1.10, and 1.11 show the electricity prices in different sectors and subsidies regarding the reference of Palestine. Based on the price-gap approach and as a reference price, Palestine's retail electricity tariffs were selected. Electricity in Palestine is almost unsubsidized and, therefore, represents the approximate true retail cost for a specific energy mix used for power generation. In all other Arab countries, prices are currently set by the national governments. The goal of this method is not to calculate the exact number of subsidies, but to provide a general idea of the magnitude of subsidies in the electricity sector.

Figure 1.9: Residential electricity prices and subsidies benchmarked to Palestine in 2015



Source: RCREEE (2016a, p. 56)

The net importing oil nations have carried on ambitious reforms for subsidies since 2015. After the oil prices had started declining in mid-2014, most of the oil-exporting countries also decided to phase out electricity subsidies. After analysing the economic impact of subsidies, it seems obvious why the MENA countries have decided to phase out the subsidies. Egypt, Bahrain, Tunisia, Saudi Arabia, Jordan, UAE, and Oman have all shown the intention of introducing reforms in power subsidies in the period 2013-2016.

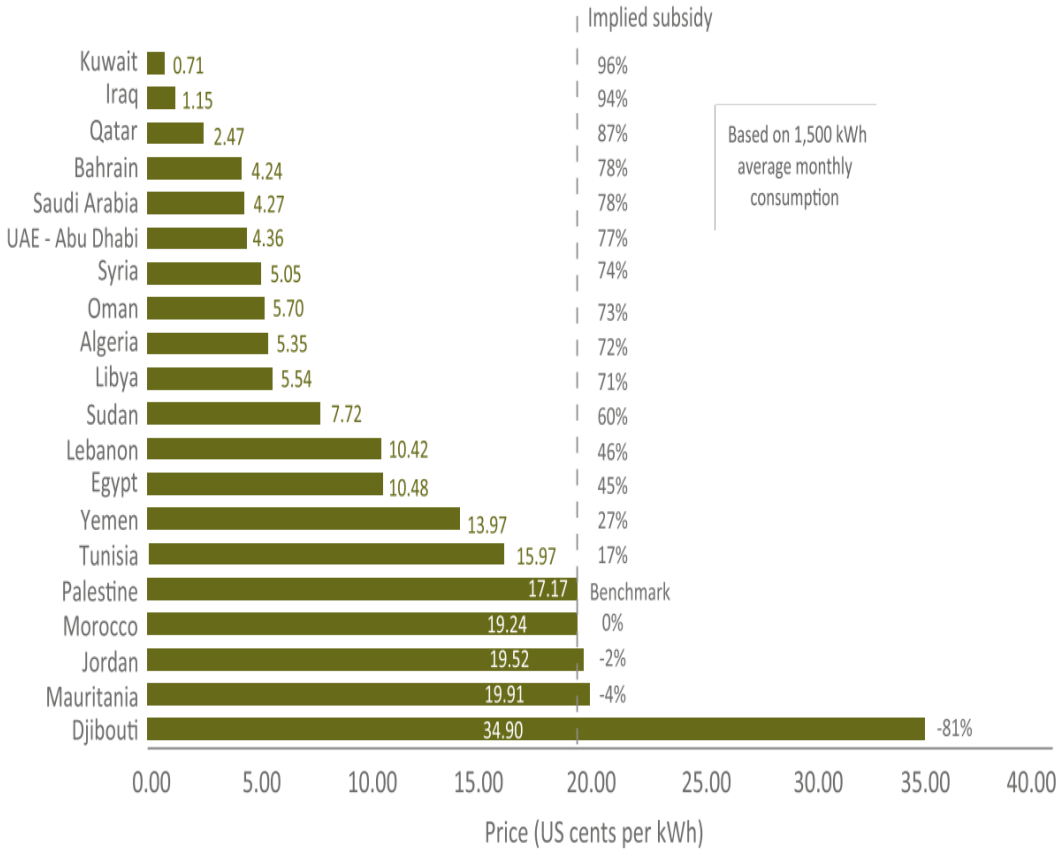
The reforms for subsidies in Egypt started in mid-2014 when the government introduced a five-year transitional plan to end subsidies to the electricity sector. This plan was approved in July 2014. The government has agreed to increase the tariff for most consumer segments in the middle of 2014 until 2018. The industrial sector that consumes extra-high voltage electricity will experience the highest increase in tariffs amounting to 20% per year. The most recent tariff increase occurred in July 2015 that ranged from 25% to 40% depending on the level of consumption.

Phasing out of subsidies in Bahrain started in the early months of 2016 for non-Bahraini residents. The phasing out of subsidies will continue until 2019. The new price of electricity for expats was fixed in 2016 at USD 0.16 per kWh for electricity consumption that is below 3,000 kWh, USD 0.34 per kWh for electricity consumption from 3,000 to 5,000 kWh, and USD 0.5 per kWh for consumption that exceeds 5,000 kWh. The Bahraini government plans to gradually increase the rates to USD 0.77 per kWh for the latest segment in 2019. The increase does not affect local Bahraini, who will continue to pay $0.08, $0.24, and $0.42 per kWh for the three segments of electricity consumption. The tariff for the industrial and commercial

sector was fixed at $0.42 per kWh. The majority of subsidies that were provided by the government of Bahrain were targeted towards electrical power consumption by residential Bahrainis and expats. The real price of generating electricity in the country amounts to USD 0.77 (29 Bahraini fils)[15] per kWh. The subsidies represent a heavy financial burden amounting to around 85% of the total electricity costs. However, in light of the record decline in oil prices, oil revenues of the government were badly hit. As a result, the government took the decision to raise the tariffs by 5 to 6% per year.

The government of Saudi Arabia had started subsidies reforms in 2016 to reduce the burden on the budget. The aim of reducing the subsidies to the power sector was also to increase energy efficiency by reducing domestic water, fuel, and electricity prices. The government had announced that it intends to decrease the subsidy of energy to USD 61 billion in 2015, which represents 9.3% of the GDP. The tariff for the residential sector that consumes under 4,000 kWh electricity has not been changed. The electricity prices for consumers who consume 4,000 to 6,000 kWh had increased by USD 0.053 per kWh or 66.7%. The price for consumers whose consumption exceeds USD 6,000 had increased by USD 0.08 per kWh. The electricity tariff for the commercial sector had also increased by USD 0.01 per kWh. For the public sector, the unified electricity tariffs benefit the industrial sector, which has to pay USD 0.053 per kWh.

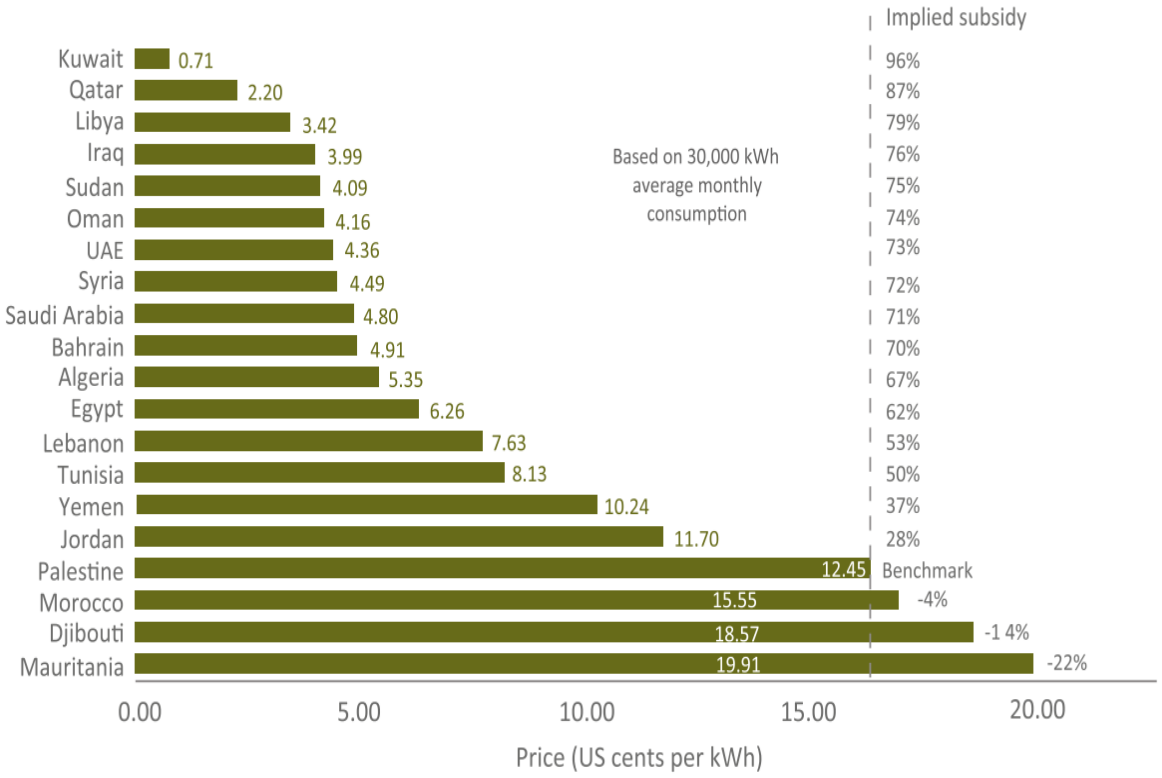
Figure 1.10: Commercial electricity prices and subsidies benchmarked to Palestine in 2015



Source: RCREEE (2016a, p. 56)

[15] USD – BHD Exchange rate as of 6 December 2017 is 0.376, Central Bank of Bahrain.

Figure 1.11: Industrial electricity prices and subsidies benchmarked to Palestine in 2015



Sources: RCREE (2016a, p. 57)

Jordan planned to greatly decrease the subsidies by the end of 2017. The phase out subsidies had commenced in 2014, and gradual increases in the prices of electricity were announced for the coming years. Most of the residents were not affected by this increase in tariffs in this country. However, the commercial and industrial sector have experienced a large increase in electricity tariffs. The highest increase in electricity prices is applicable to hotels and banks in Jordan. Hotels are expected to pay USD 0.36 per kWh, while banks pay around USD 0.45. The sharp increase in electricity tariffs may contribute to the deployment of renewable energy projects by the respective sectors.

The annual cost to subsidize electricity in the United Arab Emirates comes to around USD 29 billion, according to the IMF data corresponding to 2015. The UAE had announced new energy tariffs starting in 2016. Similar to Bahrain, the government of Abu Dhabi has decided to increase tariffs for expats. In 2016 and after introducing the new changes, the electricity bills for the expats increased by 40% from USD 0.04 to USD 0.06 for usage up to 20 kWh per day in apartments and 200 kWh per day in villas. At the same time, the rates of local Emiratis stayed the same at USD 0.01 per kWh who consume 30 kWh per day in apartments and up to 400 kWh per day in a villa.

1.8. THE INSTITUTIONAL FRAMEWORK FOR RENEWABLE ENERGY IN THE MIDDLE EAST AND NORTH AFRICA REGION

Institutions are relevant for the development of renewable energy. This section focuses on two main elements, which are the existence of independent regulators and renewable energy agencies.

1.8.1. Renewable energy institutions in the Middle East and North Africa region

In order to ensure transparent, functional, and trustworthy investment market in the energy sector, governments should set up a transparent and independent regulation concerning the power segment. An independent power regulator needs to ensure fair competition among different market players. The regulator should set tariffs, evaluate the performance of the power sector, issue license, and implement open market based legislations (USAID & NARUC, 2011).

Guidelines regarding best practices for independent, functional regulators have been provided by the 3rd EU Energy Market Directives. These guidelines state that regulators should be functionally independent and different from the public and private sectors companies. They need to be given legal powers; therefore, they can approve and modify price tariffs. The legal power should also be given to ensure the implementation of binding regulations without any interference from the government. In addition, the regulatory actions should be characterized by a clear, common, and transparent methodology. They should also have access to adequate funds to hire outside and in-house consultants.

The countries in the MENA region that are committed to make the power market transparent have founded regulatory agencies. Table 1.11 presents the list of electricity regulatory agencies in the MENA countries. Nevertheless, most of the regulators do not have the required resources and are subjected to interference from the government sector. The governmental bodies are also participating in the regulatory decisions. In this respect, only the Jordanian Energy and Minerals Regulatory Commission (EMRC) continues without intervention from the government (Cambini & Franzi, 2013). Thus, EMRC has been given the power to establish tariffs and grant licenses without getting prior approval from the government. In contrast, political interference is high in Egypt, Algeria, Sudan, Saudi Arabia, and Palestine. The reason for low political independence is that the regulatory agencies are considered mainly as advisory bodies of the government. The government in these countries has the final decision regarding power sector regulations. In the case of Abu Dhabi, the government puts its representatives on the board of the regulatory bodies. As a result, the regulatory body is semi-governmental and not fully independent yet, which is reducing the regulator powers in monitoring activities and licensing independently from governmental policies.

The transfer of power from the government-controlled agencies to independent regulatory bodies has remained a challenge in most of the countries in the MENA region. Nowadays, the regulatory bodies are not independent in the majority of the countries. The public utility companies and distributors generally carry on associated functions where there are no impendent regulatory agencies. A noteworthy development took place in Egypt where a new electricity law was introduced in July 2015. This law has separated the Consumer Protection Regulatory Agency and the Egyptian Electric Utility from the Electricity Ministry. This has resulted in the creation of an independent body for regulation of the market. This step will help

create a more independent and transparent and electricity market that will encourage the private sector.

Table 1.11: Electricity regulatory agencies in the MENA countries

	Electricity Regulatory Agency	Power Off-taker for Large-scale RE Projects
Algeria	Commission de Régulation de l'Electricité et du Gaz (CREG)	Société Algérienne de Gestion du Réseau de Transport de l'Electricité (GRTE)
Bahrain	Nonexistent	Electricity and Water Authority (EWA)
Djibouti	Service des Réglementations de la Direction de l'Energie	Eléctricité de Djibouti
Egypt	Egyptian Electric Utility and Consumer Protection Regulatory Agency (EgyptERA)	Egyptian Electricity Transmission Company (EETC)
Iraq	Nonexistent	Directorate of Transmission Directorate of Transmission Project
Jordan	Energy and Minerals Regulatory Commission (EMRC)	National Electric Power Company (NEPCO)
Kuwait	Non existent	Ministry of Electricity and Water
Lebanon	Non existent	Electricité du Liban (EDL)
Libya	Renewable energy Authority of Libya (REAOL)	Renewable energy Authority of Libya (REAOL)
Mauritania	Autorité de Régulation Multisectorielle	Société Mauritanienne d'Electricité (SOMELEC)
Morocco	Under establishment	Office National d'Electricité (ONE)
Oman	Authority for Electricity Regulation	Oman Power and Water Procurement Company
Palestine	Palestinian Electricity Regulatory Council (PERC)	(OPWP)
Qatar	Nonexistent	Qatar General Water and Electricity Corporation "KAHRAMAA"
Saudi Arabia	The Electricity and Co-Generation Regulatory Authority (ECRA)	Saudi Electricity Company (SEC)
Sudan	Electricity Regulatory Authority (ERA)	Sudan Electric Transmission Company (SETCO)
Syria	Non existent	Public Establishment for Electricity Generation and Transmission (PEEGT)
Tunisia	Nonexistent	Société Tunisienne d'Electricité et du Gaz (STEG)
UAE	Abu Dhabi Regulation and Supervision Bureau (RSB)	Dubai Electricity and Water Authority (DEWA); Abu Dhabi Water and Electricity Authority (ADWEA)
Yemen	Non existent	Public Electricity Corporation (PEC)

Source: RCREEE (2016a, p. 62)

The administrative and institutional barriers represent the main barrier to the development of renewable energy. The process of obtaining permits is complex and non-transparent. Many public authorities are involved, and there is a lack of clarity in the framework for renewable energy.

Many countries in the MENA region have established dedicated renewable energy agencies in order to overcome the obstacles and ensure the development of renewable energy. The renewable agency should be a dedicated independent public entity having an ability to implement policies, simplify administrative tasks, and help to develop large scale private and

public renewable energy projects. Table 1.12 shows the renewable energy institutional stakeholders in the MENA countries.

Table 1.12: Renewable energy institutional stakeholders in the MENA countries

	RE Policy Maker (Dedicated RE Department or Dedicated Agency)	Other Key RE Institutional Stakeholders
Algeria	Renewable Energy and Energy Conservation Directorate at the Ministry of Energy and Mines	Sharikat Kahraba Takate Moutajadida «SKTM», filiale du Groupe Sonelgaz Center for development of RE (CDER) Silicon Technology Development Unit (UDTS) Unit Development of Solar Equipment (UDES) Center for Research and Development of the Electricity and Gas (CREDEG)
Bahrain	No dedicated RE department or agency in place yet	Electricity and water Authority (EWA); Sustainable Energy Unit (SEU);
Djibouti	Direction of Energy at the Ministry of Energy in charge of Natural Resources	Agence Djiboutienne de Maîtrise de l'Energie (ADME)
Egypt	New and Renewable Energy Authority (NREA)	Research Center for Energy and Environment under Ministry of Science and Technology Research Center under Ministry of Higher Education and Scientific Research (universities and institutes) Energy and Environment Research Center under Ministry of Industry
Iraq	Renewable Energy Department at the Ministry of Energy and Mineral Resources	National Energy Research Center (NERC)
Jordan	No dedicated RE department or agency in place yet	National Energy Research Center (NERC)
Kuwait	No dedicated RE department or agency in place yet	Kuwait Institute for Scientific Research (KISR)
Lebanon	Lebanese Center for Energy Conservation (LCEC)	UNDP – CEDRO and UNIDO – DREG Projects; The Lebanese Solar Energy Society (LSES) Industrial Research Institute (IRI) National Council for Scientific Research (CNRS)
Libya	Renewable Energy Authority of Libya (REAOL)	General electricity company of Libya(GECOL) under the ministry of electricity and renewable energy Center for Solar Energy Research and Studies (CSERS)
Mauritania	Department of Electricity and Energy Management (DEME) at the Ministry of Petroleum, Energy and Mines (MPEM)	Agency for the Development of Rural Electrification (ADER); Multisectoral regulation Authority (ARM); Agency for the Promotion of Universal Access to Basic Services (APAUS);
Morocco	Direction of Electricity and Renewable Energies at the Ministry of Energy, Mines, Water and Environment; Moroccan Agency for Solar Energy (MASEN); Agency for the Development of Renewable Energy and Energy Efficiency (ADEREE)	Société d'Investissements Energetiques (SIE); Institut de Recherche en Energie Solaire et Energies Nouvelles (IRESEN); Centre National pour la Recherche Scientifique et Technique (CNRST)
Palestine	Palestinian Energy Authority (PEA) Palestinian Energy and Environment Research Centre (PEC)	Energy Research Centre (ERC) at An-Najah National University
Qatar	Qatar General Water and Electricity Corporation "KAHRAMAA"	Qatar Science and Technology Park (QSTP) Energy and Environment Research Institute (QEERI) Qatar Solar Technologies (QST)
Saudi Arabia	King Abdallah City for Atomic and Renewable Energy (KACARE)	Saudi Aramco
Sudan	Directorate for Renewable and Alternative Energy within Ministry of Water and Electricity	National Center for Energy Research (NCR)
Syria	National Energy Research Center (NERC)	Scientific Studies and Research Center Higher Institute for Applied Sciences and Technology Research Centers in universities; mainly Damascus University Industrial Research and Testing Center
Tunisia	Agence Nationale pour la Maîtrise de l'Energie (ANME)	Centre de Recherche et des Technologies de l'Energie (CRTEN)
UAE	Ministry of Climate Change and Environment	MASDAR
Yemen	Renewable Energy Department within the Ministry of Electricity and Energy	Renewable Energy and electronic design Centre, University of Science and Technology Technical Centre for Training and registration – Dhahban, Public Electricity Corporation (PEC)

Source: RCREEE (2016a, p. 63)

One of the most important features of the renewable energy agency is coordination among different stakeholders. This includes both private and public institutions. Moreover, the agency needs to ensure an effective use of human capital resources, and technical resources to achieve targets for renewable energy projects.

The agencies can act as a negotiator and facilitator of agreements in countries where the governments receive the support of the donors for renewable energy development. Dedicated agencies can also increase awareness about renewable energy, carry on feasibility and quality assessment studies, and promote R&D for development of renewable energy. All of this requires the availability of qualified staff, sufficient resources, and empowered leadership.

1.8.2. Governance quality in the Middle East and North Africa region

Many elements are perceived to influence the investor decision to invest in the renewable energy sector. Apart from the technical aspects, the main factors that affect the investor climate include the stability of the government and disruptions caused due to civil disturbances and war. Other factors that affect the investment environment include the competitive environment, regulatory environment, and fluctuations in the currency. Three well-known indexes that analyse these specific factors include the BTI Status Score, the World Bank Ease of Doing Business Index, and the Global Competitiveness Index. Those rankings are shown in table 1.13.

Table 1.13: Countries performance under international indices in 2016

World Bank Ease of Doing Business		BTI Status scores		Global Competitiveness Index	
UAE	31	Tunisia	6.15	Qatar	14
Bahrain	65	UAE	6.05	UAE	17
Qatar	68	Qatar	6.01	Saudi Arabia	25
Oman	70	Kuwait	5.85	Kuwait	35
Tunisia	74	Lebanon	5.74	Bahrain	39
Morocco	75	Algeria	5.11	Oman	62
Saudi Arabia	82	Jordan	5.09	Jordan	64
Kuwait	101	Djibouti	5	Morocco	72
Jordan	113	Palestine	5	Algeria	87
Lebanon	123	Bahrain	4.96	Tunisia	92
Palestine	129	Oman	4.75	Lebanon	101
Egypt	131	Morocco	4.6	Egypt	116
Sudan	159	Egypt	4.4	Mauritania	138
Iraq	161	Mauritania	4.35	Yemen	-
Algeria	163	Saudi Arabia	4.26	Iraq	-
Mauritania	168	Iraq	3.53	Palestine	-
Yemen	170	Yemen	2.91	Sudan	-
Djibouti	171	Libya	2.64	Syria	-
Syria	175	Sudan	2.44	Libya	-
Libya	188	Syria	1.8	Djibouti	-

Source: RCREEE (2016a, p. 67)

The Ease of Doing Business (EDB) index of the World Bank shows basic data concerning operation and establishment of commercial sector companies. Thus, it gives an overview of the investment environment in a country. This index is not tailored for the MENA region, nor it focuses on the renewable energy sector. The EDB index ranks the 189 world economies. It focuses on how the legislative environment is conducive for carrying out businesses. The results

of the index in 2016 show wide differences between the countries in the MENA region. The UAE had the highest EBD index in the region, ranking 31st out of 189 countries. This country is followed by Bahrain, Qatar, Oman, and Tunisia that have a ranking of 65, 68, 70, and 74, respectively. Morocco and Saudi Arabia have an EBD ranking of 75 and 78, respectively. Jordan, Egypt, Palestine, Mauritania, and Yemen are ranked at the bottom of the list at 113, 131, 139, 168, and 170, respectively. Syria and Libya have the lowest ranking in the MENA region, 175 and 188, respectively.

The Bertelsmann Stiftung Transformation Index (BTI) assesses similar factors to EBD index, but at a wider context. The index focuses on economic and political factors that provide valuable insights into the internal governance. It places a strong emphasis on social integration, political participation, institutional stability, competition, and organization in the market (The Bertelsmann Stiftung, 2016). A high BTI score indicates stronger performance. The BTI scores in the MENA region depicts unstable situations in certain countries. The overall average had declined in the MENA region; thus, the score decreased from 4.74 to 4.53 for the 20 countries in the MENA region in 2016 comparing with 2015. Tunisia has the highest score of 6.15 in the region. The economic and political situation has stabilized in this country in the past few years. Next highest scores in the MENA region are some of the GCC countries, such as UAE, Qatar, and Kuwait. These countries have been able to attract foreign investors. The position of Egypt position is 13th in 2016, which has dropped from 9th a year earlier. The war moved countries like Syria and Libya to the bottom of the list with scores of 1.8 and 2.64, respectively.

The Global Competitive Index (GCI) has been introduced by the World Economic Forum (WEF). The aim of the index is to assess the state of competitiveness in 144 countries, analysed a large number of factors. Competitiveness is defined by the WEF Report (World Economic Forum, 2019) as a set of policies, entities, and elements that affect the productivity of companies in a country. The GCI is based on twelve factors or pillars of productivity, grouped in four different categories, such as enabling environment, markets, human capital and innovation ecosystem. Enabling environment refers to institutions, ICT adoption and macroeconomic stability. All of the dimensions are given a score from 1 to 7. The UAE has led the GCI index in 2015, while Qatar had the highest score among the GCC countries in 2016. The high GCI ranking of Qatar has been due to stable macroeconomic budget that is supported by budget surpluses. Low levels of debt have also been the contributing factor for a high score. It should be indicated that the latest financial constraints due to low oil prices have not been factored by the index; thus, it is expected that low oil prices may undermine the ranking of this country. In order to maintain a strong investment environment, this country should focus on technology transfer and innovation to build a sustainable economy (World Economic Forum, 2015). The GCI ranking of the UAE dropped in 2016 due to new data relating to tertiary education, which result in a significant decline in the assessment of the level and quality of higher education and training. However, this country has an excellent macroeconomic environment, well-developed infrastructure, a relatively diversified economy, and a stable investment environment. Kuwait and Bahrain have been ranked 35 and 39, respectively. The GCC countries have done well in comparison with Oman, whose ranking has decreased 16 places in 2016 to 62. Lebanon and Mauritania are placed at the bottom of the ranking at 101 and 138, respectively.

1.9. LAST TRENDS IN THE DEVELOPMENT OF RENEWABLE ENERGY IN THE MIDDLE EAST AND NORTH AFRICA REGION

Many countries in the MENA region have made significant progress towards creating better conditions for expanding renewable energy investments. In this sense, market structures have improved significantly, providing applicable private investment opportunities, and adopting measures to facilitate access to the power generation market for projects both on the network and off the grid. The subsidy reform movement across the MENA countries continues to provide better reasons for the need to increase the contribution of renewables to the energy mix. Most countries in the MENA region currently allow some private participation in power generation activities, through different ways. At least nine countries have designated areas or the development of marine renewable energy (MRE) projects, and all countries have designated institutions or departments at the ministry level to promote the development of risk learning. Network codes for renewable energy projects have already been adopted in 10 countries.

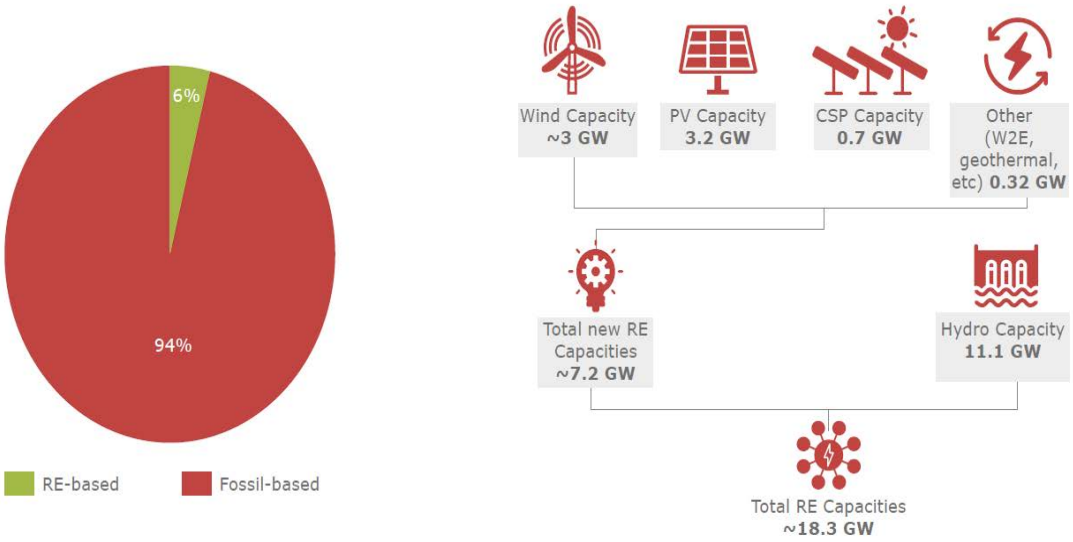
The political commitment to promoting risk learning has been translated into coherent policy frameworks, where risk learning goals are adopted with detailed action plans and supportive policies, such as competitive bidding, auctions[16], direct proposals, and a net measure continuously, where nutrition tariffs play a lesser role than before. The total installed capacity in the MENA countries for new renewable energy sources (excluding hydropower) exceeded 7 gigawatts by the end of 2018, more than double the capacity recorded in 2016. Figure 1.12 shows the share of renewable energy in installed capacity in the MENA region in 2019.

For the first time, the PV capabilities exceeded the wind capabilities (3.2 GW versus about 3 GW), which reflects that many MENA countries are taking advantage of the huge value of reducing costs and models of PV systems compared to other renewable technologies. Photovoltaic installations are spread throughout the region, be it utility scale or small/medium decentralization systems. Wind generation is currently dominated by facilities at the facility level in Egypt, Morocco, Tunisia and Mauritania, while concentrated solar energy has gained new energy in Saudi Arabia, adding to advanced projects in Algeria, Morocco, Egypt and the UAE. The development of renewable energy capacities by technology in the Arab region from 2010 to 2018 is demonstrated in figure 1.13.

Figure 1.14 shows the trend of market transformation from wind to PV technology in the period from 2010 to 2018. Despite the rising trend in terms of the share of renewable energy in total installed capacity, the MENA region is still about 6% since a few years, as figure 1.15 shows. The main reason behind this fact is that in the same period, there was growth in traditional electricity generation capacities. It should be noted that Arab African countries enjoy a higher total share of 12%, which indicates the relatively faster pace of development, as Arab African countries represent a share of renewable energies 65% of the total renewable energy energies in the MENA region. Sudan tops the 49% stake due to its large water capacity. In the case of excluding hydroelectric power, Morocco and Jordan lead first with 14%, followed by Mauritania with 12%. Other Arab countries were 5% behind in Tunisia, followed by Egypt and Algeria at approximately 2%. Concerning the renewable energy projects under construction, table 1.14 shows those projects at the end of 2018.

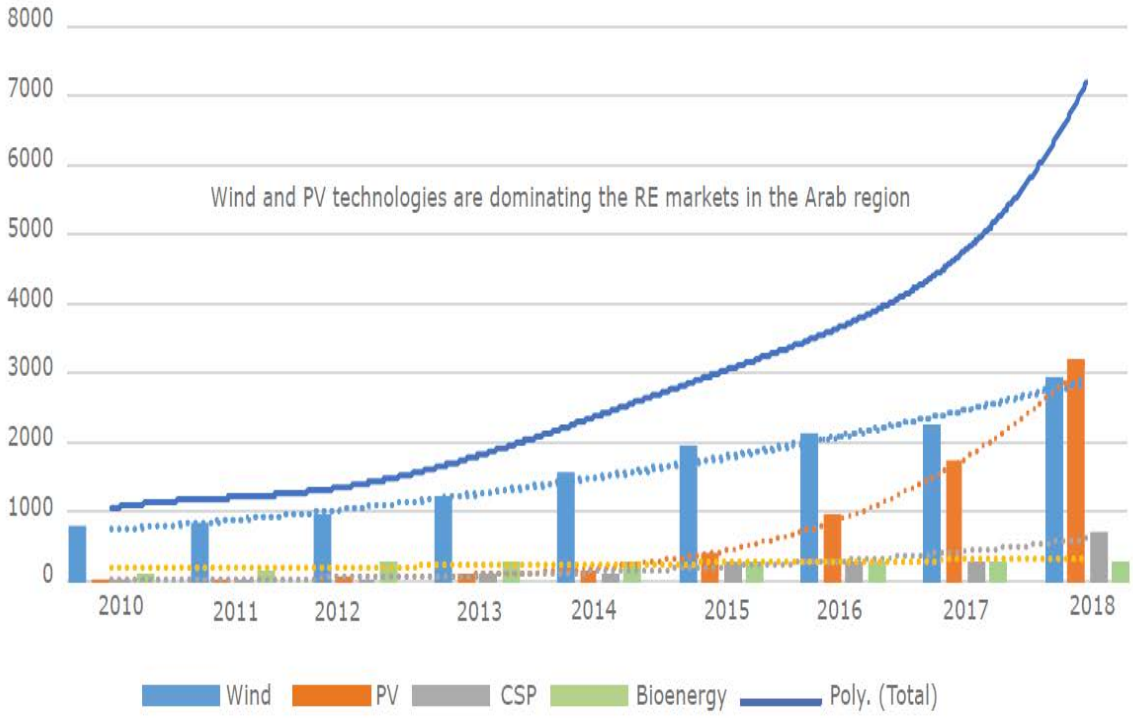
[16] According to the World Bank, renewable energy auctions are also known as demand auctions or procurement auctions, whereby the government issues a call for tenders to install a certain capacity of renewable energy-based electricity.

Figure 1.12: Share of renewable energy in installed capacity in the MENA region in 2019



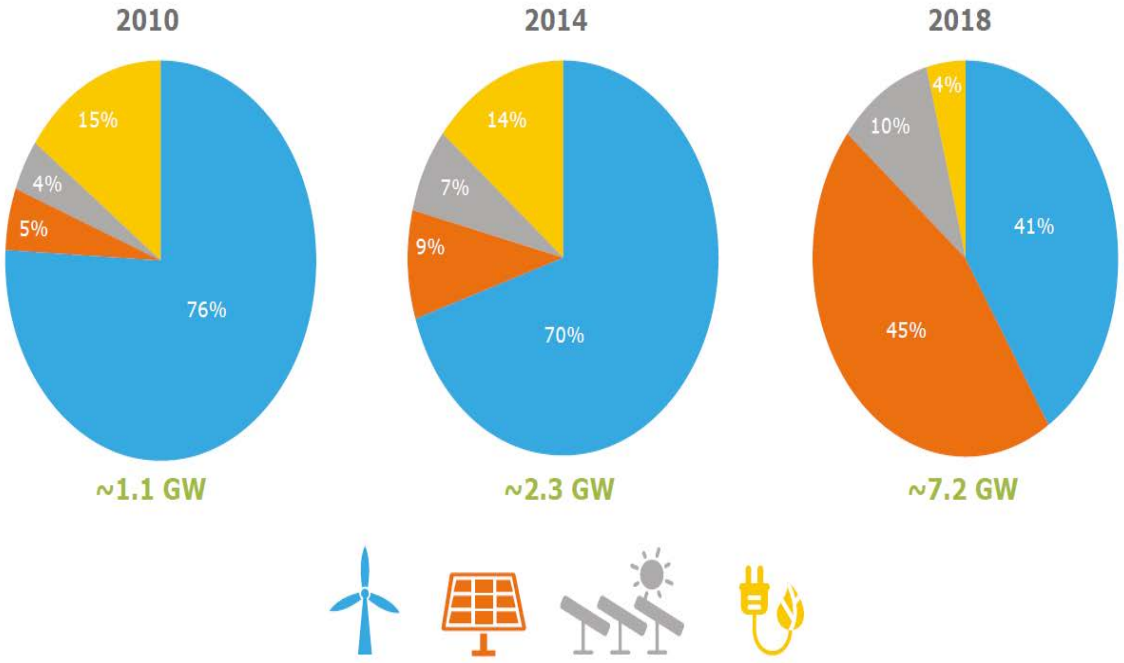
Source: RCREEE (2019, p. 10)

Figure 1.13: Development of renewable energy capacities (MW) by technology in the Arab region 2010-2018



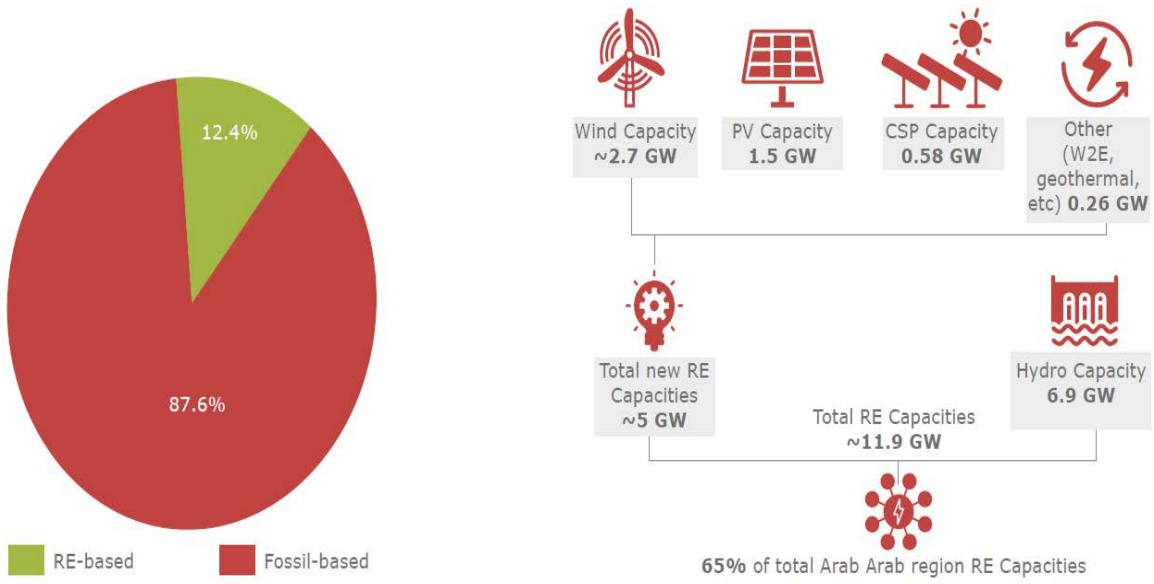
Source: RCREEE (2019, p. 11)

Figure 1.14: Market transformation from wind to PV technologies 2010-2018



Source: RCREEE (2019, p. 11)

Figure 1.15: Share of renewable energy in installed capacity in Arab African countries



Source: RCREEE (2019, p. 12)

Table 1.14: Renewable energy projects under construction in the MENA region in 2018

Country	RE Technology	MW	Project
Algeria	Wind	20	Khenchela
	PV	343	Distributed projects in different sites
	Geothermal	5	Guelma
Bahrain	Wind and PV	5	Experimental plant for solar and wind electricity production
Djibouti	Wind	20	Ghoubet
	PV	50	Grand Bara Phase I
	Geothermal	50	Asal –Fiale Project
Egypt	PV	710	Completinig Benban 1500MW solar complex
	Wind	220	Gabal Al-Zayt
		120	Gulf of Al-Zayt
		200	Gulf of Suez
		40	Increasing the capacity of Gabal Al-Zayt project
		26	Kom Ombo
		20	Hurghada
Jordan	Wind	171	89MW in Shobak, 82MW wind Direct Proposals Round I
	PV	523	343MW Solar PV Panels Projects in Al Mafraq, AlQweirah and South Amman. 180 small scale projects
Kuwait	Wind and PV	70	Shagaya RE Complex
Lebanon	Wind	200	R1 of wind projects
	PV	2.95	Projects In cooperation with the United Nations development program
Libya	Wind	60	Darnah
	PV	110	Distributed projects in different sites
	CSP	25	Sebha
Mauritania	PV	30	Nouakchott
Morocco	Wind	150	Taza
		180	Midelt
		36	El Oualidia
	PV	72	Noor Ouarzazate IV
		85	Noor Laayoune
		20	Noor Boujdour
	CSP	200	Noor ourazazate II
		150	Noor Ouarzazate III
Oman	Wind	50	Amal Oil Field Phase I out of 1021 MW plan
	PV	50	Dhofar Wind farm
Palestine	PV	20	Projects through direct proposal submission
	PV	0.87	Solar projects for schools and the Precedential Building
	Others	0.34	Electricity Generation Project from biogas in Hebron
Saudi Arabia	PV	300	Sakaka solar project
Tunisia	Wind	190	Bizerte
	PV	64	Distributed projects in different sites
	CSP	200	Tonor 1
UAE	PV	200	Mohammed Bin Rashid Solar Energy Complex Phase II

Source: RCREEE (2019, p. 49)

CHAPTER 2:

RENEWABLE ENERGY IN THE MIDDLE EAST AND NORTH AFRICA REGIONS: INVESTMENT ENVIRONMENT

USC
UNIVERSIDADE
DE SANTIAGO
DE COMPOSTELA

2.1. INTRODUCTION

The development of renewable energy worldwide has witnessed significant changes in 2016. Renewable energy investment excluding large hydropower projects was USD 241.6 billion, which means a decrease of 23%. However, the installed capacity had increased by a record 11 GW from 127.5 GW to 138.5 GW in 2016. The total share of solar, wind, geothermal, biomass and waste, marine, and small hydro projects accounted for about 55.3% of all power projects that were added in 2015. More installed capacity of solar energy (75 GW) was added in that year than any other technology. The main reason for increased investments in renewable energy was the sharp decrease in the price of PV cells as well as offshore and onshore wind power plants.

Investment in renewable energy slowed down during 2016 in two main regions: Japan and China. Several factors contributed to explain the slowdown in the renewable energy investment pace. The key reason was the lower capital costs of renewable energy development. The average dollar-denominated capital costs for solar projects at the start of construction was 13% lower in 2016 in comparison with 2015. The costs were 11.5% lower for onshore wind projects and 10% lower for offshore wind projects. Another reason for the apparent slowdown of renewable energy investment in the two main markets was the timing of the projects. Investment in most of the renewable energy projects started in late 2015, and the projects started in 2016. In this case, the investments in the projects were recorded a year earlier, while the addition in the GW was shown a year later.

This chapter provides an overview on the international renewable energy investments trends and the distribution of these investments among economies, according to their level of development, main investors in the renewable energy sector worldwide, investments growth by asset class and country. It also presents a regional view of renewable energy investments and the impact of these investments on the global energy mix. Finally, it approaches the growing energy needs across the MENA countries, the share of renewable energy private investments, and the recent developments in renewable energy investments in the MENA countries for the years 2017, 2018 and 2019.

2.2. DISTRIBUTION, CHARACTERISTICS, AND TRENDS OF GLOBAL RENEWABLE ENERGY INVESTMENT

2.2.1. An analysis of global renewable energy investment by development level

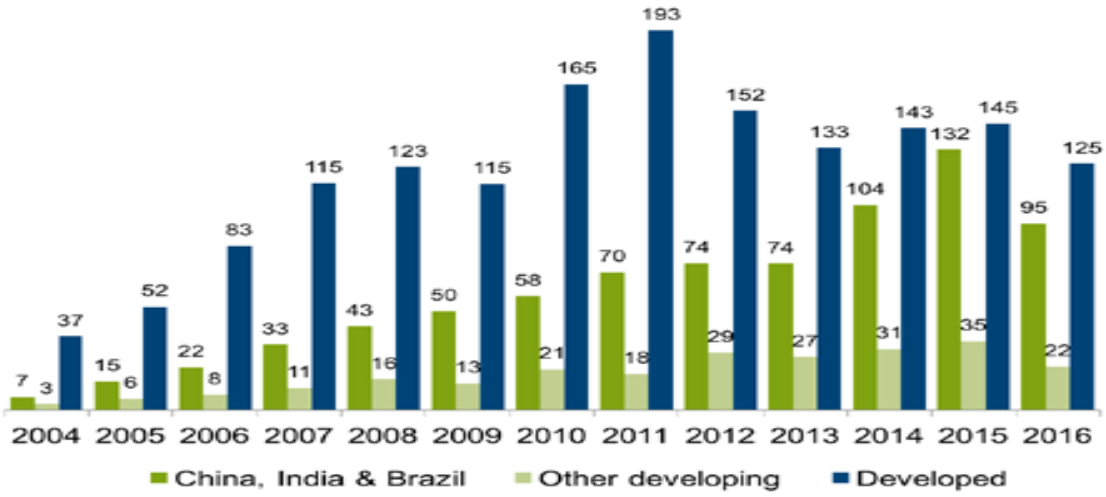
Developing countries exceeded developed countries for the first time in 2015 in renewable energy investment. However, they had surprisingly lost that lead in 2016. Figure 2.1 shows that the total investments in renewable energy development decreased in 2016 to $116.6 billion, a drop of 30% comparing with 2015 levels. In contrast, renewable energy investment in the

developed countries increased to USD 125 billion representing an increase of 14% in the same year.

Figure 2.1 paints a different picture on worldwide renewable energy investment. Developing countries are categorized into two groups. On one hand, the big three consists of Brazil, China, and India; and, on the other hand, the remaining countries. This figure highlights the dominant position of the big three countries in the past decade compared to other countries. However, this figure also shows a large decrease in renewable energy investment in the region in 2016. The investment in renewable energy in Brazil, China, and India amounted to USD 94.7 billion in 2016, representing a decrease of 28%. Renewable energy investment had also decreased in the rest of the developing countries in 2016. The investment had fallen by 37% to USD 21.9 billion.

The drop in renewable energy investment in other developing countries was surprising. The investment had been gradually ascending in the past few years. Investment in renewable energy development reached USD 34.9 billion in 2015 with major investments being done in Turkey, Chile, South Africa, Mexico, the Philippines, Uruguay, Pakistan, and Morocco. The increase in investment fitted in with the increasing energy demand and exceptional natural resources for the development of renewable energy.

Figure 2.1: Worldwide renewable energy investment in 2004-2016, USD BN



Source: Frankfurt School of Finance & Management (2017, p. 15)

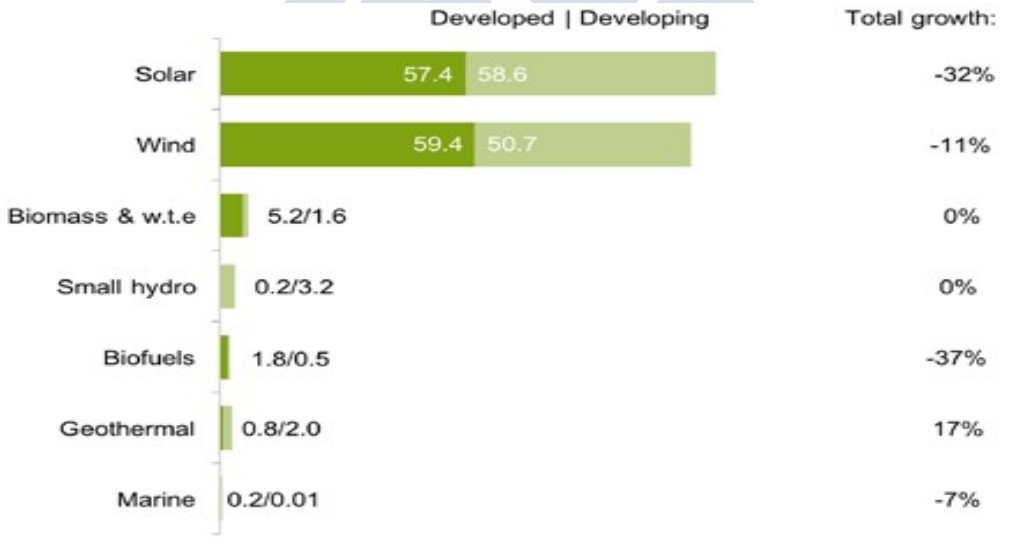
The reason for the sharp decline in renewable energy investment in 2016 compared with the several years before is discussed in detail in later subsections 2.2.2 and 2.2.3. A number of common factors behind this decline include lower dollar-denominated costs of the project and delays in securing finance for projects that were accepted in the auctions. However, not all the other developing countries experienced a fall in investment. Thus, the investment had increased in Bolivia, Egypt, and Jordan.

The amount of investment in different renewable energy projects worldwide is shown in Figure 2.2. Developing economies, including the big three, accounted for more than 50% of solar and wind investment in 2015. They had maintained the lead in solar but lost the lead in

wind energy generation in 2016. Investment in renewable energy in the developed countries had increased in 2016 to USD 59.4 billion, an increase of 11%, mostly due to the increase in offshore projects. In contrast, the investment in developing countries had decreased to USD 50.7 billion, which represents a decrease of 28%. Investment in solar power projects was USD 57.4 billion in developed countries, representing a decrease of 31%; while the investment in developing countries was USD 50.7 billion, representing a decrease of 34%.

The lead in the development of other renewable energy sectors, including small hydro, geothermal, and biomass, was consistent over the years in the developing nations. The lead in biofuels has alternated between Brazil and the US over the years. In general, the developed countries maintained the lead in 2016 in biomass and waste projects. A total of USD 5.2 billion was invested in the developed countries, while only USD 1.6 billion was invested in the developing countries. However, the developing countries took the lead in biofuels with USD 1.8 billion compared to USD 454 million in the developed countries. Investments in geothermal and small hydro projects were also higher in the developing countries. A total of USD 2 billion was invested in geothermal projects in the developing countries as opposed to USD 775 million in the developed countries. In the small hydro project sector, the total investments amounted to USD 3.2 billion in developed countries and USD 229 million in the developing countries.

Figure 2.2: Worldwide renewable energy investment and total growth in 2016, USD BN



Source: Frankfurt School of Finance & Management (2017, p.15)

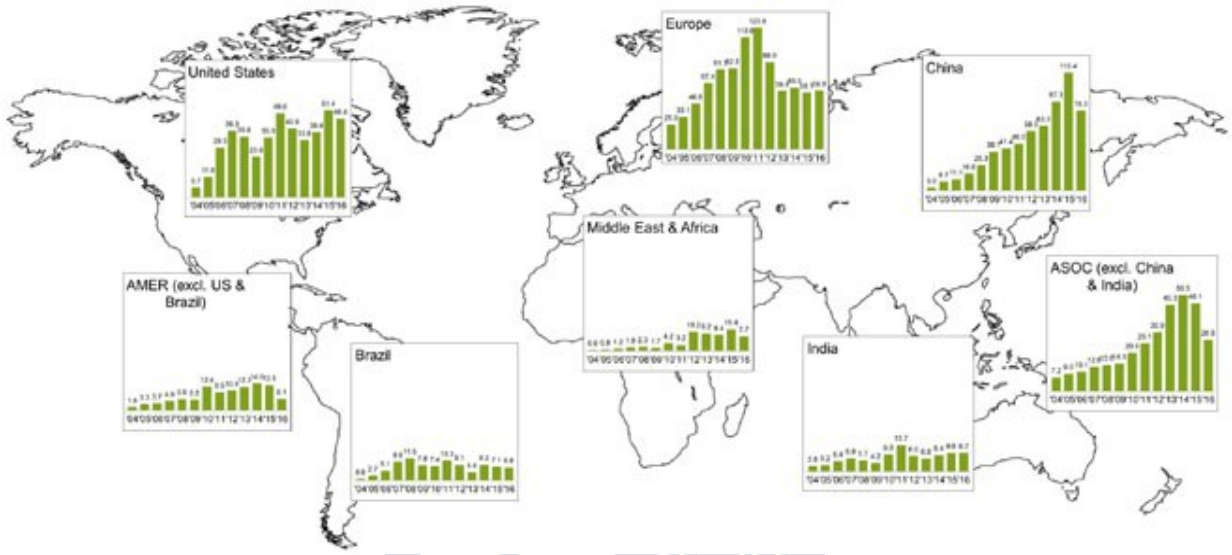
2.2.2. Main investors in the renewable energy sector worldwide

The investment in renewable energy displayed contrasting trends among the countries. Figure 2.3 shows the trends over 13 years period (2004–2016). The US remained a strong centre for investment in renewable energy. It has reportedly invested around USD 46.4 billion in the sector since 2011. Concerning dollar commitments, China had remained the largest share with around USD 78 billion invested in 2016. However, the investment had decreased over the years, declining 32% in comparison with 2015. The investment in the year 2016 represented the lowest

since 2013. It should also be noted that the series of rising investment has been broken by this decrease in 2016.

On the one hand, India has been one of the most growing markets in the past few years. A total of USD 9.7 billion was invested in 2016, the same as in 2015. The investments have also remained consistent since 2010. On the other hand, Brazil has experienced obstacles in investment over the year without much significant increase. The investment of USD 6.8 billion in 2016 was the second lowest since 2006 and decreased by 4% as compared to the previous year.

Figure 2.3: Worldwide renewable energy investment by region in 2004-2016, USD BN



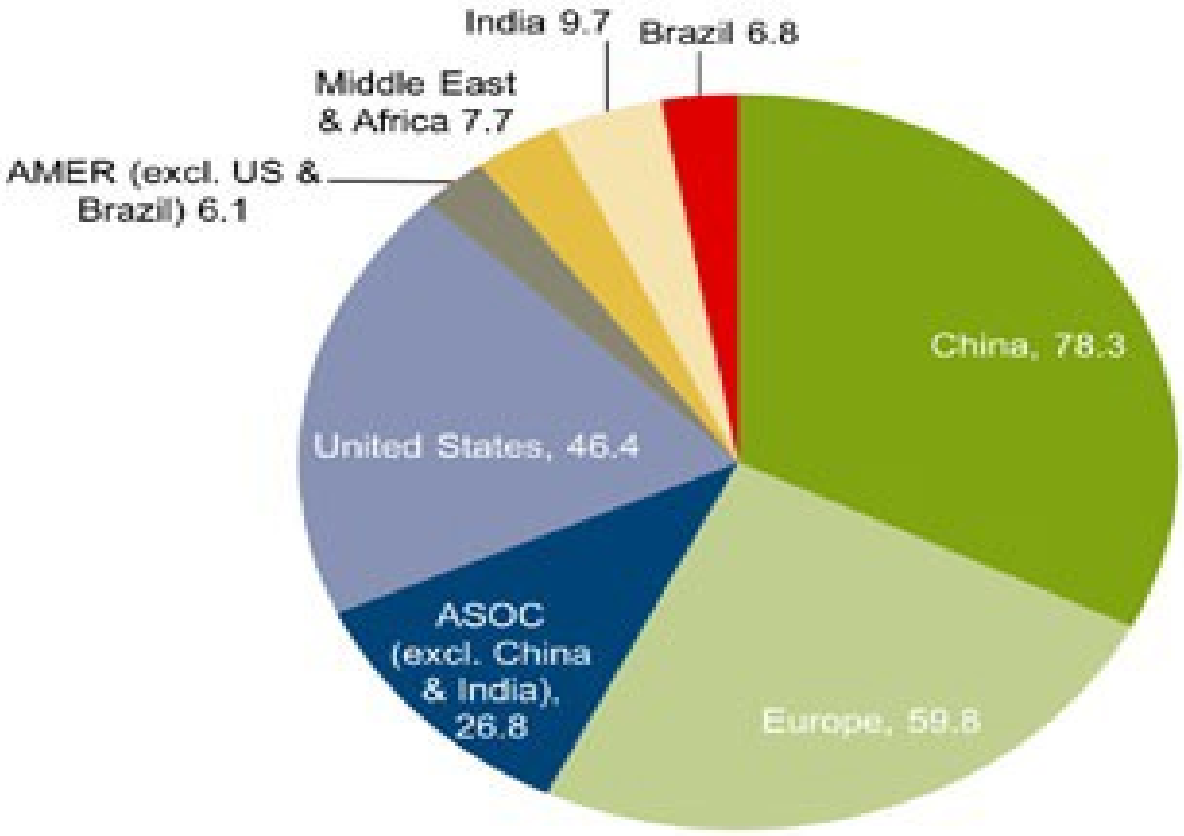
Source: Frankfurt School of Finance & Management (2017, p. 22)

Statistics show that investment in Europe had stabilized in the past few years. They had fallen from the peak of USD 100 billion per year during the Italian and German solar booms of 2010 and 2011. The total investment in the region in 2016 amounted to $59.8 billion, which means an increase of 3% compared with the previous year. Most of the investments were made for offshore wind projects. The MENA region had the lowest investment during the period 2011-2016. The total investment amount of USD 7.7 billion was 32% below the previous year figure. The decrease was mostly due to a break in the financing of the projects in Morocco and South Africa.

Countries in America, excluding Brazil and China, and the Asia-Oceania, excluding India and China, saw interruptions in investment in 2016. The growth trend was remarkably lower in these regions in comparison with years. The investment amount in Asia-Oceania had decreased by 42% to USD 26.8 billion, meaning the lowest figure since 2011. The decrease in investment in the Americas was 54%, falling to USD 6.1 billion, the lowest figure since 2007. A number of countries in the Americas, such as Mexico, Canada, Chile and Uruguay, had experienced a sharp decline in investment in 2016. A sharp decline in the investment in Japan was the main reason for a decline in the investment in the Asia Pacific region.

The share of investment in the main regions is depicted in figure 2.4. China accounted for the largest percentage (32%) of renewable energy investment in the world in 2016. Europe came in the second spot in the share of global investment in the renewable energy sector with a participation of 25%. The investment share of US was 19%, while the percentage of investments in Asia-Oceania was 11%. The investment share in renewable energy in India was 4%. The share of global investment in Brazil, Africa, the Middle East, and other Americas was 3% each.

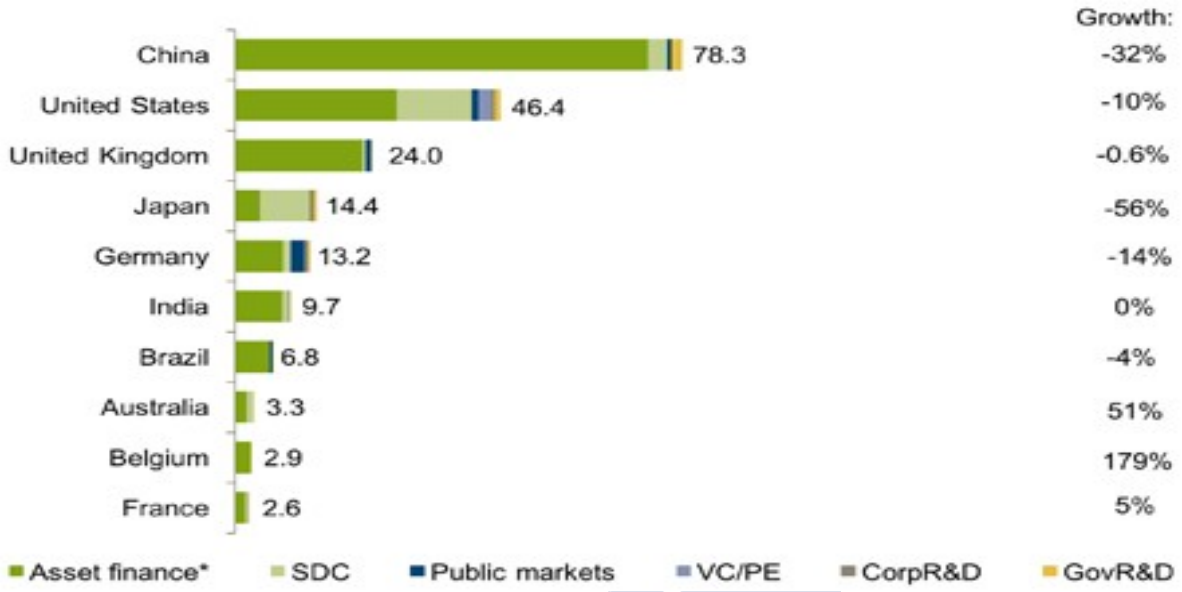
Figure 2.4: Worldwide renewable energy investment in 2016, USD BN



Source: Frankfurt School of Finance & Management (2017, p. 22)

Figure 2.5 shows the renewable energy investment in the top 10 countries. The investments in seven of the ten countries have remained consistent in the past few years. However, the investment in Japan has fallen significantly pushing it down to the fourth position below the UK. The investment level in the top seven countries was lower in 2016, except for India, where the investments were relatively steady. The percentage of decrease varied in different countries. For instance, the investment decreased by 5% in Brazil and the UK, while they decreased by about 30% in Japan and China. The last three countries in the list experienced significant changes in 2016. Canada, South Africa, and Chile dropped out to be replaced by France, Belgium, and Australia.

Figure 2.5: Worldwide renewable energy investment and growth by asset class and country new investment in 2016, USD BN



Source: Frankfurt School of Finance & Management (2017, p. 23)

2.2.3. Renewable energy investments in developed economies

Concerning renewable energy investments in the developed economies, this subsection focused on the situation of the United States and the European Union, in addition to some OECD countries.

The US has remained in the top two or three positions regarding investment in the renewable energy sector since 2004. The largest investment occurred during the Obama administration in 2011, due to the green stimulus program introduced by the administration focused on renewable energy development. The federal loan guarantee and Treasury grant schemes contributed to the development of renewable energy. The investment in renewable energy had declined to USD 46.4 billion in 2016. However, the investment levels were well above those in 2013 and 2014. Table 2.1 divides the investment according to types and sectors. Investment in the renewable energy segment was relatively more diverse compared with the majority of other countries. Most of the investments were from venture capitalists, public markets, utility finance companies, and private equity firms. Small scale renewable energy projects have also contributed to strong showings in the market. Investment in small-distributed capacity PV and rooftop projects was particularly strong in 2016 amounting to USD 13billion, which represents an increase of 33% from 2015. Financing by utility finance companies amounted to USD 29.8 billion, representing a decrease of 2% compared to the previous year. Investment in solar and wind projects amounted to USD 14 billion each.

In December 2015, the US Congress had unexpectedly agreed to extend the investment tax credit for solar and production tax credit for wind power projects by five years. This underlines the increasing interest in renewable energy development among investors in 2016. However, the extension in tax credit for such a long period resulted in some developers taking their time going ahead with the new projects.

The public-sector investment in the renewable energy sector in the US had decreased significantly to USD 1.3 billion in 2016, and the public investment had declined by 87% that represented the biggest decline since 2011. Solar developer SunEdison that had raised around USD 2 billion in 2015 declared bankruptcy last year. The YieldCo funds that owned operating solar projects related to renewable energy were not able to raise the required equity in 2016, due to a sharp decrease in the share price. Private equity and venture capital in renewable energy companies amounted to USD 2.3 billion, representing a decrease of 2% in 2016. On one hand, spending in R&D of renewable energy in the corporate sector had declined to USD 498 million, representing a decrease of 24% compared to 2015. On the other hand, the public-sector R&D investment had increased by 51% to USD 1 billion.

Table 2.1: US investment in renewable energy by type and sector in 2016, USD BN

	Asset finance	Re-invested Equity	SDC	Public markets	VC/PE	CorpR&D	GovR&D	Total
Solar	14.7	-0.8	13.1	0.2	1.7	0.3	0.1	29.3
Wind	14.7	-0.6	-	1.1	0.2	0.0	0.1	15.5
Biofuels	0.1	-	-	0.0	0.3	0.1	0.6	1.0
Geothermal		-	-			0.0	0.1	0.1
Biomass & w.t.e	0.2	-	-		0.1	0.0	0.1	0.4
Small hydro	0.1	-	-		0.0	0.0	0.0	0.1
Marine		-	-	0.0	0.0	0.0	0.0	0.1
Total	29.8	-1.5	13.1	1.3	2.3	0.5	1.0	46.4

Source: Frankfurt School of Finance & Management (2017, p. 24)

Table 2.2 depicts a breakdown of investment in renewable energy types (including solar, wind, biofuels, etc.) and sectors (including asset finance, re-investments equity, etc.) in Europe. The investments in the sector were largely through asset finance, which accounted for USD 46.9 billion out the total USD 59.8 billion. Of this total amount, the share of solar projects was only USD 1.6 billion, which represented a decrease of about 75%. The amount invested in biomass and waste was only USD 3.9 billion, which means an increase of 14% over 2015. Wind power projects accounted for most of the asset finance investment amounting to USD 40.6 billion that had increased by about 10% compared with 2015. Investment in onshore wind projects had declined by 26% to USD 14.8 billion. In contrast, investment in the offshore wind projects had increased by 53% to USD 25.9 billion. Around USD 6.7 billion was raised by small-distributed capacity in Europe in 2016, representing a decline of about 18% compared to the previous year. The three largest contributors included Germany, the Netherlands, and the UK.

Table 2.2: European countries renewable energy investment by type and sector in 2016, USD BN

	Asset finance	Re-invested Equity	SDC	Public markets	VC/PE	CorpR&D	GovR&D	Total
Solar	1.6	-0.1	6.7	1.0	0.4	0.2	0.5	10.2
Wind	40.6	-0.2	-	2.8	0.1	0.2	0.2	43.8
Biofuels			-	0.0		0.2	0.4	0.6
Geothermal	0.8		-			0.0	0.1	0.8
Biomass & w.t.e	3.9	0.0	-	0.0	0.0	0.1	0.1	4.2
Small hydro	0.0		-			0.0	0.0	0.1
Marine		-	-	0.0	0.0		0.1	0.1
Total	46.9	-0.3	6.7	3.8	0.5	0.8	1.4	59.8

Source: Frankfurt School of Finance & Management (2017, p. 24)

The investment by public markets in Europe had increased by 170%. The largest contribution was made by Innogy, a subsidiary of the German utility company RWE. This company was able to raise USD 2.2 billion in the initial public offering. Venture capital and public equity investment amounted to USD 516 million, which was double the amount raised in 2015. Public and corporate sector R&D investment amounted to USD 1.4 billion and USD 780 million, respectively. The investment by the corporate sector had declined by 37%, while the public-sector investment had declined by 24%.

The largest investment in renewable energy development in Europe was made by the UK. Most of the investment in this country was through asset finance, in fact, around USD 22.5 billion of a total of USD 24 billion represented asset finance investment. The four biggest renewable energy projects in the UK included Hornsea (1.2 GW), Beatrice Cape (588 MW), East Anglia One (714 MW) and Burbo Bank Extension (258 MW). All these projects were wind power projects, in which a total of USD14.2 billion was invested. Each of these projects qualified for tariff support either through the first instalments of new Contract-for-Difference (CfD) scheme or the expiring Renewable Obligation Certificate program. The investment had somewhat postponed after an interruption in the programs after the UK general election in May 2015. Investment in the 299 MW Tees project amounted to USD 841, which was the largest investment to date on a biomass plant. This was also secured through the CfD scheme[17].

The second largest investment in Europe occurred in Germany. Around USD 13.2 billion was invested in the region. The asset finance investment amounted to USD 8.4 billion that had decreased by about 34%. Most of the investments were in onshore and offshore wind projects. Three of the offshore wind projects, which are the 385 MW Arkona Becken Sudost, 396 MW Merkur, and the 450 MW Brokum Riffgrund, had attracted around USD 5.1 billion. There was not significant investment in the rest of the renewable energy projects apart from onshore wind projects. This was due to the ambiguity about the switch of Germany to auctions from feed-in tariff. Auctions were held for PV projects in 2016, while around 2 to 3 rounds may have been for onshore wind projects in 2017.

Table 2.3 shows investment in the top 10 largest European markets. The biggest investment in 2016 was made in the UK, followed by Germany. Investments in the remaining countries in Europe were between USD 1.3 billion and USD 2.9 billion. A large number of renewable energy projects were financed including 309 MW Rental wind farms and 370 MW Northen wind farms in Belgium, in which the investment amount was USD 1.2 and USD 1.3 billion, respectively. Another noteworthy renewable energy project was the 406 MW Horns Reve offshore wind project, in which USD 1.1 billion was invested.

A lot of other renewable energy technologies apart from offshore wind were able to attract large financing in Europe. The largest onshore wind project was the 1GW Fosen project that cost USD 1.3 billion in 2016. The second largest biomass plant in the world set up in Denmark was known as the Amagervaerket biomass plant. The total investment in the 150 MW project was around USD 739 million.

[17] CfD of Tees was secured in the FIDeR in 2014 before the full auction of CfD in early months of 2015.

Table 2.3: Net investment in renewable energy and growth by country in 2016, USD BN

	2016	% growth on 2015
United Kingdom	24.0	-1%
Germany	13.2	-14%
Belgium	2.9	179%
France	2.6	5%
Denmark	2.5	128%
Norway	2.2	1419%
Italy	1.8	31%
Sweden	1.7	117%
Turkey	1.5	-51%
Netherlands	1.3	-2%

Source: Frankfurt School of Finance & Management (2017, p. 25)

Table 2.4 shows renewable energy investment in five major developed economies in the world in 2016. Increased commitments to renewable energy development were shown in Australia and Israel in 2016. In Israel, the Ashalim II Sun Negev complex accounted for most of the investment, because about USD 805 million were invested in this 110 MW project. A large number of wind projects were financed in Australia. The two largest projects in the country included the USD 438 million 270 MW CWP Sapphire wind project and the USD 326 million 175 MW White Rock plant. Both these projects were located in New South Wales.

Table 2.4: Investment in renewable energy in developed economies and growth in 2016, USD BN

	2016	% growth on 2015
Japan	14.4	-56%
Australia	3.3	51%
South Korea	1.4	-10%
Canada	1.7	-54%
Israel	1.2	80%

Source: Frankfurt School of Finance & Management (2017, p. 26)

The largest drop in renewable energy investment in developed countries was seen in Canada. Investment in the country had declined to USD 1.7 billion, representing a decline of 54%. This represented the lowest amount of investment since 2004. The investment was far below the USD 5 to 6 billion levels in the early years of this decade. The only renewable energy project that was more than 100 MW was the 224 MW onshore wind power project named Nicolas-Riou in Quebec. Ontario, where most of the green investments were made in the past, had announced the suspension of the second phase of the Large Renewable Procurement Program in 2016 due to overcapacity of existing plants. In the meanwhile, the new government in Alberta has shifted the focus to renewable energy and is planning to purchase 5 GW clean energy projects through auctions. However, the investment will be made in the coming years, and it was not featured in the announcement of the programme (Government of Alberta, 2017).

As seen in table 2.4, investment by South Korea in the renewable energy sector amounted to USD 1.4 billion. Most of the investments were made in small size solar projects amounting to USD 1 billion. This was the same investment figure than in 2015. Its neighbour Japan had

invested around USD 14.4 billion in renewable energy development last year. Most of the renewable energy projects were also solar based. The 11.5 GW solar power plant that was built in 2015 is the second largest PV plant in the world after the one in China. The investment in renewable energy had decreased significantly in Japan last year. This was due to difficulties in grid access, as well as a shift in the policy to auctions from feed-in tariffs. Moreover, the unit price of PV cells in Japan had decreased significantly, resulting in lower investment amount. Investment in the small-scale capacity systems had declined sharply to USD 8.5 billion, meaning a decrease of 69% in 2016. This represented the lowest investment amount since 2011. Investment in wind, solar, and biomass projects through asset finance had decreased to USD 4.4 billion that represented a decline of 4%. The largest investment was in 81 MW Karumai East PV projects, in which USD 243 million were invested.

2.2.4. Renewable energy investments in developing economies

2.2.4.1. Main investors in renewable energy investments in developing economies

This section provides an overview on the renewable investments trends in developing economies, such as China, India and Brazil, and it shed light on the main investment waves. Table 2.5 depicts renewable energy investment in the three largest developing economies in 2016. The investment in China stood at USD 78.3 billion. Most of the investments were through asset finance amounting to USD 72.9 billion, which were down 34% in comparison with 2015. The investment in small scale solar projects amounted to USD 3.5 billion, meaning an increase of 32% compared to the previous year. The R&D expenditure by the government amounted to USD 1.9 billion that was up 7%.

Table 2.5: Investment in renewable energy in India, China and Brazil by sector in 2016, USD BN

	China	India	Brazil
Solar	39.9	5.5	1.0
Wind	35.0	3.8	5.4
Biofuels	0.1	0.0	0.4
Geothermal	0.0	0.0	0.0
Biomass & w.t.e	0.7	0.1	0.0
Small hydro	2.6	0.3	0.1
Marine	0.0	0.0	0.0
Total	78.3	9.7	6.8

Source: Frankfurt School of Finance & Management (2017, p. 27)

Similar investments were made in wind and solar projects in China. This country had experienced a boom in solar energy investments that lasted from the end of 2015 to the end of 2016. The main reasons for a decrease in the investment lower than expected are the growth in demand for electricity, feed-in tariff, and phase out of a number of projects. The change in investment was significant with only 8 GW installed in the second half of 2016 as compared to 22 GW in the first half of the year. It should be noted that some of the projects executed in the first part of 2016 were financed in 2015. China had added 23 GW wind capacity in 2016, which was the second highest increase in capacity behind the 29 GW increase in 2015. Later in 2015 the National Energy Administration in China had announced a decrease in the wind energy

target for the year 2020 to 210 GW from 250 announced in 2015. The reason was the persistent lack of demand growth and the subsequent curtailment of a number of power projects.

Nowadays, the share of renewables market in India is smaller than in China. However, investments in India has the potential to grow at a fast pace in the next years. Thus, the government of India has established an ambitious goal of 175 GW generated by renewable energy by the end of 2022. Around 100 GW of energy will be generated through solar power. The progress towards this target has been rather slow with around USD 5.5 billion invested for increasing the solar capacity. Most of the solar projects were awarded through auctions. However, the auction process took longer than usual in many states. In addition, most of the projects that met the required installed capacity were not closed at the end of 2016. There were delays in meeting the 40 GW target for rooftop PV projects.

Concerning India, around USD 3.7 billion were invested in wind power projects in 2016. While the official target for an installed capacity of renewable wind energy is 60 GW to 2022, India has already installed wind energy capacity of 28 GW by the end of 2016. The investments in wind energy are expected to increase in the future; however, the investments in increasing wind power capacity have remained low throughout 2016. For the most of the year 2016, activity was held back by the low renewable energy investments due to several factors including difficulties in closing power deals, low power prices, and the fact that most developers preferred solar projects that had lower cost advantage as compared to wind projects.

In Brazil, political changes and economic recession resulted in the curtailment of renewable energy investment. The energy ministry had cancelled the only auction for solar and wind blaming low demand for power in 2016. The Brazilian Development Bank (BNDES) had announced a decrease in lending for development of clean energy. In this hindsight, the investment in wind energy projects in Brazil decreased to USD 4.9 in 2016 that represented a fall of 15% compared to 2015. The decrease in wind energy investment was partly offset by an increase of about 75% in solar energy projects to USD 1 billion.

2.2.4.2. Investors in renewable energy investments in other developing economies

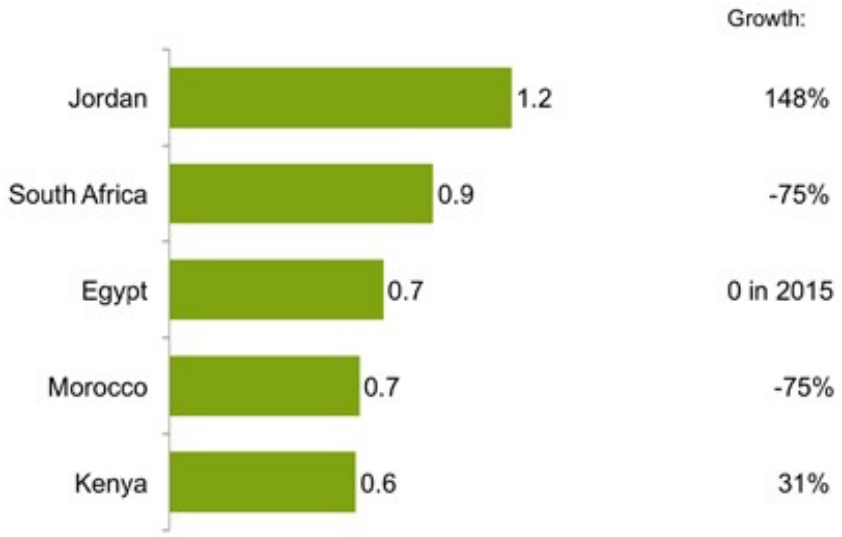
This subsection focuses on studying renewable energy investments in some developing countries, including countries in the MENA region that witnessed significant progress in the renewable energy sector, such as Jordan, Egypt, and Morocco. It also compares these countries with other developing countries from Africa, like South Africa and Kenya, which are progressing well in their energy transition towards renewables energies.

The investment in the MENA region was relatively small in 2016, despite various steps were taken by the respective governments to promote renewable energy development. The first ever auction of renewable energy projects in Africa was held in Zambia in 2015. This auction was part of the program organized by the World Bank to solve power issues in the country. During the auction, one of the cheapest bids was made for 73 MW solar power projects. Moreover, developers in the UAE had agreed to construct an 800 MW solar power plant at a price of just USD 29.9 per MWh.

Figure 2.6 shows the countries that invested above USD 500 million in renewable energy projects. Jordan attracted the most investment in the region, where about $1.2 billion was invested to increase renewable energy capacity. The aim was to meet growing power demand and lower the exposure to fossil fuel. The total investment amount in the country had increased

by 148% in 2016 compared to 2015. Around USD 616 million were invested in the wind power plants, while just USD 507 million were invested in solar projects. This increase in investment in Jordan was due to easy access to funds from development banks, including the World Bank International Finance Corporation and European Bank for Reconstruction and Development. The main challenge to renewable energy development is access to the grid. The government is trying to resolve the problem through the Green Corridor program that aims to increase the grid transmission capacity.

Figure 2.6: Investment in renewable energy and growth in developing countries in Africa and the Middle East in 2016, USD BN



Source: Frankfurt School of Finance & Management (2017, p. 28)

Morocco and South Africa experienced growth in investment in 2015, but their investments had fallen significantly in 2016. Renewable energy investment had postponed in South Africa, because the state utility company Escom was reluctant to sign new power purchase agreements (PPAs) until it received advice from the government regarding the price that was charged to the customers. The largest investment in 2016 was the USD 756 million in a 100 MW Kathu solar thermal plant located in Northern Cape. Morocco was in the news in 2015 due to a record low winning bid for an onshore wind power project at USD 30 per MWh. Auctions were held for many solar PV projects including the 400 MW hybrid solar thermal project located at a town in central Morocco named Midlet. However, most of the projects did not achieve closure by the end of 2016, except the 202 MW Aftissant wind power project that cost USD 312 million.

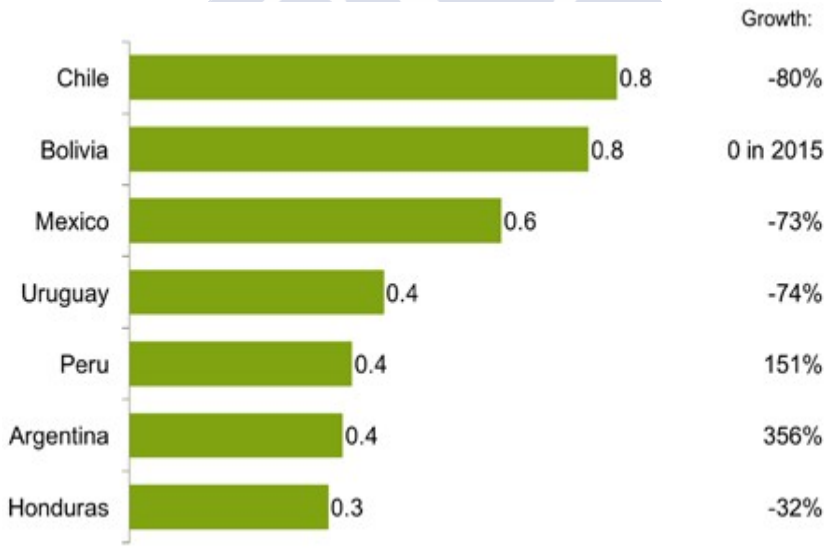
Renewable energy investments in Kenya and Egypt had increased in 2016. The Electricity Ministry in Egypt had launched a second round of the feed-in tariff program after receiving a deficient response for the first round held in 2015. During November of 2016, the country had agreed on a USD 662 million power purchase agreements (PPAs) for solar power projects. However, most of the projects were not financed before the end of 2016. The noteworthy investment during 2016 was the USD 362 million investment in the 200 MW wind farm at the Gulf of Suez. In the case of Kenya, investments were made in 2016 for the first time in the renewable energy segment. The government had announced a switch to auctions from feed-in

tariff system. The investment through asset finance was sluggish in 2016 with the notable project of the USD 403 million 140 MW geothermal project in the Olkaria area.

It can be observed that investments in the renewable energy sector in the MENA region in 2016 were relatively small, since most of the countries major investments were already made in the years 2014 and 2015 for several main projects. In addition, oil-producing countries faced some financial loses because of the low oil prices, which reduced their capacity to finance new big renewable energy projects.

Figure 2.7 depicts renewable energy investment in the Latin American countries, except Brazil, which is analysed as the main investor in the developing economies in subsection 2.2.4.1. The developments were encouraging particularly in Argentina that organized two renewable energy tenders for 2.4 GW projects in 2016. There was only a slight increase in renewable energy investment with asset finance amounting to USD 362 million. However, it was the largest increase in energy investment in the country since 2011. The year 2016 was the strongest year for renewable energy development for Bolivia since 2004. This was largely attributed to the USD 612 million investment amount for the 100 MW ENDE Laguna Colorado geothermal power plants.

Figure 2.7: Investment in renewable energy and growth in South America in 2016, USD BN

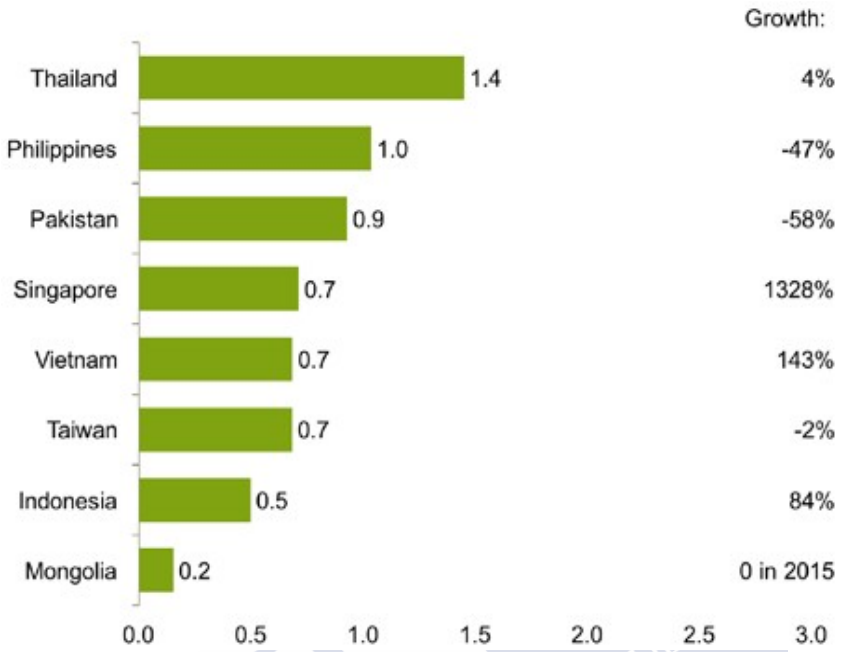


Source: Frankfurt School of Finance & Management (2017, p. 29)

Investment fell by up to 70% in Mexico, Chile, and Uruguay in 2016. Renewable energy development decreased in Chile, due to the grid access problems and the decrease in the wholesale energy prices. In addition, there were concerns about whether the companies that had won the bid at a low price will be able to find the required financing for the projects. This country was in the news in August 2016 for creating a new world record for the lowest tariffs at USD 29.1 per MWh. The auction was held for a 254 GWh solar power project in Chile. Uruguay had the best year in 2016 in terms of renewable energy investment, after the wind energy markets had reached near their saturation point. In the meanwhile, Mexico indicated the possibility of another billion-dollar investment made in 2015, after completion of auctions for renewable energy auctions in 2016. There has been an interruption in renewable energy

investment in the country due to energy reforms. The largest project in 2016 was the USD 369 million 200 MW EDP Coahuila wind energy project.

Figure 2.8: Investment in renewable energy and growth in non-OECD Asia in 2016, USD BN



Source: Frankfurt School of Finance & Management (2017, p. 30)

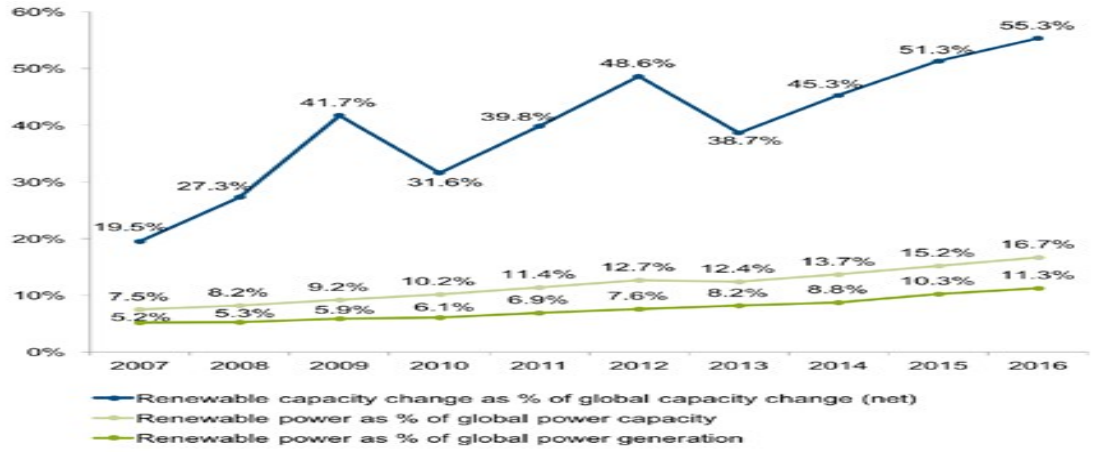
2.3. RENEWABLE ENERGY INVESTMENT IMPACT ON GLOBAL GENERATION MIX

The share of renewable power energy capacity in the global mix of power generation is depicted in figure 2.9. This graph shows that renewable energy, excluding hydropower, made up the majority of new capacity that was added around the world. The 138.5 GW solar, wind, geothermal, biomass and waste, and small hydro plants accounted for 55.3% of total energy additions, which represents the highest proportion ever. It also shows the renewable energy capacity as the percentage of global power capacity[18] and generation[19], respectively. Renewable energy represented 16.7% of installed capacity worldwide in 2016, apart from large hydropower plants. However, it represents just 11.3% of total electricity generation. The real fact about the electricity sector is that power stations generally have a lifetime between 20 to 60 years. This means that changing the generating mix in favour of renewable energy should be a slow process. Moreover, wind and solar plants generally have relatively low capacity factors. They tend to produce electricity only when the daylight or weather condition is right. This is not the case

[18] Power capacity is the maximum power output that installed generators can produce under specific conditions.
[19] Power generation is the amount of electricity generators produced over a specific period.

with gas, coal, geothermal, biomass, hydro-electric, or nuclear power plants[20]. This means that gains in the share of generated capacity will be lower than installed capacity.

Figure 2.9: Percentage of power generation and installed capacity of renewable energy worldwide 2007-2016



Source: Frankfurt School of Finance & Management (2017, p. 33)

The power generated through renewable energy sources resulted in reduced 1.7 giga-tonnes CO_2 in comparison with a situation where no renewable energy capacity existed[21]. In short, the global greenhouse gas emission problem will be solved by increasing the share of renewable power in the global power mix.

While considerable investments have been made in renewable energy development, figure 2.10 shows that in 2016 the countries continued to add power generation capacity through traditional sources. The net capacity of coal and gas power plants increased by 54 GW and 37 GW in 2016, respectively. Nuclear power plants increased in capacity by 10 GW, while the hydro-electric dams power generation capacity increased by about 15 GW. The worldwide renewable energy capacity increased the most to 138.5 GW. This means that the total increase in zero-carbon emission power generating capacity during the year was 163 GW[22]. The net figures of increase in installed capacity abovementioned represent the difference between the old stations that have shut down and the new assets that are in the pipeline. According to an estimation of Bloomberg New Energy Finance, about 87 GW capacity coal plants were commissioned in 2016, while 33 GW were decommissioned (Frankfurt School of Finance &

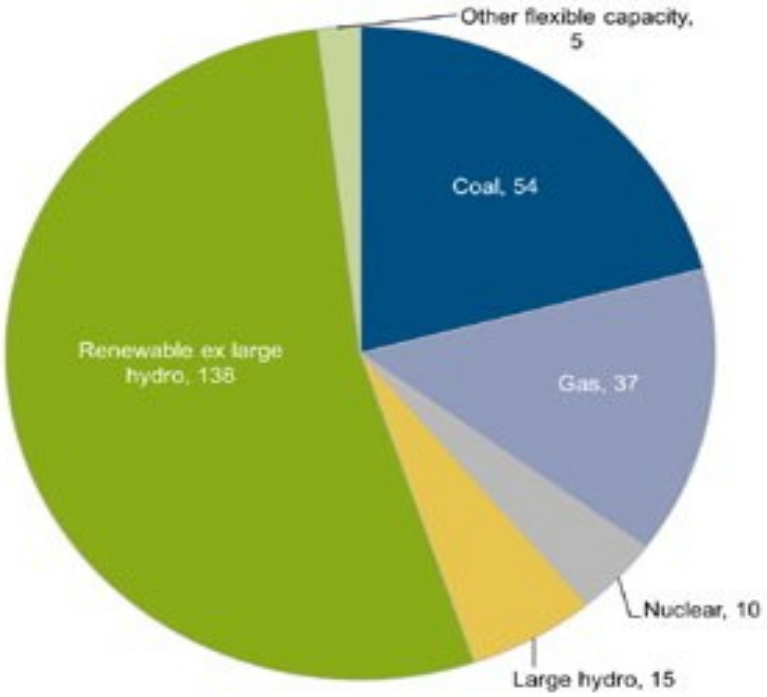
[20] The solar PV power plants on average capacity range from 15% to 25%. The capacity of offshore wind projects ranges from 40% to 50%, while for onshore wind array 25% to 35%.

[21] The figure is estimated by extrapolating the figure of International Energy Agency for carbon emission in 2014 to emissions in 2016. Extrapolation was conducted using IEA World Energy Outlook projections for annual growth in emissions until 2020. This resulted in the figure of 13,395 Mt. Furthermore, it has made the assumption that the 11.3% of the power generation demand was fulfilled by the same mix of power generation that met the remaining demand in 2016 instead of being met by renewable energy. Therefore, the total emissions by the power sector amounts to 15,101 Mt. In this way, the emissions reduced by renewable energy sources accounted for 1,706 Mt (15,101-13,395).

[22] The amount in figure does not show a reduction in oil-fired power generation capacity by 9 GW. When this decrease in installed capacity is taken into account, the amounts correspond to 55.3% share of renewable energy (excluding large hydro projects) in total additions in power generation capacity.

Management, 2017). The majority of the new coal assets were commissioned in developing countries, while most of them were decommissioned in developed countries.

Figure 2.10: Increase in total power generating capacity in 2016, GW



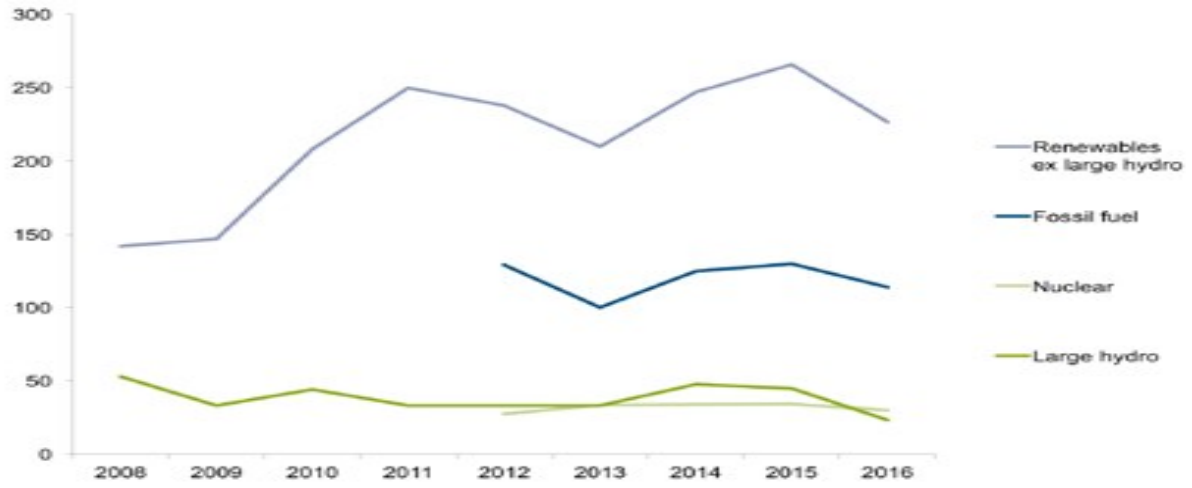
Source: Frankfurt School of Finance & Management (2017, p. 33)

Renewable energy continued to attract most of the investments compared to fuel oil power plants, as figure 2.11 shows. The global share of green power generation and capacity has been increasing over time. Almost all costs of projects that generate electricity from renewable energy sources are to be available and paid in advance. In general, the cost of building a fossil fuel power plant is cheaper. However, the running costs are very high as fuel has to be purchased on a continuous basis. Despite the high cost of building fuel oil power plants, the costs committed to building them was lower (USD 113.8 billion) compared to renewable energy sources (USD 226.6 billion) in 2016[23]. The worldwide investments in other two technologies were even lower with nuclear power, attracting USD 30 billion and large hydro projects attracting USD23.2 billion in 2016[24]. The renewable energy excluding large hydro projects amounted to 58% of total worldwide investments in new power generation capacity in 2015. The investments in 50 MW large hydropower projects increase the share by a further 6%.

[23] The investment amount of USD 222.6 billion is only for increasing renewable power projects capacity. The total amount of USD 241.6 billion consists of government and corporate R&D, corporate level investment, and asset finance of biofuel power plants.

[24] The estimate of nuclear power plants is not based on investment decisions that are final, such as technologies, but rather on the annual capital expenditure. They represent the high risk of project delays and cost over-runs, as well as the period of investment programs for building nuclear power capacity. The investment of USD 25 billion in the Hinkley Point C UK nuclear power reactor, for instance, has been spread over several years instead of attributing it to 2016. The UK government and EDF have given the green light to the project in the second part of last year.

Figure 2.11: Total investments in power generation capacity in 2008-2016, USD BN



Source: Frankfurt School of Finance & Management (2017, p. 34)

2.4. ENERGY SITUATION IN THE MIDDLE EAST AND NORTH AFRICA REGION

This section provides an overview on the mechanisms of the energy sector in the MENA region in terms of the main aspects of supply and demand, taking into consideration the projections of these elements until 2040.

The consumption of energy in the MENA region had increased at a fast pace compared to any other region in the world. On the one hand, energy consumption in the region had increased by 4.2% in 2015, which represents the largest increase than any other region in the same year. On the other hand, the average increase in consumption in the region has been 4.5% from 2005 to 2015. Production of oil in the region was at the highest level since 2005 with 1412.4 million tonnes. Despite this fact, the dominant fuel used as a power source in the region is natural gas instead of fuel oil. The share of natural gas had increased to 49.9% in 2015 from 48.9% in 2014. In contrast, the share of oil has decreased to 48.1%. Oil consumption had increased by about 2.1% to 220 Kb/d. This increase was attributed to increase demand in the UAE and Saudi Arabia, while the demand in Iran has declined in the past few years. In contrast, consumption of natural gas has increased from 29 Bcm to 490 Bcm. The rate of increase in natural gas consumption was 6.2% in 2015 compared with 2014 levels, which is also slightly higher when compared to the ten-year average. Most of this growth was contributed to increase consumption of gas in Iran. Electricity generation using natural gas had increased by an average of 3.5%.

The amount of energy per unit of GDP, or energy intensity, had increased by about 2.6% in 2016, which represented a record increase in the energy intensity in the region. In contrast, the energy intensity in the world has decreased by 2% in 2016. Over the past decade, energy

intensity has increased on average by 0.9%, while the global intensity has decreased by 1.6% (BP, 2016).

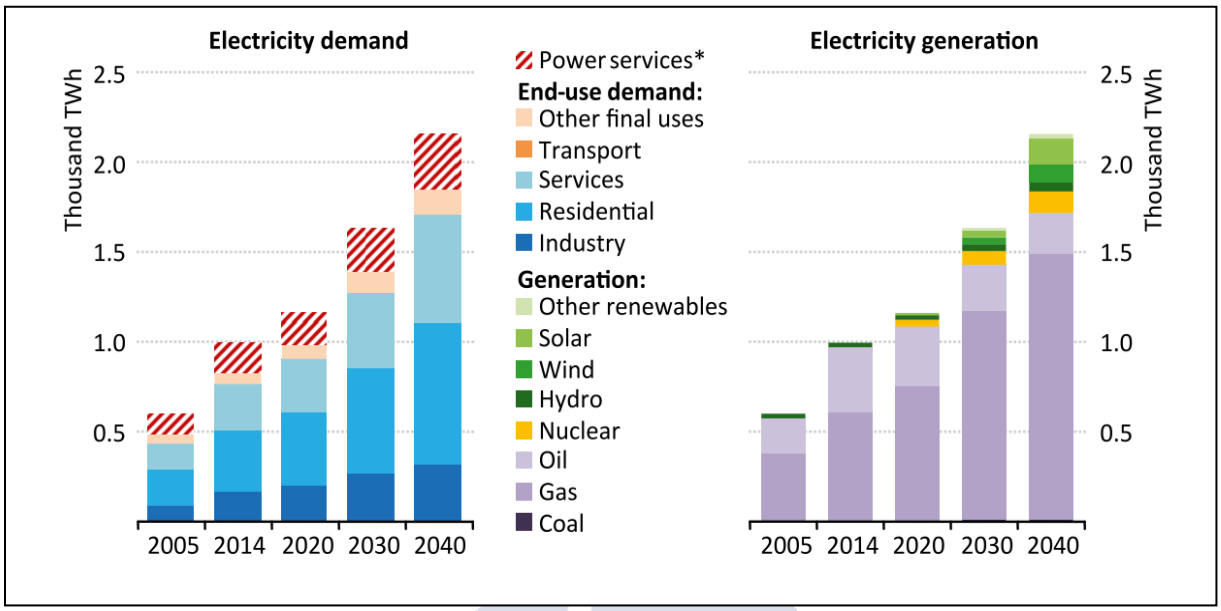
The increase in power demand in the MENA region can be attributed to the fast expansion of the economy, the rising standard of living, the energy-intensive nature of the industries, and the increasing number of petrochemical energy. High government subsidies have kept power prices low, which has been one of the factors for increased demand. The demand will continue to increase unless the government reduces the subsidies on power. Growing population is also one of the reasons for the increase in power demand. The population in the region has increased by about 2% a year in the period from 2004 to 2016, according to the World Bank databank. While forecasts about the energy demand vary, British Petroleum (BP) projects that the annual energy demand in the region is expected to exceed the world average and increase by 2.2% between 2015 and 2035. The net demand for electricity is expected to increase by about 54% during the same period. This reflects a need for considerable investment in increasing the capacity of power generation (BP, 2017).

Figure 2.12 depicts the energy outlook by IEA for 2016 and it shows that the demand of power in the MENA region has increased by about four times since 1990 (IEA, 2016) The subsidized energy prices as well as the increase in industries have led to an increase in demand from the residential and industrial sector. Power generation through oil and gas in the MENA region is declining, but it is still considerable compared to the rest of the world. The share of natural gas in the energy mix has increased continuously up until the early years of the present millennium reaching 60% in 2040. The share of natural gas has remained at the same level ever since. One of the main variables in the IEA Outlook projections has been the removal of energy subsidies (IEA, 2016) This is expected to increase the price of oil used by the power generation companies, as well as end-users. The decrease in the prices of oil and gas has significantly reduced the government revenues. This has put pressure on the government officials in the region to reduce energy subsidies. Some of the countries are already implementing key reforms in this regard, including Qatar, Kuwait, the UAE, and Saudi Arabia. These reforms will result in increased energy efficiency as well as provide the incentive to switch to alternative sources of energy, including nuclear power and renewable sources. The New Policies Scenario expects only a modest increase in progress related to subsidy reforms is expected until 2040.

The energy demand in the MENA region is expected to decline by about half of the 6.2% rate that was prevalent between the period 1990-2014 (IEA, 2016). This can be attributed to a decrease in the population growth rate and the growth in GDP. Nevertheless, the final demand for power in the region has more than doubled mainly due to the growth in the residential and services sector. About one quarter of the energy demand in the region, which means 430 TWh, is expected to be attributed to the use of appliances by the residential consumers. The demand in the residential sector is projected to triple to about 200 TWh in 2040. In contrast, the share of power demand in the industrial sector is projected to fall, despite the expansion of aluminium smelting in the region. It is expected that power demand in the industrial sector will amount to half of the total demand in the country.

The power mix in the MENA region is undergoing rapid change. The oil-powered plants are expected to peak soon with the share falling to about 10% in the next two decades. The share of oil-powered plants is almost 33% in 2016. The share of gas fired plants is expected to about 70% of the total power generation mix in 2040. Power generation from solar and wind plants is expected to increase from near zero at present to about 240 TWh, which is more than from fuel oil.

Figure 2.12: Energy demand and generation in the MENA in the IEA New Policies Scenario



Source: IEA (2016, p. 281)

The share of the nuclear power plant is also expected to increase. Thus, it is projected to reach 5% of the total power mix by 2040. Power capacity of high efficiency combined cycle gas turbines (CCGTs) is expected to increase by about 80 GW in 2040. In contrast, the combined power and heat or desalination units will increase by nearly 50 GW in 2040. This resulted in an overall increase in the gas power plants to 46%. The consumption of gas increased by less than 90% even though the power output had jumped by 140%. The improvements in the efficiency of gas powered plants, as well as the increase in the share of low carbon power to 20% by 2040 as compared to 2.5%, at present are important factors in the estimated improvements in the power supply energy intensity by more than 40% to 390 g CO_2/kWh in that period.

The annual investment in the power plants over the next decade is projected to increase by an average of about USD 15 billion. Most of the investment is expected to be in gas fired plant. However, the investment in wind and solar energy is expected to account to about 60% of the estimated annual investment of USD 24 billion in the decade leading to 2040 (IEA, 2016).

2.5. PRIVATE INVESTMENT IN RENEWABLE ENERGY IN THE MIDDLE EAST AND NORTH AFRICA REGION

The total share of the private sector in renewable energy development indicates the general investment environment, as well as the effectiveness of support policies. A large share of the

private sector reflects and increased confidence of investors in the legal institutions, system, support policies, and the profitability of renewable energy projects. The government agencies in the MENA region, including public owned electricity companies, are at the forefront in the development of renewable energy. They have taken the lead in investment in renewable energy development in the region, usually with the support of the local banks. The situation regarding private investment has largely improved since 2013. However, the overall situation remains somewhat the same.

The countries that have introduced policies in 2016 to attract input of the private sector in the renewable energy sector include Egypt, Morocco, and the UAE. Tunisia and Jordan had put forward legislation for improving the investment environment for small scale renewable energy project. Egypt was successful in attracting private investors in the development of renewable energy projects. The private sector has been attracted through competitive bidding schemes, as well as feed-in-tariff schemes. The International Finance Corporation, a branch of the World Bank, has shed light on the fact that the renewable energy projects in Egypt will require a capital investment of USD 8 billion over the period 2017-2020. This represents a significant opportunity for both lenders and investors (RCREEE, 2016). Private investments were made in 3560 MW renewable energy projects in Egypt in 2015. Out of this total, around 2,400 MW are related to the PV projects, 1200 MW to wind projects, and 50 to 100 MW to CSP projects. However, many of the projects were postponed as the investors who had qualified for wind and solar project under the feed-in-tariff scheme faced financial difficulties, due to currency risks, as well as delays in negotiating with the government over parts of the contract. They also faced difficulties in securing finance for the project. Many developers are now anticipating stage two of the FiT. And a faster turnaround is expected because of the lessons learnt during the previous stage. In this context, Egypt has commissioned megaprojects through direct proposal forms submissions from different firms, such as Siemens (RCREEE, 2016). Table 2.6 shows the large-scale private renewable energy projects in Egypt in 2016.

Table 2.6: Large-scale private renewable energy projects status in Egypt in 2016

	Technology	Project	Capacity (MW)	Status	Lead Developer	Approximate Total Investment Costs
Egypt	Wind	Gulf of Suez Feed In Tariff	700	Developers qualified	Multiple	USD 4050 million
	PV	Benban Feed In Tariff	2000	Developers qualified		
	Wind	Gulf of Suez	250	PPA under negotiation	Toyota	USD 1500 million
	Wind	BOO	250	Under development		
	PV	West Nile BOO	200	Under development	-	
	PV	Kom Ombo BOO	200	Under development	-	
	CSP	West Nile –BOO	50-100	Under development	-	
TOTAL			**3650**			**USD 5.550 Billion**

Source: RCREEE (2016, p. 37)

A large increase in private sector investment in the renewable energy sector has been experienced both for small and large-scale projects in Jordan. The policy framework introduced by the government has attracted private investors to contribute to renewable energy development. The investor pool is relatively diversified and includes both foreign and local firms. At present, more than 400 MW solar and wind projects are in different development

stages. The renewable energy projects in the country have attracted about a billion dollars. The size of the projects on average is medium usually below 50 MW. A large number of power projects are concentrated on the southern regions, particularly in the Ma'an Development Area. Preference will be given to renewable energy projects in the eastern and southern parts of the country in the second round of the process for direct submission of the proposal.

In the case of Morocco, the government made great strides to attract private investment in renewable energy projects. The IPP public competitive process was highly influential in attracting private interest in renewable energy development. The investments by the first quarter of 2015 were made in 2267 MW renewable energy projects of which 510 MW were CPS projects, and 1757 MW were wind energy projects. The pool of developers in Morocco is dominated by a few large investors. This is contrary to the situation in Jordan, where the pool of investors is relatively diversified. A large number of wind power projects have been introduced by Nareva Holding Company, a company which is the subsidiary of Moroccan National Investment Company. The latest bid for bid power related to five projects having a total of 850 MW capacity was awarded to Nareva, Enel Green Power (EGP), and Siemens. Moreover, CSP projects in the country have been awarded to a consortium headed by ACWA Power. Another interesting point to note is that the MASEN has taken a participation of 25% in every CSP projects. The net investment in large scale power projects in the country is estimated to be USD 5.707 billion (RCREEE, 2016). Table 2.7 shows the status of large-scale private renewable energy projects in Morocco in 2016.

Table 2.7: Large-scale private renewable energy projects status in Morocco in 2016

	Technology	Project	Capacity (MW)	Status	Developer	Approximate Total Investment Costs
Morocco	Wind	Tétouan (Lafarge Cement Plant)	32	In operation since 2006, 2011	Lafarge	USD 50 million
	Wind	Ciments du Maroc	5	In operation since 2000	Ciments du Maroc	USD 10 million
	Wind	Tarfaya	300	In operation since 2014	NAREVA Holding and ONEE	USD 610 million
	Wind	Akhfenir	100	In operation since 2014	NAREVA Holding	USD 415 million
	Wind	Haouma in the Tangier region	50	In operation since 2014	NAREVA Holding	
	Wind	Foum El Oued in Laayoune	50	In operation since 2014	NAREVA Holding	
	Wind	Akhfenir II	100	PPA signed	NAREVA Holding	USD 180 million
	Wind	Jbel Sendouq Khalladi	120	PPA signed, under construction	UPC Renewables	USD 180 million
	Wind	Taza	150	PPA signed	EDF EN Maroc and Mitsui	USD 200 million
	Wind	Midelt	150	PPA signed	NAREVA Holding, Enel Green Power SpA and Siemens	USD 1.1 billion
	Wind	Jbel Lahdid	200			
	Wind	Tiskrad	300			
	Wind	Boujdour	100			
	Wind	Tangier II	100			
	CSP	Noor I	160	In operation since 2016	ACWA Power	USD 1 billion
	CSP	Noor II	200	PPA signed, under construction	ACWA Power	USD 1.1 billion
	CSP	Noor III	150	PPA signed, under construction	ACWA Power	USD 862 million
TOTAL			**2267**			**USD 5.707 Billion**

Source: RCREEE (2016, p. 79)

The UAE has attracted most of the investments in large scale renewable energy projects through IPP public competitive scheme similar to Morocco. The investment has been made in 1100 MW renewable energy projects. PPA has been awarded for around 200 MW of PV, while around 100 MW CSP is currently in operation. A consortium headed by Masdar had been able to win the contract for the third phase of 800 MW Mohammad bin Rashid Al Maktoum solar park. A record bid of USD 2.99 cents per kWh was made for the third phase of the project. The second phase was also completed at the time world record bid of USD 5.84 cents per kWh from the consortium led by Saudi Arabia's Acwa power. Table 2.8 shows the large-scale renewable energy projects in the UAE in 2016.

Table 2.8: Large-scale private renewable energy projects status in United Arab Emirates in 2016

	Technology	Project	Capacity (MW)	Status	Developer	Approximate Total Investment Costs
UAE	CSP	Shams 1	100	In operation since 2013	Masdar, Total and Abengoa	USD 600 million
	PV	Mohammad Bin Rashid Al Maktoum Solar Park Phase 2	200	PPA signed	ACWA Power	USD 250 million
	PV	Mohammed bin Rashid Al Maktoum Solar Park Phase 3	800	Awarded	Masdar, Fotowatio Renewable Ventures (FRV) - an Abdul Latif Jameel company, and Gransolar Group	USD 900 million
TOTAL			**300**			**USD 850 million**

Source: RCREEE (2016, p. 79)

Concerning the evolution of private investment in renewable energy, the countries in the MENA region have made a lot of advancement to attract renewable energy in 2015. The only country where private renewable energy projects were in operation was Morocco in 2010. However, this number of countries increased to five by the end of 2015, including Morocco, Jordan, Egypt, Tunisia, and the UAE. The increase in the private investment in Palestine, Jordan, and Tunisia in 2016 included large scale renewable energy projects that have started after the award of PPAs, as well as small scale projects that have been installed using net metering schemes. While there is no formal process for private renewable energy projects in Lebanon, small scale renewable energy projects are operating in this country through the net monitoring scheme. Table 2.9 shows the increase in private investments in renewable energy projects according to 2016 statistics.

Table 2.9: Increase in private investment in renewable energy projects in 2016

	Total in 2013 (% of installed capacity)	Total in 2016 (% of total installed capacity)*	Investment Increase
Algeria	0.0%	2.3%	2.3%
Bahrain	0.0%	0.0%	0.0%
Djibouti	0.0%	17.0%	17%
Egypt	0.0%	1.0%	1.0%
Iraq	0.0%	0.0%	0.0%
Jordan	0.0%	10.5%	10.5%
Kuwait	0.0%	0.0%	0.0%
Lebanon	0.0%	0.7%	0.7%
Libya	0.0%	0.0%	0.0%
Mauritania	0.0%	0.0%	0.0%
Morocco	1.3%	18.9%	17.6%
Oman	0.0%	0.0%	0.0%
Palestine	0.0%	3.5%	3.5%
Qatar	0.0%	0.0%	0.0%
Saudi Arabia	0.0%	0.2%	0.2%
Sudan	0.0%	0.0%	0.0%
Syria	0.0%	0.0%	0.0%
Tunisia	0.0%	0.4%	0.4%
UAE	0.0%	4.1%	4.1%
Yemen	0.0%	2.0%	2.0%

Source: RCREEE (2016, p. 80)

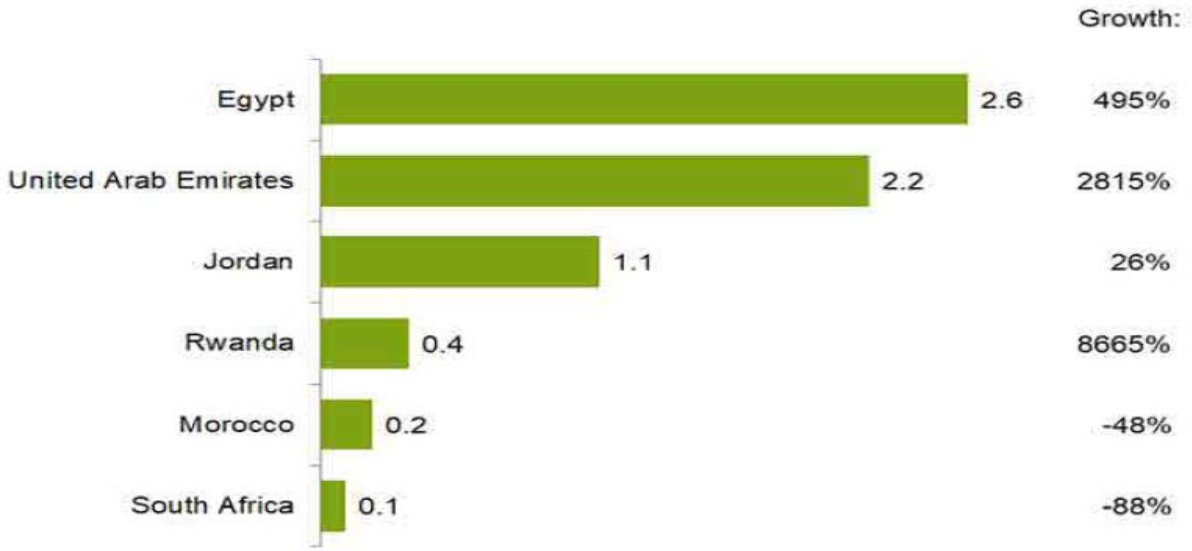
2.6. RECENT TRENDS IN RENEWABLE ENERGY INVESTMENTS IN THE MIDDLE EAST AND NORTH AFRICA REGION

2.6.1. Evolution of renewable energy investments in the Middle East and North Africa region in 2017

Figure 2.13 shows investment in six leading markets in the Middle East and Africa region in 2017. The outstanding performances of Egypt and the United Arab Emirates were USD 2.6 billion and USD 2.2 billion, respectively In the case of Egypt, about 1.3 gigawatts of solar energy projects from the second phase of the country nutrition tariff program reached a financial closure by the October 2017 deadline, with many of them around the 50-megawatt mark. However, the largest single project to attract investment in 2017 was the 263-megawatt wind project from the Gulf of Suez, which amounted USD 400 million .The renewable energy investments in the UAE in 2017 were more concentrated. Thus, two PV projects, which are the largest projects in the world, have reached their financial end: the installation of Sheikh

Mohammed bin Rashid Al Maktoum III, with a capacity of 1.2 gigawatts and USD 899 million, and the Marubeni Ginko Solar plant and Adoya Sweihan, with a capacity of 800 megawatts and estimated at USD 968 million. Both projects were funded through equity and debt from international development banks and commercial banks, and international developers won bids at high prices in 2016. Jordan has increased by 26% in renewable energy investments to reach $ 1.1 billion, the highest rate ever for this country, due to the financing of utility-scale PV projects from its second round of auctions, with the aim of meeting the country growth in energy demand. There is also growth in smaller solar systems built by commercial customers, who want to consume energy and sell the surplus to the grid.

Figure 2.13: Evolution of renewable energy investment in the MENA countries 2016-2017



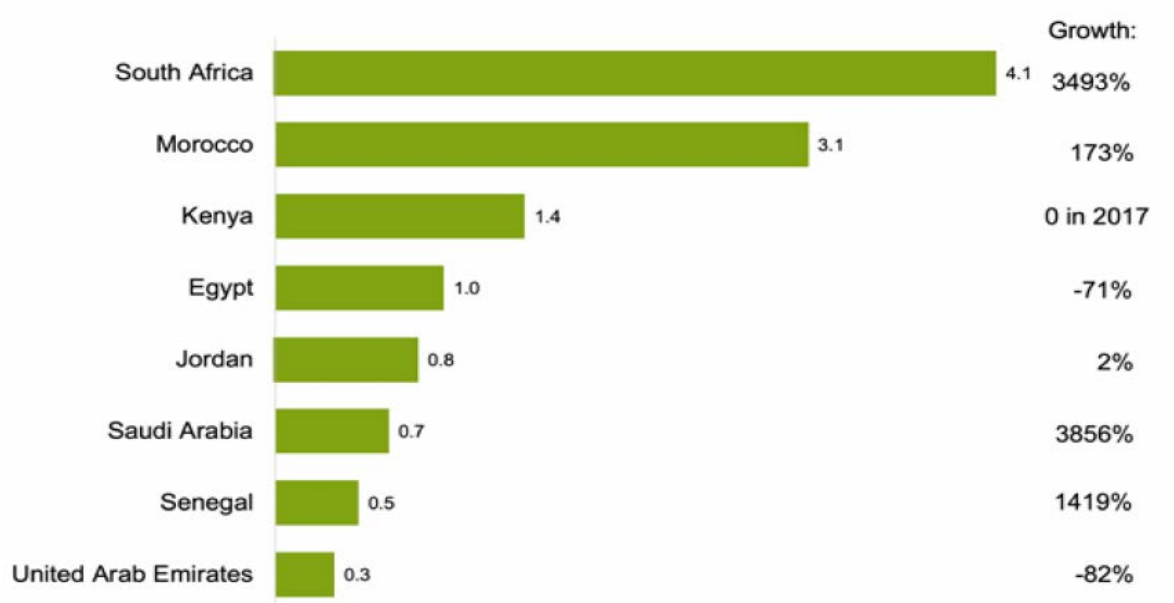
Source: Frankfurt School of Finance & Management (2018, p. 29)

2.6.2. Evolution of renewable energy investments in the Middle East and North Africa region in 2018

Some of the most promising markets for renewables, and, in particular, for solar energy, are in the Middle East and North Africa, due to the abundant sunning and rapid growth in electricity demand in most countries. This region has increased by 61% the green energy investment in 2018, to reach USD16.1 billion. Solar energy accounted for the largest share of the total, reaching USD 10.1 billion in 2018, up to 19%, but there was also a five-fold jump in wind investment.

Most of the investment in new energy (USD 12.6 billion) came in some form of utility-scale enterprise. However, there was also an estimated USD 3.4 billion in financing for small-scale solar systems, the highest in any year until now. Figure 2.14 shows details of the evolution of renewable energy investments in the MENA region by country.

Figure 2.14: Evolution of renewable energy investment in the MENA countries 2017-2018



Source: Frankfurt School of Finance & Management (2018, p. 50)

Morocco has a strong feature in renewables in the Middle East and Africa for several years, with a total investment volume each year depending on the timing of specific deals. It received USD 2.6 billion in solar financing in 2018, more than double the previous year. This figure is dominated by the 800-megawatt NOORm Midelt PV portfolio of USD 2.4 billion. The investment in wind energy reached USD 439 million, starting from zero the previous year. The market that emerges practically out of nowhere is Egypt in recent years. It accounted for USD 967 million, significantly down from USD 3.4 billion in 2017, but this reflects the timing of the funding that comes out of auction rounds, rather than any major issue. This country aims at reaching 20% of electricity production from renewable energy sources by 2022, and 41% by 2035 The largest financing for assets in Egypt last year was the third phase of the NREA wind farm, Mountain of Oil, which is estimated at USD 202 million for 120 megawatts, and Acciona and Swicorp Benban PV portfolios worth USD 180 million for 186 megawatts. Among the countries that did not break the USD 1 billion investment barrier in 2018, Saudi Arabia was the strongest rise, achieving the highest total to date, reaching USD 651 million, due to all-solar projects. The United Arab Emirates, which saw USD 1.9 billion in solar financing in 2017 and then in early 2019 hosted the largest ever solar energy deal worldwide (USD4.2 billion), had a break in the year 2018.

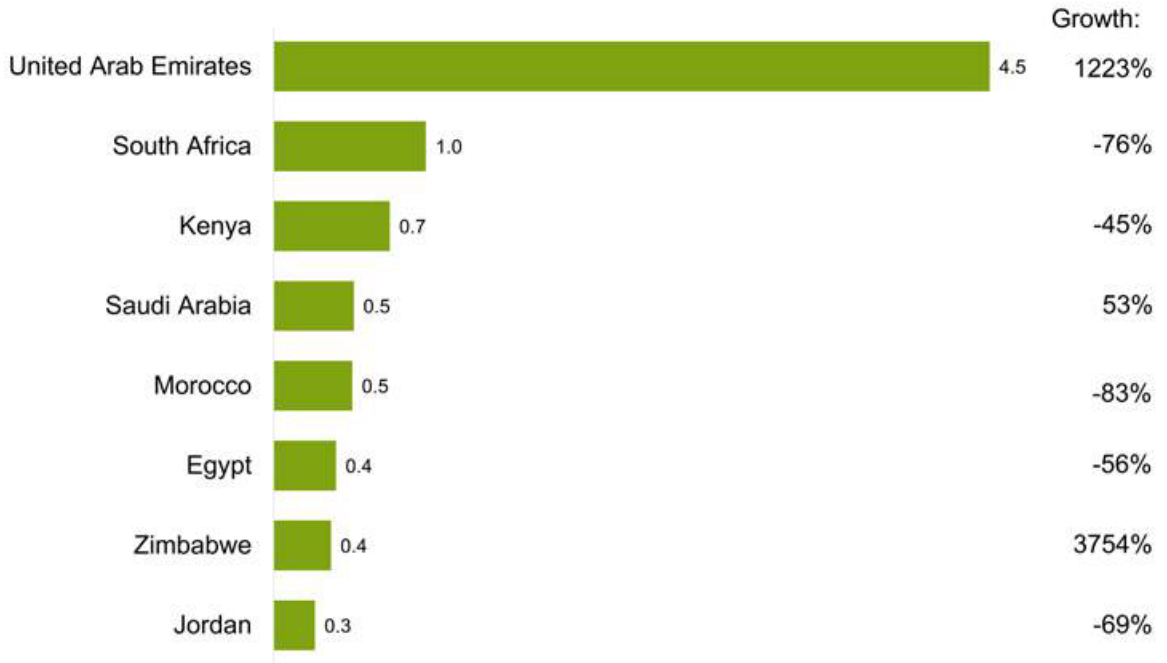
2.6.3. Evolution of renewable energy investments in the Middle East and North Africa region in 2019

Investment in renewable energy in the MENA fell 8% to USD 15.2 billion in 2019, from a record total of USD 16.5 billion reached in 2018. Several countries that have become important investors in previous years, including South Africa, Jordan, Egypt and Morocco, there has been a significant decrease in investment, mainly due to gaps in auction programs. This was generally the main reason for the decline in the region as a whole. Trade data indicate that about USD 5

billion of small solar systems were sold to unveiled clients in the MENA region last year. Their location will be decided at the appropriate time.

Figure 2.15 highlights the fact that the UAE was by far the best performer in renewable energy investment in the region in 2019. Its superiority owes to one megaproject, which is Al Maktoum USD 4.3 billion up to 600 MW of thermal energy solar from the parabolic pool and 100 megawatts of solar energy tower, with another 250 MW of PV panels. It will cover an area of 44 square kilometres, and the height of the tower will be 260 meters. The project heat storage is planned to be 15 hours, much longer than most solar thermal plants operating around the world. The financing package in March 2019 was the largest ever in the field of solar energy, the total cost is USD 4.3 billion, with the debt portion USD 2.6 billion, and the debt-to-capital ratio of 60%. The 27-year project loans came from five Chinese banks, three Emirati lenders, as well as Natixis from France and the UK-based Standard Chartered Bank. Out of approximately USD 1.7 billion in shares, 51% came from Dubai Electricity and Water Authority, 25% from Aqua Power Development, and 24% from the China Silk Road Fund.

Figure 2.15: Renewable energy capacity investment in the MENA region 2018-2019, USD BN



Source: Frankfurt School of Finance & Management (2020, p. 46)

The three most active renewable energy markets in the MENA region, which are Morocco, Egypt and Jordan, have invested a total of USD 15.7 billion over the five years from 2015 to 2019. However, the last year was relatively weak for all of them. Asset financing amounted to USD 302 million for the ONEE Morocco PV portfolio of USD 410 million, and to the Lekela Power West Bakr wind power plant 250 MW in Egypt. In all these countries, there were gaps between the auction rounds that fuelled the momentum of their renewable energy building. The fact that equipment prices, especially for photovoltaic devices, tend to drop very quickly, which has led to increased policy-makers recommendations about the appropriate timing for new capacity. However, governments continue to demonstrate their support for renewables. Thus,

Egypt, for example, saying in October 2019 that it had scrapped a massive coal project, and considering the possibility of 500 megawatts of additional renewable energy.

It should be noted that the nature of large renewable energy projects affects the shape of investments in the sector. Thus, high investments were injected in the sector in some years, while very low investments were made in other years. It can also be observed that the MENA region has received some of the lowest renewable energy prices awarded globally for solar PV and wind energy in recent years.

Among the MENA countries, Morocco has emerged as a role model for the region. The government target of 2GW of solar and 2GW of wind power by 2020 is progressing smoothly with the commissioning of Nour-1 and Nouer-2 Solar projects, in addition to several wind energy projects. Jordan and Egypt are also making steady progress in the renewable energy sector. With regard to the Gulf countries, the UAE is a leading in the renewable energy sector, in particular, concerning the development of solar energy. They are noteworthy the 100MW Shams CSP plant that has been operational since 2014 in Abu Dhabi and the 13MW Phase I of Dubai's solar park, which was completed in 2013. In the case of Saudi Arabia, the newly launched Vision 2030 document has put forward a strong regulatory and investment framework to develop the Saudi clean energy sector, which should catalyse renewable energy development in the country.

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CHAPTER 3:

RENEWABLE ENERGY IN THE MIDDLE EAST AND NORTH AFRICA REGION: RISKS AND BARRIERS

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3.1. INTRODUCTION

Once the global situation of investment trends have been analysed, especially in the renewable energy sector, as well as the current situation in investments investing in renewable energy in the countries of the Middle East and North Africa, this chapter discusses the risks affecting investment in general and investment in the renewable energy sector in particular. It focuses on those types of risks tackled in the literature and the specialized reports issued by dedicated international bodies.

The first section of this chapter deals with the set of risks related to political circumstances and includes an explanation of the various definitions of political risks and what they may include. The second section approaches the risks associated with the business environment and includes a specific set of the most important and influential risks, which embraces entry regulations, about market regulations, international trading, private credit, protecting minorities, enforcing contracts and resolving insolvency. The third section tackles the regulatory framework, and its impact on making investments decisions, especially when markets are open and connected. The absence of regulatory impact assessments before any investment decision, the mechanisms of regulatory compliance and enforcement and regulator coherence across levels of government and good governance could imply many risks on the investments. This section also discusses the importance of the supporting mechanisms for renewable energy investments and the risks associated with the non-existence of such mechanisms or the way of implementation. The fourth section provides an overview on the market and sales risks, including variability of revenues due to weather or resource risks, grid or curtailment risks and price volatility risks. The fifth section focuses on transport, construction and completion of projects risks, which could affect the first stage of the green project life cycle. Thus, the construction phase is the riskiest, because of the period of construction is crucial for this type of projects. The sixth section deals with the operation and maintenance risks by taking wind power project as an example to analyse the possible risks associated with operations and maintenance, including damages to physical assets, losses due to flaws in design, component failure, unexpected closure and other risks. The seventh section discusses a relevant group of risks, which are associated with the financial structure of any investment project, including the risk linked to renewable energy projects. It deals with the explanation and analysis of a group of financial risks, including financing barriers (long terms and project financing), interest rate risks, exchange rate risks, currency convertibility, inflation rate risks, flow of capital, financial policy bias and taxation. The last section deals with the risks related to environmental and social issues taking into consideration different renewable energy technologies, including the environmental impact of different technologies and the social acceptance of these projects.

3.2. POLITICAL RISKS

Foreign investment had decreased in developed economies and those that are in transition to developed status in 2017, while it has remained stable in developing economies. The

developing countries had attracted nearly 47% of the worldwide total foreign direct investment (FDI) in 2017, which means an increase of FDI in these countries by 11% compared to 2016. Despite the high political risk, the total FDI has reached a USD 1.43 trillion with an increase of almost USD 720 billion, or 50% according to the World Investment Report of 2018 (UNCTAD, 2018). However, global FDI flows fell by 13% to USD 1.3 trillion in 2018, and FDI flows to developed economies declined by 27%, reaching the lowest level since 2004. The inflows to Europe were less than USD 200 billion, due to negative flows in a few large host countries as a result of the repatriation of funds and a significant drop in the UK. The flows in the U.S. fell by 9% to USD 252 billion in 2018. However, flows to developing countries remained almost stable, rising by 2%. As a result, the share of developing countries in global FDI increased until it reached the 54% of total FDI (UNCTAD, 2019).

The changes in host government policy are a major source of political risk. In a democracy, adverse policy changes may occur when a new government is elected, or when an existing government facing re-election takes a populist stance. Disclosure of government fraud or irregularities may spur policy change. In totalitarian governments, a change in the balance of power between rival factions within the ruling party can have drastic effects on business (Casson & Da Silva Lopes, 2013).

The need for assessment of different political scenarios, particularly in the case of greenfield investment, where an institution invests to gain control over foreign activities, has increased the importance of political risk analysis. This technique has become an important element in the process of making executive-level decisions. Despite studies clearly defining the concept of political instability, political risk concept has largely been ignored by political science scholars, because of the multidisciplinary nature of political risk. Many different institutions and professionals carry on political risk analysis from investment consultants and financial firms to credit rating agencies. This activity is performed by many different agents, who attach different meanings to the term. A comparison of different political risk analysis techniques and the indices used in the analysis is not an easy task. Individuals and institutions that carry on the analysis generally do not reveal the reason for using a particular approach, mainly due to competition. They do not explain the methods used to collect, assess, and interpret political risk, which creates a lack of transparency in using the technique. This raises the question of the underlying assumptions and logic regarding existing indices that gauge political risk.

Political risk analysis had attracted interest among academicians after the adoption of the Marshall Plan in 1948. Over the next decades, the concept of political risks becomes highly relevant, when US private and government organizations started to evaluate the investments risks, especially outside the US using different methodologies (Sottilotta, 2013). Political risk was initially presented as a part of the country risk analysis that investigates the elements which cause a country to become insolvent. At first, the concept did not look into economic and financial factors; but later on, political risks have included methodologies to find out how to adapt to the changing environment of trade and international investment.

In the context of understanding a particular political environment, political risk analysis has been an important activity carried out by business ventures for a long time (Ferguson & Schularick, 2006). However, the term has gained interest only after the 1960s. The concept has largely been unclear as it is evidenced by the fact that a lot of studies starting from the 1970s had tried to define that vague concept (Kobrin, 1978; Fitzpatrick, 1983; Simon, 1984; Friedman & Jonghoon, 1988; Chermack, 1992; Jarvis, 2008).

When academicians had started to develop the concept of political and country risk analysis during the 1960s, the world was divided into two blocs, i.e. socialism and capitalism. The hallmarks of these two complex and distinct government processes are planned economies and free-market economies, respectively. The period also coincided with the decolonization time, as colonial powers had imploded and new economies faced challenges due to decades of exploitation. The world politics had become unpredictable, such as the Suez and the Congolese crisis in the 50s and 60s that drastically and unexpectedly changed the business environment. That is why the initially political risk was mainly focused on modernizing and underdeveloped countries (Zink, 1973; Green, 1974; Green & Korth, 1974;). Considered as non-economic risk, political risk analysis was mainly concerned about business disputes that arose during those times due to the economic socialism or the actions of seizing private business properties mostly in developing nations by relying on the principle of public interest (Jodice, 1985).

In the seventies, two major events had increased the importance of political risk analysis among government and business strategy makers, first, the Arab oil crisis in 1973 and second, the Iranian revolution in 1979. Such events with large scale impact had increased the significance of political risk analysis resulting in the introduction of political risk management by private and public insurance companies and in the establishment of consulting firms that focused on political risk analysis (Simon, 1984).

The concept of political risk had evolved to another level in the 1980s when nations faced risk due to bad debt management practices. Terrorism becomes the focus of political risk researchers during the 1990s that continued after the World Trade Center attacks in11th September 2001, and the subsequent War on Terror carried out by the US government and the allied nations. Terrorism has become one of the concerns for foreign investors and it was regarded as a political risk (Berry, 2008). Over the decades, the scope of financial and political-economic analysis has evolved from a western preformed and in particular by American multinational companies to a global phenomenon. Nowadays, it can be witnessed that developing economies invest more in risky international markets than their counterparts in developed economies (Satyanand, 2011). In the context of the current political, economic, and financial challenges that can be traced back to the 2008 financial crisis, developed countries are not looked as risk-free to foreign investors as it was before the crisis. As a result, political risk analysis no longer is confined to the least developed countries (LDCs).

The concept of political risk shares certain common elements with a country risk that refers to the ability and willingness of the state to serve its financial obligations (Hoti & McAleer, 2004). It should be noted that the scope of country risk today has expanded to include both operational and financial risks. The country risks are broader than political risks because they include the economic and financial factors in addition to the political and social elements. All of these factors will be used by foreign investors to predict and find problems in specific national environments (Howell, 2007).

Scholars have given different names to political risks in an attempt to categorize the evolution over the years of technical meanings of the concept: 1) non-economic risk (Mayer, 1985; Ciarrapico, 1992); 2) the likelihood of disturbance in multinational firm operations due to political events or factors (Root, 1972; Brewers, 1981; Jodice, 1984; Multilateral Investment Guarantee Agency, 2011; 3) political instability in the host country (Green, 1974; Thunell, 1977); 4) disruptions in the business environment due to political change that would affect profitability (Robock, 1971; Thunell, 1977; Micallef, 1982); and 5) obtrusive government

intrusions into business operations (Eitman & Stonehill, 1973; Aliber, 1975; Henisz & Zelner, 2010).

Political risk equated to non-economic risks happens at the original phase, whereby banks and companies started analysing the risks that are not classified as business risks and cannot be investigated by assessing the fundamental economic position of the country. The first definition of political risk is the initial phase in which companies and banks started to address the problem of risk assessment that cannot be classified as commercial risks, and cannot be evaluated by looking at the economic basis of a country (Mayer, 1985; Ciarrapico, 1992).

Secondly, political risk can also be defined as a likelihood of disruptions caused due to political changes. This is an accurate semantic view of the concept, since it rightly focuses on the likelihood of events harmful to multinational enterprises (MNEs) operations, instead of merely events that are damaging to company operations. Calculating the likelihood of an event is generally ignored and political risk is defined with regards to the events that can impact operations of the firm. The calculation of occurrence of an event that creates political risk is a predictive analysis that may point to a high risk even when the present risk is perceived by firms to be lower (Kobrin, 1979).

The third definition of political risk as a discontinuation in the business environment is broad. The definition focuses on the broad business environment instead of focusing on individuals. Many changes that significantly affect the profit or other goals of a firm are a type of changes that can occur in the international business environment and it constitutes a form of political risk, including discontinuities, the challenge of anticipating these developments, and when changes happened as a result of political reforms (Robock, 1971). Discontinuities can occur even if the political situation appears to be stable. The political situation may actually be stable, or it may appear stable, despite the signs of imminent changes in the political scenario. For example, during the invasion of Afghanistan by the Soviet Union and the Iranian Revolution, brewery firms had concluded that stability during an autocratic regime cannot be considered an indicator of political stability in the future (Brewers, 1981). This was also the case for companies operating in the MENA region that went through radical political upheavals during the Arab Spring in early 2011 (Komendantova et al., 2012).

The fourth definition of political risk as changes and instability in the country politics was developed by researchers who attempted to link the concepts of political sciences with management sciences. One of the relevant differences in this position is between micro political risks and macro political risks. Micro political risks refer to changes selectively addressed to specific areas of business activity, while macro political risks concern the political changes that are directed to all foreign companies (Robock, 1971). The micro political risk analysis needs to be conducted at the industry or enterprise level, while macro analysis refers to general political risk. Equating political risk to unwanted interference by the host country government is rather restrictive (Kobrin, 1979), since the assumption here is that the interventions, such as limiting foreign investment, are always damaging for the business and result in the inefficient economic system. This is a faulty assumption as an accurate assessment of political risk involves investigating different objectives of the company and the host government, which are not necessarily contradictory or diverged. Moreover, in the context of the 2008 financial crisis, which revealed the inherent risks in the under-regulation of markets and the Washington Consensus, the laissez-faire concept has lost meaning in economic theory and business practices.

The fifth definition of political risks was developed basically by Green (1972, 1974), who had made efforts to create a relationship between political risk and political regime. The political regimes were categorized by Green (1972, 1974) into several groups with decreasing risk levels:

- First group: modernizing nation-states that recently became independent, like Indonesia and Ghana;
- Second group: mobilizations systems regimes, including China, Vietnam and Cuba;
- Third group: military dictators, such as Libya;
- Fourth group: modernizing autocracies, like Jordan;
- Fifth group: quasi-instrumental regimes, including India and Turkey;
- Finally, the sixth group: adaptative instrumental regimes, like the United States and the United Kingdom.

This categorization of the political risks by Green (1972, 1974) according to the regime types rest on different assumptions. The foremost assumption is that changes in the political situation are harmful to the operations of foreign firms. Another assumption is that the modernization of the economy generally puts the political system under a lot of pressure and, in this case, the institutions will have to choose only two options; to adopt or to be replaced. Yet another assumption is that younger countries are less adaptive to political changes that result in high political risk as a result of the changes in the country political systems. This categorization of political risks based on the type of regimes is not proved empirically, and it does not explain the specific methods of linking different political systems to political risks. A large number of private and public firms today conceptualize and assess political risks, including the World Bank, Eurasia Group, Political Risks Service Group, among many others. However, most of these institutions do not reveal the specific methodologies used in the assessment, nor are the methodologies for assessing risks share common grounds. This is an important point to understand since the political risk assessment is most of the time disregarded due to the lack of clear concept and criteria of assessing the risks.

In conclusion, political risk analysis in political science and international business studies largely remains a vague concept, despite decades of work done. The conceptual confusion regarding political risks that has attracted interest among scholars and professionals requires a reappraisal of the concept. Apart from Jensen (2003, 2008) and Green (1974), no studies had described the political risk in relation to political systems. Moreover, according to Sethi and Luther (1986), most of the research conducted on political risks has been paid insufficient attention to developing concepts and definitions that accommodate the breadth of the problem. And if the definitions will continue to be not clear enough, other methodological issues are unlikely to be resolved. According to Jarvis & Griffiths (2007), the eighties saw a renouncement by political analysts to a systematic approach as low political risks and high levels of political stability are evident in developed countries, which are often characterized by the liberal, capitalist, and western character. By definition, any country with different characteristics may pose a political risk and a high potential for instability. Nevertheless, the economic and political turmoil after the 2008 financial crash shows that political risks are also inherent in liberal democratic and capitalist countries, particularly in the West. As abovementioned, nowadays, a

reassessment of systemic political risk and a new definition is required. The risk could be redefined as the probability of an occurrence of an event negatively influencing the profitability, due to unexpected circumstances like revolutions in the local or foreign political arena, or the policy of the government that affects property rights of international investors. In both these situations, risk analysis needs to be carried out circumspectly by considering the political systems, as well as international events. The latter factor deserves particular attention in the context of future research goals, especially concerning the international dimension of political risk that has been conceptualized as a bad neighbourhood[25].

3.3. BUSINESS ENVIRONMENT RISKS

This section analyses the business environment elements that might have a notable impact on renewable energy investments as well as possible related risks. The various elements of the business environment that are presented here were mainly drawn by analysing the elements that the World Bank is accustomed to using, in particular, in the Doing Business annual report (World Bank, 2020). An overview is provided on the entry regulations and its impact on investments and projects, the regulations of the labour market, international trade, access to private credit, protecting minorities and enforcing contracts.

3.3.1. Entry regulation

This subsection describes the regulations regarding time, cost, and the process of registration in 85 countries. More specifically, the legal requirements for setting up the business are highlighted, including the cost of meeting the business registration requirements, and the minimum time to complete the process. This study has been largely inspired by the study carried out by De Soto about business setup in Peru (De Soto, 1989). However, this study does not take into account corruption and bureaucratic delays, while examines the official regulatory requirements, time, and cost of setting up a business in respective countries.

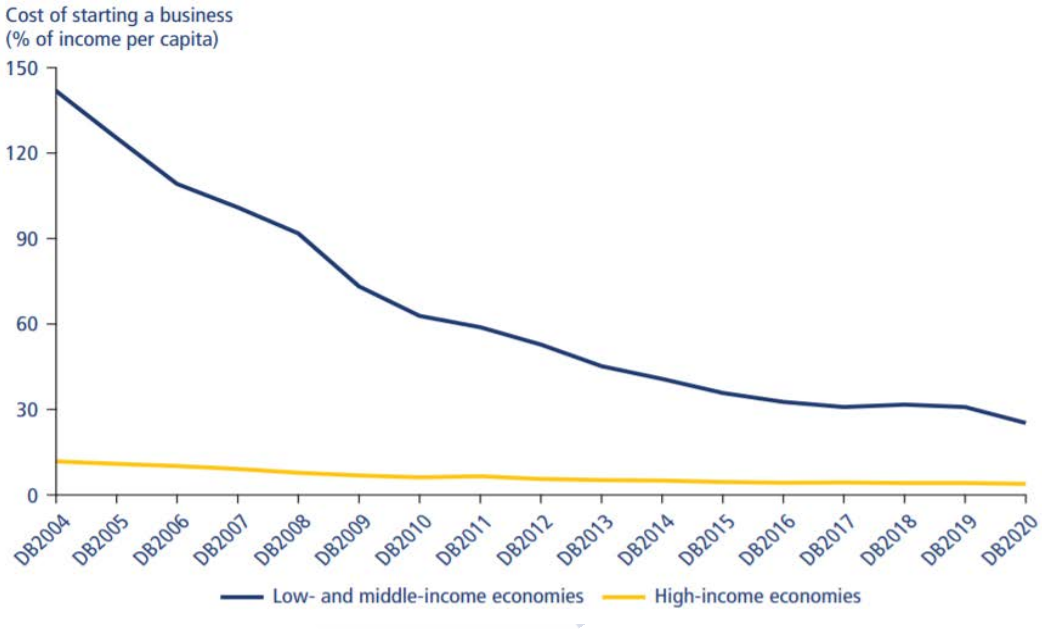
Low-income economies can reduce the income gap with the developed countries by achieving higher levels of economic efficiency. The relation between entry regulation and the income gap between developing countries and the United States was studied by Herrendorf & Teixeira (2011). The results showed that the barriers of entry in developing countries are the main reason behind almost half of the income gap.

One of the best tools that present quantitative indicators on business regulations worldwide, including entry regulations among several elements is the Doing Business report, a publication which is a flagship of the World Bank group. As figure 3.1 shows, Doing Business reports of the World Bank indicate steady convergence between developed and developing economies in

[25] The Economist. (2009). Aux barricades! - Political instability index. https://www.economist.com/news/2009/03/25/aux-barricades, accessed on 18/7/2018.

the last two decades, in particular, in the business incorporation area. Since 2003, the data show that 178 economies have implemented 722 reforms to reduce or eliminate barriers to entry; 106 economies have removed or reduced the minimum capital requirements, about 80 countries have introduced or improved one-stop stop shops and more than 160 have simplified the procedures (World Bank, 2020). However, Doing Business 2020 data indicate that there is still a large discrepancy between low-income and high-income economies regarding the ease of starting a business. Thus, a businessman in a low-income economy usually spends about 50.0% of income per capita to start a company, compared to only 4.2% of a businessman in a high-income economy (World Bank, 2020).

Figure 3.1:The cost of starting a business in low and middle- and high- income economies



Note: The sample comprises 145 countries.
Source: World Bank (2020, p. 6)

According to the public interest theory advanced by Pigou (1938), unregulated markets are characterized by recurrent shortcomings that arise due to monopolistic power to influence externalities. Social efficiency helps to overcome these deficits and ensuring that the interests of the general public are protected through enacting regulations. When applied to a business establishment, this concept holds that new entrants are screened by the government to ensure that applicants to ensure only desirable sellers enter the market. This helps reduce the market failure rate by eliminating less demanded, low-quality products and looking at other factors, such as pollution. This is done to ensure that new companies meet the minimum criteria for providing a good or service. By registering, the new companies obtain a kind of official approval, which gives them sufficient reputation to establish appropriate transactions with the public, enterprises, and other parties (SRI International, 1999). The interest theory assumes that socially superior outcomes occur by enforcing stricter regulations and increasing the procedures for setting up a business.

Another pertinent theory is the public choice theory that views government regulations as less socially efficient and damaging (Tullock, 1967; Stigler, 1971; Pletzman, 1976). According to the theory of regulatory capture of Stigler (1971), when the industry obtains the regulation, which is designed and operated to its benefits, and, therefore, the industry actors have the capacity to get the desired regulations, the result is lower organisation and information cost. Following this theory, strict regulations regarding business entry favour existing players resulting in above-normal profits. The regulations increase the barrier to entry that leads to monopolistic competition that benefits certain market players.

According to another group of scholars, the public choice theory holds that regulations are set up to benefit bureaucrats and politicians (McChesney, 1987; De Soto, 1989; Shleifer & Vishny, 2002). This system rests on the assumption of bribery, campaigns for regulations, and gathering votes. An important reason for the existence of many of these permits and regulations is to give officials the authority to refuse them and collect bribes in exchange for providing permits (Shleifer & Vishny, 1993).

The tollbooth and capture theories have similarities since both addresses the creation of rent through political influence. The tollbooth theory highlights the benefits to the politicians, while the capture theory stresses on the benefit to the industry, even when the government becomes worse. Making regulations by receiving bribes can be efficient in theory. The government can acquire equity shares in a regulated business. However, in practical terms, the practice of bribes or creating rents for politicians and bureaucrats lead to inefficient regulations since the regulators are not organized and focus on an increase in rents through corrupt practices. The similarity of this approach to highway tollbooths is relevant here. The efficient operation of highways financed through tax revenues can result in low or no tools. Nevertheless, in the political reality, each town creates its own tollbooths. Moreover, toll collectors may sometimes block other to force traffic through a particular tollbooth. In other words, political influence in the collection of tools results in a largely inefficient system compared to influencing regulations through bribery by political officials. In this theory, regulators can collect bribes due to the regulations from all potential new entrants. This treatment can impact all new investors, which sometimes includes several ways of blackmailing like delays and other types of obstacles unless the investor pays a large amount of money (Emery et al., 2000).

In view of these theories, the experts team from the World Bank assessed the regulation of entry globally and addressed two sets of factors. The first set refers to the consequences of entry regulations, in particular, the beneficiaries and the impact on public interest in terms of quality of goods, competition, and other issues. In contrast, public choice theory considers that more stringent regulation is always linked with less competition and higher corruption levels (Djankov et al., 2002). The second set of factors concerns the examination of different theories used by governments to establish the necessary regulations. In this context, there are two main theories: the public interest model and the public choice model. The public interest model is used by governments that are more representative and very close to consumer choices. Thus, they establish very strict entry regulations. In contrast, the public choice model is implemented by governments, which are not subject to popular oversight. Therefore, they are establishing very strict entry regulations to benefit these governments and to possibly benefit the incumbent firms.

The examination of the data on business entry regulations applicable in 85 countries shows that nations with more open access to the political system, high political rights, and more constraints at the executive levels will have more business-friendly regulations for new entrants

compared to countries with a more autocratic system. An analysis of a nation per capita income control is important since richer governments can argue to have improved government systems and a decreased need for regulating entry businesses. This may be because richer nations have fewer market shortcomings and they also have alternative processes for dealing with obstacles for setting up a business. The fact that countries with improved governance have less restrictive regulations for setting up the business, as well as the obvious interpretation of the reduced size of the unofficial economy and less corruption, provides evidence for the tollbooth theory that business entry should be regulated to benefit the local governments.

According to the World Bank data of 2019, the number of days required to set up a firm range from 230 in Venezuela to 0.5 in New Zealand, with a global average of about 19.5 days (World Bank, 2020). The required steps to establish a business varies from 0 in Venezuela and 1 in Georgia and New Zealand, with a global average of about 6.6 steps (World Bank, 2020). These figures are based on the assumption that there are no delays, either due to the regulatory process or on the part of the applicant. The cost of creating a business also varies from as high as 211.8% GDP per capita in Venezuela to 0.1% of GDP per capita in Ireland, with the average global cost being 19.7% of GDP per capita (World Bank, 2020). The establishment of business in most countries is time-consuming and extremely exhausting in most of the regions in the world.

In the cross-section analysis, stricter regulations were not found to result in higher quality products or improved health due to reduced pollution. Moreover, the strict regulatory environment did not result in a more focused competition. In contrast, strict regulations for setting up the business are linked with the increased size of the unofficial economy and higher corruption levels. This shows support for the public choice theory instead of the public interest theory. The public interest theory may criticize this argument by stating that heavy regulatory processes result in increased market obstructions and the lack of alternative methods of addressing them, such as freedom of the press and impartial judiciary. Furthermore, the reasoning could be that the unofficial economy and corruption may be adverse effects of a strategy that otherwise will be beneficial. Therefore, it cannot be regarded as a proof against the public interest theory. The adverse outcomes can be ignored since they may also result in screening out inefficient market players (Banerjee, 1997; Acemoglu & Verdier, 2000;). In other words, the negative outcomes may result due to the injudicious transfer of regulations in developed countries to underdeveloped ones. In this context, the question about which type of regulations is more effective arise. It depends on the conceptual suitability of the countries in implementing the policies.

3.3.2. Labour market regulations

It is important to investigate the reasons for government intervention in the labour market. Most interventions by the government can be explained by the theory that free labour markets are inefficient due to there are rents for employee relationship, and the fact the employers tend to abuse workers to extract maximum possible rents from them. These elements result in creating an inefficient and unfair environment. An illustrative example is the discrimination of marginalized and disadvantage societal segments. Other examples include underpaying disabled workers, not investing in developing human resource capital and firing employees who are then supported by the state. Due to the likelihood of abuse and unfairness by the government, every state makes regulations to protect the rights of workers.

Labour market reforms to prevent abusive working practices are of four different types that include the following ones:

- Laws that regulate employment relations, such as increasing the cost of raising work hours or firing workers;
- Laws that prohibit discrimination at the workplace;
- Laws that protect the basic rights of the workers like bereavement leave, minimum wages, and paternity/maternity leaves; and
- Laws that offer social insurance against ageing, unemployment, sickness, disability, and death.

3.3.2.1. Efficiency

The consideration of efficiency is important since it affects the choice of institutions, according to Demsetz (1967) and North (1982). This approach shows that countries prefer using a combination of intervention measures in the labour market to bring the desired change in terms of improved societal welfare and reduced market failure rates. Some research studies carried out in 2002 and 2003 identified government intervention measures that are not prone to subversion and are cost-effective (Glaeser & Shleifer, 2002, 2003; Glaeser, Scheinkman, & Shleifer, 2003; Djankov, La Porta et al., 2003). These studies have found that nations implement stricter intervention measures when worker abuse is prevalent in the market to solve market failures. Moreover, governments implement less strict labour intervention measures when public interference may cause order distortions. The efficiency theory is too broad in scope and strongly influences regulations. There are two potential implications of this theory. The first one is that in case that efficiency is the appropriate model, different political factors like leftist power or government constraints will not result in efficient regulatory practices. To guarantee social peace, some divided societies require more regulations and select leftist governments to implement them. However, nowadays divided societies require fewer regulations, which makes this argument weaker. The second situation applies when government labour market intervention system for protecting employer rights is efficient. In such a situation, the interventions will not have a significant negative effect, like a reduction in manpower, unemployment, and an increase in the unofficial economy. However, the benefits of regulations may be greater compared to these problems that require an indeterminate welfare assessment. The connection between legal theories and efficiency is even more challenging, as explained below.

3.3.2.2. Political power

Political power theories consider institutions as a vehicle through which resources are transferred from political power that leaves to one that assumes the power and also to establish the authority of the incoming political power (Olson, 1965; Marx, 1970; Finer, 1997). The political power theories regarding labour markets suggest that regulations are more defensive when the leftist groups are at the administration. In effect, there are two types of political theories. The first type is applicable to both authoritative and democratic governments, and it considers laws as being influenced by specific interest groups (Becker, 1983; Olson, 1965; Posner, 1974; Stigler, 1971). The other type deems elections as the main factor influencing political decisions, and the winning parties get to shape legislation.

The theories regarding political power are the best elucidation of the regulations regarding labour choice. The interest type political theories consider enactment of labour laws as a response to the unions pressure. They are more applicable when there are powerful unions, regardless of the type of government. The other electoral type political power theories consider protecting rights of employees as the main aim or regulations that are mostly introduced by leftist, socialist, and social-democratic countries in order to benefit electoral constituencies (Esping-Andersen, 1990, 1999; Hicks, 1999).

Another view of political theories is that the checks and balances regarding activities of the government limit the use of regulations for personal benefit (Buchanan & Tullock, 1962). Authoritative regimes are less restricted as compared to elected democratic government systems, due to which there will be more redistribution agencies and regulations. The legislative restrictions, constitutions and other types of check and balances are beneficial to reduced legislations, and this view is supported by empirical evidence regarding the entry legislations (Djankov et al., 2002).

3.3.2.3. Legal theory

A large number of scholar discussions focus on the legal theory that highlights two traditional legal practices applicable in the West of Europe during the 12th century: common law and civil law. These laws have also influenced legislation in the new world through colonization. The majority of countries that have been subjected to colonial rule have these basic legal systems that have been implemented involuntarily, due to which they are external to their respective economies.

Apart from the civil and common laws, traditions have influenced legislation. For instance, the German code became part of Germanic Western Europe and also spread to Japan, Taiwan, and Korea. Moreover, socialist laws had influenced legislation in countries that were part or under the influence of USSR. In addition, the native Scandinavian and Nordic traditions have influenced laws in Denmark, Norway, Finland, and Sweden. According to the legal theory, nations that belong to different traditions use different techniques for gaining social control of organizations (Djankov, La Porta et al., 2003). Following a Glaeser & Shleifer (2002), the differences in legal systems in different countries has been due to efficiency. However, the method of social control of organizations may be influenced by the incorporation of laws from the colonial masters, instead of being a voluntary choice. This is the case with the majority of countries around the world.

Legal theories may be consistent with the concept of efficiency when the cost of enforcement is considered. For instance, if a nation inherits most of the laws from the colonizer, in this situation, the legal tradition is shaped by the basic laws, the system for implementation of these laws, and human resources required for enforcing the law. If a country decided to regulate an activity such as work that was previously unregulated, the marginal cost in enacting a method that is similar to the parent country tends to be less compared to writing the codes from scratch since rules and people are divided across regulatory actions (Mulligan & Shleifer, 2004, 2005). In this situation, adopting the regulatory practices of the colonizing country may be more efficient. The path dependence in the regulatory and legal methods arises due to efficiently adapting an existing regulatory approach to the new circumstances.

According to the prediction of the legal theory, the regulation patterns in the context of labour markets generally follow the traditional methods regarding social control that is commonly used by the legal systems. The implication is that socialistic and civil laws would

regulate the markets more as compared to common law countries that help in maintaining the contract freedom to a large extent (Deakin, 2001). Another prediction of legal theories is that countries, where common laws are applicable, have less conducive social security structures since they are assumed to rely on labour markets to insure the workers. In addition, the legal theory assumes that the regulation patterns tend to be correlated across different regions.

The concepts presented by legal theorists are criticized by experts who support political power theories, such as Roe (2000) and Pagano & Volpin (20059). Supporters of power theories, who are mostly the leftists, argue that the tradition of civil law mostly coincides with political pressure for regulating the system in Western Europe countries. By aggregating the large data regarding legal origins and orientations in a sample of 85 countries, the study has undertaken to distinguish between pure legal theory and pure political power.

3.3.2. Trading across border and on time

According to the World Bank data, the MENA region average ranked 117 in 2019 cross border data system. On the export side, the average time to export is 52.5 hours, and the cost of export is around USD 441.8 concerning border compliance[26], while the time to export is 66.4 hours and the cost of export is around USD 240.7, regarding documentary compliance[27]. On the other hand, focusing on the import side, the average time to import in hours is 94.2, and the cost of import is around USD 512.5 for border compliance, whereas the time to import is 72.5 hours and the cost of import is around USD 262.6 concerning documentary compliance (World Bank, 2020).

Table 3.1 shows the different rankings of the MENA countries, where it can be noticed that Palestine ranked first in terms of trading across borders taking into consideration all measures used by the World Bank, followed by Morocco, and then by Oman, Jordan and Bahrain. The countries in conflict are also facing various obstacles and several difficulties in terms of cross border trade. This is clearly demonstrated in table 3.1, which shows that most of these countries, such as Syria, Iraq, and Yemen, are the last ones in the ranking.

The time required to move goods to the port and meeting custom regulations directly affect the trade costs. Djankov, Freund, & Pham (2010) studied the impact of diverse trade costs on trade volume. For this purpose, the data about trade costs were compiled from 345 ports, shipping agents, and customs officials in more than 126 countries. The average time to reach a 20-foot container or similar from a port located in a large city to a ship in the accessible part of town was calculated. To measure the effect of trade costs on the frequency of trade, Djankov et al. (2010) has made use of divergence gravity equation. An equation was developed to help finding out the impact of time delays on countries relative exports in different regions having similar geography, endowments, and tariff structure. Moreover, the importer effects, such as tariffs and remoteness, were investigated by comparing exports to the same importer. An example includes assessing whether exports from Argentina or Brazil to the US decrease the

[26] Border compliance captures the time and cost associated with compliance with the customs regulations of the economy and regulations related to other mandatory inspections in order for the shipment to cross the boundaries of the economy, in addition to the time and cost of handling that takes place at the port or borders. The time and cost for this sector includes the time and cost for customs clearance and inspection procedures undertaken by other government agencies.

[27] Documentary compliance captures the time and cost associated with complying with the documentary requirements of all government agencies of the origin and destination economies and any transit economies. The goal is to measure the total burden of preparing a package of documents that will enable the completion of the international trade of the product and the partner pair assumed, including time and cost as well, any information required from government agencies as information and electronic forms are considered within this package of documents

time costs of related trade after controlling for standard trade determinants, such as relative distance, size, and income. One important concern is the effect of trade volume on the costs. When the volume of trade is large, the investment marginal value in trade facilitation could be higher since the savings in costs are extended to a large number of goods. Moreover, a lot of time-saving techniques like computerized scanning of the containers are only available in ports with high-volume activities. This means that increased trade is more likely to improve trade facilitation just as it facilitation can lead to increased trade (Hummels & Skiba, 2004)[28]. However, larger trade volumes can also lead to less efficient trade infrastructure and increased congestion that results in higher estimated time and costs effects. In this regard, an example is the increase in trade volumes in China in 2003 that had resulted in an increase in waiting time by an average of about two days at the port city of Shanghai. A positive correctional between trade and delays can be found when Chinese trade data are taken between the period 2002 and 2003. Due to the delays, the Chinese government added 12 loading berths in 2004 that led to decreased export times. That is why scholars need to distinguish between causation and correlation. This will reduce the issue of endogeneity problem to the point where major variation in the trade facilitation originates from regional variation.

To evaluate the trade costs impact, Djankov et al. (2010) had assessed the data instrumenting for the required duration for export. They use a sample consisting of landlocked countries that used to estimate the time required to export goods from the border to the ships in the neighbouring countries, while excluding the possible domestic costs. The reasoning for this technique is that although trade volumes influence trade times, the trade volumes are not likely to have a strong impact on export times in international countries, particularly because landlocked countries are not large and then they contribute only with a small percentage of the trade in a particular port.

Another approach that can remove the possible endogeneity is using a difference-in-difference equation (Djankov et al., 2010). This technique investigates the interactive impact on time delays and time sensitivity on the flow of trade that controls for industry and fixed effects. The assumption is that long delays are an obstacle even more important for traders who export time-sensitive products. The strategy has been used by Romalis (2004), Cunat & Melitz (2007), and Levchenko (2007), who had investigated the impact on trade of labour flexibility, institutions, and endowments, respectively. The main benefit of this strategy is that it helps in assessing whether the increased cost of trade can reduce exports in time-sensitive areas, and vice versa. The problem identification may still exist if trade in a time-sensitive sector results in improved trade facilitation, even though the likelihood is less as the products represent a small percentage of the total trade.

For Djankov et al. (2010), every day of delay before a product is being shipped implies that trade is reduced by 1%. In other words, one day equals to a country that distance from its trade partners by about 1% or nearly 70 km. For instance, if Uganda is able to reduce the time to ship from the factory to the port by about 31 days, which was the sample median, it will result in an expected increase of about 31% that reduces the distance with the key trading partners by about 2200 km, about two-thirds the distance from Kampala (Uganda capital) to Cairo (Egypt capital).

[28] According to Hummels and Skiba (2004), trade volumes reduce shipping cost and affect the timing of adopting containerized shipping.

Table 3.1: Trading across borders in the MENA countries in 2020

Rank	Country	Trading across borders rank	Time to export: Border compliance (hours)	Cost to export: Border compliance (USD)	Time to export: Documentary compliance (hours)	Cost to export: Documentary compliance (USD)	Time to import: Border compliance (hours)	Cost to import: Border compliance (USD)	Time to import: Documentary compliance (hours)	Cost to import: Documentary compliance (USD)
1	Palestine	54	6	51	72	80	6	50	45	85
2	Morocco	58	6	156	26	67	57	228	26	116
3	Oman	64	28	279	7	107	39	244	7	124
4	Jordan	75	53	131	6	100	79	206	55	190
5	Bahrain	77	59	47	24	100	42	397	60	130
6	Saudi Arabia	86	37	319	11	73	72	464	32	267
7	Tunisia	90	12	375	3	200	80	596	27	144
8	UAE	92	27	462	5	140	54	553	12	283
9	Qatar	101	25	382	10	150	48	558	72	290
10	Libya	129	72	575	72	50	79	637	96	60
11	Mauritania	144	62	749	51	92	69	580	64	400
12	Djibouti	147	72	605	60	95	118	1055	50	100
13	Lebanon	153	96	480	48	100	180	790	72	135
14	Kuwait	162	84	665	72	227	72	634	96	332
15	Egypt	171	48	258	88	100	240	554	265	1000
16	Syria	178	84	1113	48	725	141	828	149	742
17	Iraq	181	85	1118	504	1800	131	644	176	500
18	Sudan	185	180	967	190	428	144	1093	132	420
19	Yemen	188	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

n.a. means not available data.

Source: Own elaboration based on the World Bank database (2020)

3.3.3. Private credit

The private credit development in different countries highlighted the key role played by the legal protection of the investor, credit offices and agents, and different institutions in providing support to the markets (Jappelli & Pagano, 2002; La Porta et al., 1997). While these studies underline a number of empirical regularities, the main issues include low sample size, insignificant results, and a few other econometric problems. Djankov, McLiesh, & Shleifer (2007) improve upon the empirical irregularities by expanding the number of data to credit firms in 129 countries for a period of 25 years. This expanded dataset represents an advance compared to existing work in five major directions. Firstly, a large dataset makes possible to investigate the judicial efficiency and effectiveness of different credit institutes in different countries. Secondly, a large sample size leads to increased country coverage, which causes more statistically reliable results regarding the role played by alternative credit institutions. Thirdly, the new data make possible to analyse the effects of reforms at the institutional level for financial development, while avoiding econometric issues related to the cross-section data. Fourthly, time series analysis can be carried out to assess the progress of credit institutions over a period of time in different countries. Finally, it allows a better analysis of the roles of culture and legal origins in influencing credit firms (Stulz & Williamson, 2003). In the MENA region, the depth of credit information index is 5.3[29], credit registry coverage related to the percentage of adults is 15.8%, and the credit bureau coverage is 16.3% of adults (World Bank, 2020).

The views regarding the amount of private credit that can be extended to a financial firm and individuals can be grouped into two categories. The first view considers that information is key for giving a loan. Lenders are less concerned about the lemons or financing non-practical projects when they have detailed information about the credit history and other borrowers information. This credit information theory was presented by Jaffe & Russell (1976) and Stiglitz & Weiss (1981). The second view is that the power of creditors depends on the viability of private credit. Lenders are more expected to extend credit, when they have greater power to force payments, access to collateral, or get control of the company. This power theory of credit has been pioneered by Townsend (1979), Hart & Moore (1994, 1998), and Aghion & Bolton (1992). Djankov et al. (2007) assess the importance of power and information theories in determining the difference in the private credit market size in different countries using data for 129 countries between the period 1979-2003.

To understand the power theories, the creditor rights index, which was first introduced by La Porta et al. (1997, 1998), is used. It assesses the legal rights of creditors in a country, especially in taking action against various defaulting debtors in many regions. It is considered as an effective measure of determining creditor power. For assessment of information theories,

[29] This index of the World Bank ranges from 1 to 8.

data on public and private credit registries[30] in many countries during the sample period were collected. The registries contain information on present credit of borrowers, past credits, and percentage of debts with different lenders. These are present in many countries and have been proved to affect the availability of credit (Pagano & Jappelli, 1993; Jappelli & Pagano, 2002; Sapienza, 2002; and Jappelli, Pagano & Bianco, 2005).

Cross-country regression analysis performed by Djankov et al. (2007) highlighted the ratio of private credit to GDP in the context of creditors rights and availability of registries. This research had made use of time series analysis. These researchers had carried out the study in two phases. During the first phase of the study, the stability of the credit institutions was analysed over a period of time, and the extent of convergence (or divergence) in different countries. Their study specifically tested the proposed hypothesis about countries with laws that emerged from different traditions, which tend to demonstrate convergence in the scores of creditor rights. Furthermore, assessing the changes in the rights of creditors or the institutions of information can help assess the effect of the reforms on the private credit. The differences-in-differences technique helps addressing the concern of credit firms by assuming they are local and represent an alternative to the changing approaches that are generally criticized (Glaeser et al., 2004).

Information and credit power theories with both interim and ex-ante improved information and ex-post enhanced creditor rights can lead to the development of the credit market. According to Jappelli & Pagano (2002), the information and credit institutions may be considered substitutes with some nations having more developed information institutes, while others have more creditor power due to legislations. Their study investigates in detail the substitution hypothesis. In general, underdeveloped countries have legal systems that are functioning poorly that may lead to an ineffective lending channel based on ex-post rights of the creditor. Moreover, the power may be dependent on the sharing of information for an effective functioning of the credit markets. In contrast, the more developed countries might have a functional bankruptcy system resulting in enhanced creditor power. The countries have different strategies for businesses social control depending on the specific legal norms. In other words, common law countries generally depend on private contracting. These predictions can be better evaluated in the credit markets since the credit market theories consider the rights of the creditor and the implementation through the order of the courts. In contrast, information theories generally deal with regulatory disclosure of information and government-owned firms for information sharing.

A significant legal origin effect was noted by Djankov et al. (2007) in credit market institutions, whereby French civil law countries have lower creditor rights scores than common law countries. However, the former was found to have greater public credit registries in comparison with the latter. The same work had also noticed insignificant convergence in scores of creditor rights or in information entities among legal sources. The dissimilarity had been observed in the measure of legal institutions for the past 25 years. In addition, Djankov et al. (2007) had noticed that the scores of creditor rights, as well as the incidence of private registers, were better in the developed countries than in less developed countries. Better creditor rights,

[30] Credit registries are a typical response to information asymmetry problems between lenders and borrowers. A credit registry is either a publicly or privately owned entity that consolidates information on borrowers from lenders. According to the World Bank, a credit registry is one of the two main types of credit reporting institutions. In general, credit registries are developed to support the state role as a supervisor of financial institutions. Where credit registries exist, loans above a certain amount must, by law, be registered in the national credit registry. In some cases, credit registries have relatively high thresholds for loans that are included in their databases. Credit registries tend to monitor loans made by regulated financial institutions.

as well as the existence of credit registries, were linked with higher private credit to GDP ratio in the cross-section data of nations. According to Djankov et al. (2007), the ration private credit to GDP increases after improvements were noticed in the rights of creditors or new credit registries were introduced. The cross-sectional validation through analysis of legislative reforms represents an important innovation in the study. Another important point highlighted by this study is the great importance of creditor rights for private credit in developed nations, while credit registries were more important in underdeveloped nations. Earlier studies were improved and enhanced with these findings that highlighted the critical role of credit registries, particularly in underdeveloped nations with French common law that shows the effectiveness of an appropriate intervention of the states.

3.3.5. Protecting minority investors

The corporate governance practical and academic approaches have increasingly highlighted the issue of expropriation of investor since the past two decades. This concept, which is also known as tunnelling or self-dealing, refers to the use of power by controlling shareholders and managers to divert the wealth of the corporation for personal gain instead of sharing with investors. Different forms of self-dealing have been underlined, such as high compensation, executive privileges, transfer pricing, misappropriation of corporate opportunities, and financial transactions for personal benefit, like personal loans to insiders, directed equity, and even theft of corporate capital (Shleifer & Vishny, 1997). Self-dealing practices has been highlighted in both empirical and theoretical works. Previous research studies regarding corporate governance have shed light on issues, such as managerial effort (Holmstorm, 1979), consumption of prerequisites by managers (Jensen & Meckling, 1976), and overinvestment and managerial effort for gain (Baumol, 1959; Jensen, 1986). The modern theory of corporate finance underlines the corporate insider ability to use corporate wealth for personal gain that is named as private benefits of control (Grossman & Hart, 1988; Zingales, 1994; Hart, 1995). These misappropriations of corporate funds to the controllers have been empirically studied in different contexts, particularly in the case of the US savings and loan crises in the 80s and 90s (Akerlof & Romer, 1993), the Asian and Mexican financial crises (Johnson et al., 2000; La Porta, Lopez-de-Silanes, & Zamarripa, 2003) and the corporate governance in countries where there was a transition from socialism (Glaeser, Johnson, & Shleifer, 2001). The conversion has been analysed by finding out the personal benefits of control due to voting power and even the treatment of majority shareholders in the case of takeovers (Nenova, 2003; Dyck & Zingales, 2004).

Studies by scholars such as Clark (1986) have influenced economists by underlining the key role of the legislative body in controlling corporate self-dealing. Empirical and theoretical research on this subject shows differences in protection of investor rights among countries. It impacts the insiders ability to exploit outsiders and determine investors confidence in the markets, and subsequently, the market development (La Porta et al., 1997, 1998; Shleifer & Vishny, 1997; Shleifer & Wolfenzon, 2002). An important issue concerns the role of the legislation in preventing the shady practice of corporate self-dealing. One way to deal with this issue is to ignore it and to rely on the forces in the market to address this issue. This approach is not taken in any society since the temptation to exploit the wealth in the unregulated market is great. Another view is that society can prevent shady corporate practices by banning all dealing between controllers and the corporation. However, this extreme approach is also not taken by society since the related-party transactions in most situations are economically beneficial. The question regarding what countries actually do to tackle the problem of funds

misappropriation has been addressed empirically by Djankov, La Porta et al. (2008). They explain the situation when an owner of two companies uses these companies for fictional self-dealing through transactions between them, which results in individual benefit. Their paper had surveyed attorneys associated with the international Lex Mundi law companies in 102 countries to find out how the countries legal systems affect the transactions. Their research also developed numerical measures to ascertain the intensity of laws dealing with self-dealings related to multiple dimensions in both the private and public sectors in 72 countries. The rules structure regarding self-dealing was determined on the basis of assessing factors in different countries. The literature review demonstrated that the legal source of the countries (German, French, Scandinavian or common law) determines the strategy for protecting the rights of minority shareholders, creditors using the bankruptcy and other corporate laws, as well as the regulation of the issuance of security through pertinent laws (Djankov et al., 2007; La Porta et al., 1997, 1998).

According to the World Bank data and the ranking index, which ranges from 1 to 10 points, the extent of disclosure index in the MENA region is 6.4, the extent of director liability index is 4.8, the ease of shareholder suits index is 4.7, the extent of shareholder rights index is 3.2, the extent of ownership and control index is 3.6, and the extent of corporate transparency index is 3.5 (World Bank, 2020). Table 3.2 shows protecting minority investors ranking and scores in different MENA countries based on the World Bank database and analysis of several measures, including the strength of minority investor protection, the extent of disclosure, and the extent of shareholder rights index, among other elements. It can be observed that Saudi Arabia is the first MENA country in the ranking with the third position worldwide, followed by United Arab Emirates in the position 13, then Morocco in the position 37. Yemen, Algeria, and Libya are in the last three positions in the MENA region (162, 179 and 183, respectively).

3.3.6. Enforcing contracts

Different institutions serve to ensure the protection of assets and also enforcement of the contractors in the MENA region. The average time to enforce contracts is 622 days, the cost of the claim is 24.7% of the total claim value, while the quality of the judicial process according to the World Bank index (from 1 to 18) is 6.6 (World Bank, 2020).

One of the main economic propositions states that the protection of property, as well as the execution of contractor, is important for trade, investment, and overall economic growth of nations (Montesquieu, 1984; Smith, 1976). On the one hand, the majority of the institutions that focus on the protection of investor assets and execution of contracts are government bodies, such as courts and regulators. On the other hand, some institutions that focus on the protection of investor rights are private that include informal discussions and reputations of the party and do not depend on government protection (Macaulay, 1963; Galanter, 1981; Ellickson, 1994). The government regulatory bodies put a restriction on the private conduct that might negatively affect the investors, and the disputes regarding property and contract issues are settled in courts.

Table 3.2: Protecting minority investors in MENA countries in 2020

Rank	Country	Protecting Minority Investors rank	Protecting Minority Investors score	Strength of minority investor protection index (0-50)	Extent of disclosure index (0-10)	Extent of director liability index (0-10)	Ease of shareholder suits index (0-10)	Extent of shareholder rights index (0-6)	Extent of ownership and control index (0-7)	Extent of corporate transparency index (0-7)
1	Saudi Arabia	3	86.0	43	9.0	9.0	7.0	5.0	6.0	7.0
2	UAE	13	80.0	40	10.0	10.0	4.0	4.0	7.0	5.0
3	Morocco	37	70.0	35	9.0	2.0	7.0	6.0	5.0	6.0
4	Bahrain	51	66.0	33	8.0	4.0	5.0	5.0	7.0	4.0
5	Kuwait	51	66.0	33	5.0	9.0	4.0	2.0	6.0	7.0
6	Egypt	57	64.0	32	8.0	3.0	3.0	6.0	6.0	6.0
7	Tunisia	61	62.0	31	6.0	7.0	5.0	4.0	4.0	5.0
8	Oman	88	56.0	28	8.0	5.0	3.0	4.0	5.0	3.0
9	Syria	97	54.0	27	7.0	5.0	3.0	3.0	5.0	4.0
10	Djibouti	103	52.0	26	8.0	8.0	10.0	0.0	0.0	0.0
11	Jordan	105	50.0	25	4.0	4.0	3.0	2.0	6.0	6.0
12	Iraq	111	46.0	23	4.0	5.0	5.0	5.0	3.0	1.0
13	Lebanon	114	44.0	22	9.0	1.0	5.0	3.0	1.0	3.0
14	Palestine	114	44.0	22	6.0	5.0	6.0	2.0	1.0	2.0
15	Sudan	153	30.0	15	3.0	1.0	6.0	2.0	2.0	1.0
16	Qatar	157	28.0	14	2.0	2.0	2.0	3.0	2.0	3.0
17	Yemen	162	26.0	13	6.0	4.0	3.0	0.0	0.0	0.0
18	Algeria	179	20.0	10	4.0	1.0	5.0	0.0	0.0	0.0
19	Libya	183	18.0	9	4.0	1.0	4.0	0.0	0.0	0.0

Source: Own elaboration based on the World Bank database (2020)

The exact mechanisms of protection of property and execution of contract terms are not explained by economic theorems. The reality is that the mechanisms of action are not perfect and involve significant irregularities. Private enforcement and security often tend to turn violent. However, they tend to be efficient in some environments. In fact, according to Smith (1976), a reasonable and fair administration of justice is considered as one of the few government functions that is working properly allowing an individual to seek compensation from the more powerful richer segment of the society, who have control over enforcement of privacy protection measures (Hay & Shleifer, 1998). In addition, public regulations are sometimes effective (Glaeser et al., 2001; Glaeser & Shleifer, 2001, 2003). However, they are often captured and corrupted by guilty parties, such as pollutants and monopolists, that need to be restricted (Stigler, 1971). Most economists have been optimistic about the judiciary, as the instruction that upholds contract terms and protects private property (Coase, 1960). Apart from some economists such as Jappelli et al. (2005) or Johnson, McMillan, & Woodruff (2002), most of them have not focused on determining the limitations.

Assessing different institutional arrangements is important for understanding the main elements that impact the effective functioning of the courts. A research work by Djankov, La Porta et al. (2003) contains an empirical study regarding the court effectiveness in addressing simple problems in 109 nations. This study investigates the process through which a plaintiff can use the court to force a tenant, who did not pay rent and to collect a return check. It also highlights that even small issues can take time to get resolved through courts; thus, the majority of countries have an average of about 200 days. Moreover, a large variation has been found in countries regarding the expedition of court matters. An attempt has been made to explain the variation through three different theories. Firstly, according to the incentive theory, the efficiency in court activities depends on the incentives of the participating parties in resolving the dispute that includes the lawyers, judges, and the defendant (Buscaglia & Dakolias, 1999; Messick, 1999). This theory considers courts as being inefficient when the parties do not have a strong incentive. The judges may be apathetic to the outcome, legal processionals may be paid more when a case is prolonged, and the defendant wants to avoid a judgment. The implication of the incentive theory is that court performance can be improved through setting important deadlines for judges, paying contingency fees to lawyers, and lower pay rules for defendants in case of a delay in judgment. Secondly, for the development theory, courts similar to many other institutions work more efficiently in developed countries with an educated population (Demsetz, 1967; North, 1982). This theory holds that the fixed costs exist for establishing the institutions that become socially worth to be established and paid where the demand for these institutions are high mainly due to the enhanced level of the economy. Based on this theory, underdeveloped societies tend to rely on informal sources for dispute resolution. However, more developed nations depend on courts and complex contracts to address issues. In addition, a better educated population leads to increased court efficiency and the demand for issue resolutions. The third important theory that is more recent and significant is that courts performance depends on how the operations are regulated, which is known as procedural formalism. The theoretical model regarding the ideal court shows that any dispute between two parties can be addressed through a third party based on fairness and justice with some use, knowledge of the legislation, experience, attorneys, formal submissions, and other procedural constraints regarding the presentation of witnesses, evidence, and arguments with no appeal (Shapiro, 1981). However, most legal systems generally regulate the process of resolution of disputes as well as the presentation and collection of the evidence with an insistence of legal basis of claims and decisions of the judges with a focus on written submissions. The question arises whether the formal court rules affect the quality of dispute resolution. The dispute

resolution process is handled by legal professionals, including judges and lawyers. The system clarifies the methods that should be followed to resolve the disputes and the process of gathering and presenting the evidence. Moreover, the system relies on legal justifications for the claims decisions of the judge and gives preference to written submission. However, once more, the question is whether the existing system results in an effective dispute resolution. These theories have been investigated in cooperation with the internationally renowned law firm Lex Mundi. The exact process used in different countries to resolve disputes is described next. These cases are related to the default in rent payments by a tenant of a residential property resulting in eviction and collection of check returned due to non-payment. The dispute was explained to the law firm in detail and information was requested regarding the detailed legal process for dispute resolution and the relevant laws in each country. The responses were used to construct the degree of formalism, which can be defined as the extent of deviation from the neighbour model due to regulations.

Several studies regarding the comparative history of laws and regulations underline the systematic variation of formalism based on legal origins (Berman, 1985; Damaska, 1991; Merryman, 1985; Schlesinger et al., 1988). Data provide empirical evidence of greater regulation of dispute regulation process, including actions of the lawyers and judges in countries using civil law in comparison with common law countries. This factor explains nearly 40% of changes in formalism in different countries. In addition, the dispute resolution process is less formalized in rich countries than in less developed countries (Djankov, La Porta et al., 2003). To confirm the three hypotheses raised by Djankov, La Porta et al. (2003) regarding the factors of judicial quality, estimates were taken from the law firms that have participated in the study regarding the duration in days of dispute resolution from the complaint filing to the ultimate resolution through the implementation of the judgment. The quality of judicial decision was assessed through different data sources that cover areas, such as access to justice, contract enforceability, corrupt practices, incentive measures for attorneys, judges, and litigants; as well as World Business Environment Survey data of small enterprise regarding some elements of legal system, like consistency, honesty, fairness, among others. Moreover, data have been collected regarding the educational level and per capita income in different countries. These data show that greater formalism of dispute resolution process indicates longer duration of resolution of disputes. The higher level of formalism is also associated with higher corruption, weak contract enforceability, and less fairness of the system. The results for dispute regulations for check collection and eviction are found to be valid both in terms of instrumental variable estimates with the legal origin as a measure of formalism, and ordinary least regressions. In addition, empirical evidence verifies development hypothesis that rich nations have a better-quality judicial system for dispute resolution. However, data analysis does not show any evidence of incentives offered to participants of the legal system influencing the quality of the judicial dispute resolution process.

Concerning the theories of procedural formalism, the ideal universal court is characterized by dispute reputation of two parties by a third-party guided by the respective custom and common sense (Shapiro, 1981). The idealized court does not depend on formal regulations and does not limit the processes employed by the parties to resolve the dispute. However, the dispute resolution system deviates from this norm in most countries. The dispute is generally resolved by professional lawyers and judges, and the processes are structured to restrict the presentation of claims and counterclaims, interpretation of evidence, and communication of different parties.

Courts in many countries focus on written records of the judicial proceedings and allowing the appeal of the judge decisions instead of holding an informal meeting to resolve the disputes. In other words, the dispute resolution processes are heavily regulated in most countries. The reason for regulation of the dispute resolution process is similar to that for regulating other issues, i.e. greater control of the sovereign over the outcome. The sovereign may want to punish the guilty party to a greater extent compared to a third party, to reduce mistakes in relation to informal decisions, and to create precedents for the case. The sovereign may also want the dispute to be addressed to gain political favour or in some cases to punish the opposing party members and enemies. Another reason for the sovereign to heavily regulate the dispute resolution process is to promote political and trade uniformity. As a result, the sovereign may regulate the justice system; therefore, that legal representatives are nothing more than passive beings who utter the laws, but are powerless in moderating the rigor or force of the judiciary (Montesquieu, 1984). Another reason for the regulation of the dispute resolution process is the vulnerability of the informal triad justice to undermining the authority or power by the elites. The party disputant, who is politically and economically more powerful, will be able to influence the decision of the courts through threats or bribes. The opposing aspect of this subject is access to justice by the less privileged segments of the society instead of subjugation of the powerful elites or the state. According to the German jurist Rudolf von Jhering, “form is the sworn enemy of arbitrary rule, the twin sister of liberty” (Djankov, La Porta et al., 2003, p. 7). That is why in most countries around the world, legal procedures are heavily formalized. In addition, the patterns of the formalized regulations as indicated by historians are linked with the laws origin, i.e. common or civil laws that have English and Roman origin, respectively and transferred to other countries through colonization and conquest by colonial powers, including England, France, Spain, and Germany. While the legal systems in many countries have developed over the years, the main features of the original civil and common laws are preserved over the years (La Porta et al., 1998, 1999). Different theories explain the process of influencing the legal procedures through legal origins and formalization of the processes.

The differences in civil and common laws can be attributed to the French Revolution and Enlightenment, according to Hayek (1960) and Merryman (1985). In the countries using civil law, the procedures are essentially comprehensive statements of the judicial authorities, remedies and procedural organs, according to Schlesinger et al. (1988). The formalism of judicial processes in accordance with the Jehring logic was considered as an assurance of freedom. In contrast, in the US and England, the legal professionals were trusted by the revolutionaries, due to which the political procedures were afforded relatively greater degree of independence. According to Schlesinger et al. (1988), judicial law is considered to complement the unwritten law in the traditions of common law, and when interpreting its provisions and filling its loopholes, resort to common law had to be made.

The differences in judicial procedures in countries with civil or common law can be traced back to the 1100s and 1200s, according to Dawson (1960), Berman (1985), Damaska (1991), and Glaeser & Shleifer (2002). According to Glaeser & Shleifer (2002), a greater extent of formalism can be attributed to the prevent coercion of law enforcement agents by the disputants through bribery or violence. The risk of judicial coercion was greater in France in comparison with England, where disputes were resolved by juries that represents greater conformity to the Shapiro ideal. In other words, the legal processes for resolving disputes were influenced by the law and order situation in France and England and the respective laws were transferred to other countries through colonization and conquests (Watson, 1974; La Porta et al., 1998; Berkowitz et al., 2003). In the majority of the countries, significant parts of the legal processes were

inherited in most cases involuntarily. The nature of the transfer of laws allows us to differentiate two hypotheses at the substantive level. In countries where the legal processes have been formed voluntarily, it can be argued that the greater emphasis on form over content leads to the formalism, which represents an inefficient evolution from immature law and order situation. However, in the case that legal processes are transferred through colonization, the adaptation model is not applicable, and the consequences of the legal formalism can be attributed to the exogenously identified characteristics of the legal processes.

3.3.7. Resolving insolvency and debt enforcement

One of the most relevant contracts in most economics is debt, because it allows institutions to finance their investment and individuals to consume products. However, debts have to be enforced through a contract that depends on different legal institutions and processes, giving power to creditors to go after the defaulter assets and income without showing any offence. Some processes of debt enforcements like foreclosure require no judicial intervention. However, most countries rely on courts for enforcement of contractual obligations in case of a firm or individual has multiple lenders mostly through insolvency or bankruptcy processes.

Djankov, Hart et al. (2008) investigated the enforcement of debt provisions regarding insolvent companies in 88 nations and presented the data regarding practitioners of insolvency in different countries using a case study similar to an insolvent firm. The International Bar Association Committee on Bankruptcy had developed the case that represented the insolvency of mid-sized firms in different countries. The firm analysed in this study, which works in the hospitality industry with a specific number of employees, structure of ownership and capital, reduced value when sold gradual and valued as a continuous facility. The firms are generally similar in different countries with the exception that the economic values have been normalized according to the income per capita of a country.

The data regarding cost, time, and potential characteristics of the assets concerning gradual sale compared to maintaining the status quo as a continuous facility were used to develop the measurement of the efficiency of the process of debt contract enforcement in different countries. Moreover, different attributes of the debt enforcement processes were identified, including the appeals structure and the floating charge availability that directly influence the efficiency. The determinant of the efficiency of debt enforcement is related to the legal origin and income per capita, and it also predicts the development of the debt market in different countries. The efficiency measure is also related to the measures of the contract enforcement quality and the public regulation shown in different studies.

Concerning the MENA region, the recovery rate is 27.3 cents on the dollar, the time in years is 2.7, the cost is 14.0% of the estate, and the strength of insolvency framework is 6.3, according to the World Bank index (from 1 to 16) (World Bank, 2020). Table 3.3 about resolving insolvency in the MENA countries shows the ranking of each country according to the World Bank database. In 2020 statistics, it should be noted that Djibouti ranked first with a worldwide position of 44 and score of 65.9; followed by Bahrain with a position of 60 and score of 58.2; then Tunisia with a position of 69 and score of 54.2. Besides, it can be observed that

11 MENA countries are ranked after 100, such as Egypt, with 104 position and a score of 42.2; or Qatar, with 123 position and score of 38, while Iraq, Libya, Saud Arabia and Palestine took the last four positions due to the non-availability of the data.

The enforcement of the debt contract can be compared to the same business section in different nations, which has several advantages. The first advantage is that it allows investigating the effectiveness of the processes and the determinants. Another advantage of comparing the performance of debt enforcement in different countries is that it results in determining quantitative measurements that are less vulnerable to criticisms. Moreover, the comparison of measures of enforcing laws in different countries can help in a comparative analysis (Djankov et al., 2008). The insolvency process can be addressed through three simple procedures, which are liquidation, reorganization, and foreclosure with or without court direction (Baird, 1986; White, 1989; Thorburn, 2000; Baird & Rasmussen, 2002; LoPucki & Doherty, 2004; and Bris et al., 2006). The liquidation process can lead to subsequent liquidation that can also be called as reorganization. The process of foreclosure is an important standard since it can theoretically result in an efficient outcome as a socially correct inducement for a single senior creditor. However, the current worldwide averages show the procedure is inefficient, since it involves a lot of time and cost. The efficient outcome of a continuous facility or the firm was achieved in only 36% of the countries. On average, about 48% of the value of the firms is lost in enforcing the debt, due to the cost of delays in judicial proceedings, enforcement of debt, and the loss due to the wrong outcome. Furthermore, per capita income and origins of law are important factors to determine the efficiency of the judicial procedures. Developed countries have an advantage compared to countries regarding enforcement of complex procedure (Djankov, Glaeser et al., 2003; Franks & Loranth, 2005; Gennaioli & Rossi, 2008; Djankov et al., 2008; Ayotte & Yun, 2009). According to Djankov et al. (2008), the different legal and economic rules are found to have different levels of efficiency of the enforcement of debts in different regions. In most nations, legal rules give authority for deviating from the main priority of senior secured creditor. These deviations are more noticeable in the poorest regions and countries with French legal origins. The ex-ante efficiency measured by analysing the collection of debt by a senior creditor is the main indicator of debt enforcement as compared to ex-post efficiency. This makes these findings on the legal origin and the income per capita more valid. Moreover, the process of foreclosure is most suitable for debt recovery, when the entire business is pledged by the debtor as collateral, but not suitable when only certain assets are pledged. This is in line with the common view that socially the senior creditor has the ideal incentives to end the business providing that defaulting on the loan will result in greater control. As a result, the foreclosure efficiency increases when collateral is offered to the senior creditor out of the court (Franks & Sussman, 2005)[31]. The efficiency of the legal process significantly reduces when the legal rules require the firm to wind down operations or give authority to the customers and suppliers to end contracts during the bankruptcy process. Moreover, the efficiency is reduced due to the failure to carry on the proceeding and the time-intensive appeal process against the decisions of the court regarding the insolvency. To improve efficiency, newer measures should be in place that can be statistically and economically significant predictor regarding the debt market development in different industries, according to Djankov et al. (2008).

[31] Franks and Sussman (2005) provided evidence regarding the effectiveness of floating charge debt in the case of foreclosure of businesses in the UK.

Table 3.3: Resolving insolvency in the MENA countries in 2020

Rank	Location	Resolving Insolvency rank	Resolving Insolvency score	Recovery rate (cents on the dollar)	Time (years)	Cost (% of estate)	Strength of insolvency framework index (0-16)
1	Djibouti	44	65.9	44.0	1.5	11.0	13.5
2	Bahrain	60	58.2	41.3	2.5	9.5	11.5
3	Tunisia	69	54.2	51.3	1.3	7.0	8.5
4	Morocco	73	52.9	28.7	3.5	18.0	12.0
5	UAE	80	49.3	27.7	3.2	20.0	11.0
6	Algeria	81	49.2	50.8	1.3	7.0	7.0
7	Oman	97	44.0	41.1	3.0	7.0	7.0
8	Egypt	104	42.2	23.3	2.5	22.0	9.5
9	Jordan	112	39.7	27.3	3.0	20.0	8.0
10	Kuwait	115	39.2	32.2	4.2	10.0	7.0
11	Qatar	123	38.0	30.0	2.8	22.0	7.0
12	Lebanon	151	29.1	30.8	3.0	15.0	4.0
13	Sudan	152	28.8	30.2	2.0	20.0	4.0
14	Syria	158	27.0	21.1	4.1	16.0	5.0
15	Yemen	159	26.9	21.0	3.0	15.0	5.0
16	Iraq	168	0.0	n.a.	n.a.	n.a.	n.a.
17	Libya	168	0.0	n.a.	n.a.	n.a.	n.a.
18	Saudi Arabia	168	0.0	n.a.	n.a.	n.a.	n.a.
19	Palestine	168	0.0	n.a.	n.a.	n.a.	n.a.

Source: Own elaboration based on the World Bank database (2020)

3.4. REGULATORY FRAMEWORK RISKS

Regulatory policy refers to the process of creating, modifying, implementing, and executing regulations. Economic performance is improved by regulations that promote innovation, dynamism, and competitiveness. The main goal of the reform in regulations is to boost the effectiveness and efficiency and create an improved balance in carrying out economic and social policy over time. Effective regulations that promote greater integrity, transparency, quality regulation, and openness improve investment attractiveness and cut down the cost of business operations.

The investment and business environment are greatly influenced by the quality of laws. Regulations that are inefficient or not properly enforced can result in decreasing business activities, diverting capital to non-productive activities, increasing unemployment, reducing new market entrants, and putting a damper on entrepreneurial activities. The predictability of rules helps achieve business goals and increases investor confidence. Moreover, investor confidence is influenced by the quality of public services that depend on government regulations for public and private sector providers. From an investor perspective, regulatory policies should help guide officials and serve as a standard for action that determines the expectations of investors from the government concerning regulations.

The importance of an efficient regulatory framework and supporting institutions increases given that the markets become more connected and open. However, the challenges for regulators will increase with the development of the markets. The main characteristics of regulatory quality according to investors include clear frameworks and objectives that can help in the enforcement of laws; therefore, when the regulations are implementing the costs are justified by the social, environmental, and economic benefits. Moreover, the regulatory quality is expected by investors to result in increased distributional effects and maximized net benefits. The regulatory policy should establish rules that guide and serve as a standard action for officials and clearly defines expectations of investors from the government. The regulations in the past have generally been driven sectorally and are poorly coordinated across public departments that result in a complex regulatory landscape. A more thorough approach that is generally managed by the central government helps in reducing the chances of duplication or creation of contradictory regulations. Furthermore, a thorough approach can clarify the role of regulations regarding different aspects of policy with more defined goals, such as reduced red tape or increased competition. The OECD *Recommendation of the Council on Regulatory Policy and Governance* (2012) offers a comprehensive framework for identifying an integrated government policy regulation (OECD, 2012).

3.4.1. Regulatory impact assessments

The aim of regulatory impact assessment (RIA) is to measure and investigate the potential costs, benefits, and impacts of the new or updated regulations. The RIA will provide decision-makers with more qualitative data and a framework to determine the options and the potential social, environmental, and economic consequences of the decisions. However, the regulatory efforts can be undermined due to a poor understanding of the pertinent issues or the effect of actions of the government that can undermine efforts to make regulations and result in unintentional outcomes and failures. The main benefit of RIA is to identify the issues for which government intervention are required and to ensure that actions that are appropriate and justified

in terms of social, economic, and environmental outcomes. This process serves as a systematic method for investigating the effects of the regulations, assisting in making informed regulatory decisions, helping in determining the effects of regulation on investors, and avoiding regulations that hinder business activities. The 2008 OECD *Introductory Handbook for Undertaking Regulatory Impact Analysis* details the main steps that are involved in designing regulations using the RIA-based approach (OECD, 2008). RIA should be made available, including relevant regulatory proposals to gain and maintain public trust and providing better quality services to the public using minimum resources. Using RIA should be considered a good practice during the consultation process.

3.4.2. Regulatory compliance and enforcement

The institutions and mechanisms should be in place for enforcement of regulations and promotion of compliance. Inconsistent and inadequate enforcement of laws tends to weaken the predictability of the regulations and framework for investors. The regulations need to be enforced equally for all the economic parties. However, governments have not focused on the possibilities of improving the implementation of the laws. The proper implementation is necessary for an efficient regulation. The implementation of regulations also requires proper inspections to ensure compliance with the regulatory procedures. Quality inspection planning, communication, and targeting are crucial to be integrated with the regulatory governance system in order to prevent corruption and promote ethical actions. A framework for supporting initiatives for improving the enforcement of regulations has been introduced in the 2014 OECD *Best Practice Principles for Regulatory Policy: Regulatory Enforcement and Inspections* through inspections that will make the process more efficient and effective and less costly for the government and less burdensome for the parties who are inspected. The mentioned OECD best practise principles focus on addressing the creation of policies, tools, and institutions for promoting compliance and reforming the inspection services for achieving the desired outcome (OECD, 2014b).

3.4.3. Governance and institutional structure

The role of independent regulators is important for achieving societal and economic aims and regulating complex situations in different sectors. The activity of the regulators has an important impact on the regulation of the sectors and results in increased capital investment, the flow of revenues, and expected investment returns. Regulatory agencies have a crucial role in connecting with the citizens, investors, and the business community when making regulatory decisions. The government needs to create a consistent set of policies regarding the functions and roles of regulators, and also a mechanism for coordination of activities with the relevant bodies. This contributes to creating greater confidence that the regulations are created on an impartial, objective, solid, coherent and coordinated basis with no conflict of interest, improper influence, or bias. The regulatory bodies need to work jointly with the stakeholders in order to ensure effective market development, while acting as an impartial judge in handling disputes among the market members and at the same time acting in the best interest of the consumers. This requires a system for assessing the procedural justice and legality of regulations and the actions carried out by the agencies that have the power to issue regulations for the purpose of promoting trust and transparency. This system needs to be accessible and affordable for the business and the citizens. The OECD *Best Practice Principles for the Governance of Regulators*

can serve as a guide to help regulatory agencies in creating the framework for achieving these aims (OECD, 2014a).

3.4.4. Regulatory coherence

Nowadays, investors have a great opportunity due to increasing globalization, which is made clear by the increase in foreign direct investment and activities of multinational organizations. At the same time, there are different country-specific rules and norms applicable in different countries. The specific norms and regulations may meet specific preferences. However, the deviations result in unnecessary increased burden for businesses. There is a greater need for increased government coherence across different government levels, as well as at the international level for multinational businesses. The regulatory coherence can be achieved through a coordination mechanism among the national, supranational, and sub-national government levels. High-quality regulations at one government level will be of no benefit in the case of low-quality regulations in the lower government level. The government has to promote the regulations across borders to reduce systematic risks and prevent divergences in regulations that result in increased burden for the investors, and address challenges regarding health, ecology, and safety. The OECD has introduced a typology of global regulatory coordination method that will guide nations on how to achieve increased uniformity in international and local laws and standards (OECD, 2013a).

3.4.5. Open governance

The shift towards open governments serves as important incentives for the government to enhance performance. Corporate actors, enterprises and citizens are able to assess and evaluate the outcomes of government policy, criticize poor performance, and suggest improvements. An increased public awareness about quality government regulations has become an important power for modernization and reform in the public sector. The engagement of the citizens has moved beyond the simple delivery of services and consultations to enhance monitoring and joint enforcement. Nowadays, governments can create a diverse ecosystem using online platforms as well as information and data management tools for better engagement with the public in implementing policies and evaluating outcomes. The open and inclusive policy making can help enhance the performance of the policy allowing governments to gain a better understanding of the evolving requirements of the public and leverage the ideas, information and resources of the business community.

The OECD principles on digital governance, presented in the OECD Governance: Digital-Government Toolkit website acknowledge the role of technology in supporting the creation of more effective policies and the development of transparent, open, participatory, innovative, and reliable regulation. However, actually, most governments do not still consider the technology as an effective tool to collaborate and influence outcomes of public governance. The main focus of the principles is to create a substantial shift from the government approaches that are citizen-centric with the government anticipating expectations of the businesses and citizens to a more citizen-driven method, where businesses and citizens participate in the process of regulation formulations by the governments. Nevertheless, implementing this theoretical paradigm is difficult. The governments have to invest for creating an inclusive and open policy as an important part of the core business, to create a supportive administrative and political environment, and to promote

required skills among the citizens. Assessing the quality of an inclusive and open policy-making process and the impact is a new challenge for most governments. This is why the latest *OECD Guiding Principles for Open and Inclusive Policy Making* contains ten recommendations for supporting the actions of governments (OECD, 2010). These include public participation, consultation, and rights to information regarding policy development and delivery of service that should be firmly grounded in the regulations. Moreover, the responsibility of the government in responding to the citizens should also be clearly defined. The implementation of these rights requires independent supervisory arrangements. Furthermore, effective public participation, information, and consultation require adequate human, financial, and technical participation. Government officials need to have appropriate training, guidance, skills, and proper governance structure to support online and traditional tools. The standards serve as a straightforward framework for nations to evaluate their efforts and become more transparent and open towards investment.

3.4.6. Support mechanisms for the renewable energy sector in the Middle East and North Africa region

Renewable power energy policies and goals have been set in 109 countries around the world by 2011. Nearly half of these countries were developing countries. The support of the government for renewable energy can be in many different forms. In most countries, government agencies support renewable energy projects by providing incentives that help in reducing the cost of the project. The incentives that help support the renewable energy sector include grants, subsidies, and premiums for reducing the costs of installation, investment, and expenses incurred by the private sector. Government authorities also provide financial support to promote renewable energy power generation. The support is generally in the form of tax exemptions and reductions. However, the effectiveness of incentives depends on a thorough understanding of the profitability factors in the renewable energy sector business plan, as well as a thorough evaluation of the weaknesses and strengths of the investment climate.

The transaction costs of government incentives are significantly increased due to individual customization. Moreover, the direct incentives can result in an opposite effect, since the original targets may not be the main beneficiaries and the other stakeholders in the business value chain might be more important. For example, in a market with a few firms, financial support for renewable energy development can, in fact, lead to increase the price due to increased demand and purchasing power. In this case, the main beneficiary will be the supplier whose profit will increase, while the investor will have a small benefit due to the fiscal incentives. That is why the government needs to be careful when creating a support mechanism and ensure that the financial incentive does not result in an increase in the price resulting in wasted public resources.

The government should offer incentives that make renewable energy investment more profitable and attractive to the investment throughout the life cycle of the project instead of reducing the cost of investment. There are three approaches that can make renewable energy investment more attractive (OECD, 2013b). The first approach includes using quantity-driven incentives or market delivering policies that require market participants to produce a specific quantity of power derived from renewable energy at unspecified prices that allow renewable energy to be sold at an acceptable profit. The second approach includes using price-driven incentives that involve offering higher tariff for renewable electricity to support profitability.

The profit-driven and quantity-driven strategies serve as a transitional tool that can help support multiple phases of renewable energy development projects. They are short-term incentives that can help ensure private investors remain cost-competitive and develop advanced renewable energy technologies until they are able to function without the need for government subsidies. The third strategy involves a long-term approach to address and eliminate the risks related to renewable energy investment through financial support. The risks can be reduced by offering loan guarantees or soft loans as financial incentives can assist renewable energy projects in reducing the risk and help in making the projects attractive for private investors. Most financial incentives have an automatic impact on the risks associated with renewable energy projects. For example, a power purchase agreement can play a key role in reducing the risk associated with an investment in renewable energy projects by offering a guarantee to private investors that the government will purchase excess energy produced during the period of feed-in tariffs that will help in reducing the market risks (Kilinc-Ata, 2016).

3.4.6.1. Price-driven incentives: Offering higher tariffs

Price-driven incentives involve fixing the prices, but not putting any limit on the quantity of energy production. This approach is considered less market-driven compared to the quantity-driven approach.

3.4.6.1.1. Feed-in Tariffs (FiT)

The main support incentives for the wind and solar power in most of the developed countries include feed-in premiums (FiPs) and feed-in tariffs (FiTs). A report elaborated by Bloomberg New Energy Finance (BNEF) shows that nearly 87% of the world solar power capacity and 59% of the wind capacity have been introduced in the FiT markets (Bloomberg New Energy Finance, 2011; Corfee-Morlot et al., 2012). FiTs are regarded by the European Commission (2008) as the most efficient incentive in the short-run for encouraging private renewable energy investment. This method addresses the main challenges regarding private investment in renewable energy programs, while reducing the wastage of public money. However, setting the price at an appropriate level is difficult for governments due to an information gap (Angelopoulos et al., 2017).

FiT aggregates the financial and regulatory incentives guaranteeing the producer: i) fixed prices that are linked to the cost of generating renewable energy, ii) long term electrically production contracts ranging from 15 to 25 years, and iii) access to the grid. This incentive includes setting up a long-term contract between the producers of renewable energy and the government at a fixed price for each MWh renewable power that is fed into the grid. The price in most countries is set by the related governmental bodies and the published policy or strategy with the main goal of rewarding renewable energy producers. Tariffs are most of the time based on the cost of production of different renewable energy technology along with a premium that makes it possible for investors to earn a reasonable return on investment. That is why the price is generally set at a level that is more than the price of fuel-oil based electricity. The incentives offered to renewable energy companies are related to the difference in the electricity market price and the feed-in price. The increased costs are passed over to the electricity consumer. The effectiveness of the FiT model is the cost-based dimension that allows renewable energy projects with different market competitiveness to be completed with good returns (OECD, 2013b; Yurchenko & Thomas, 2015).

One of the main issues abovementioned regarding the implementation of the FiT approach is the lack of required information for setting the right price level. Setting a very low price can lead to low profits for investors. In contrast, setting a high price can result in reduced profits for the power distribution companies. Moreover, the effectiveness of the FiT rests on the government capacity to accurately evaluate the cost of projects and keeping the payment levels according to the actual costs. Addressing the inefficiencies requires differentiating the tariff levels by the cost of renewable energy production. However, this requires a high level of technical skills that may not be available in a country. Another issue of the price-driven FiT approach is that the costs are passed to the consumer that is a politically sensitive issue particularly in the MENA region, where electricity is subsidized by the government (Couture & Gagnon, 2010).

3.4.6.1.2. Targeting certain policy objectives through specific tariffs

Location-specific tariffs for wind energy projects have been tested in Germany. The objective of the policy was to ensure even distribution of wind power plants located in a specific region through separating profits from the power production capacity. A flat tariff was offered to all wind electricity manufacturing companies during the first year after their establishment. This can help avoid concentration of above-normal profits for certain power generators at good locations. However, a tariff incentive scheme that is location-specific can result in higher profits for producers at more windy locations for maintaining the efficiency of the FiT scheme (Kilinc-Ata, 2016).

3.4.6.1.3. Adapting financing of FITs to the needs of developing countries

FiTs involve passing of some of the costs to the consumers. The number of market players, as well as the number of renewable power products that are incentivized by a particular tariff level, is not easy to estimate. In developing countries, implementing FiTs require modification, due to the fact that consumers of electricity, particularly in poor regions, are susceptible to any increase in the electricity price. To overcome the limitations, the following two design options had been considered (Mendonça, Jacobs, & Sovacool, 2010):

- Cost-sharing: The increased costs for the end consumers will be covered through a cost-sharing program or a national fund created for the development of renewable energy.
- Capacity caps: Putting a limit to the capacity of renewable plants installed in a specific location can help reduce the costs borne by the end consumer. The caps can also have negative effects but are the only way under the FiT program for governments to control the volume and the deployment rate of renewable energy.

3.4.6.1.4. Net metering

The concept of net metering that is also known as virtual power plants helps consumers to create their own renewable energy and sell the surplus at a higher tariff. The independent power producers, which can be average consumers or energy-intensive industries, are allowed to generate renewable power to offset the use of all or some of the energy and feed the surplus to the national grid at an intensive tariff. A meter or a device is installed to determine the price of energy produced and consumed by the independent power producer that can help in calculating the price difference, This incentive has the advantage for the government to create a larger share of the renewable energy in the total energy mix without having to subsidize excess energy.

Many countries have implemented the net metering incentive, particularly in the developed world, such as Japan, the US, Australia, Thailand, Mexico, or Denmark. The two most successful net metering programs were implemented in New Jersey and California that resulted in the installation of more than 23,000 solar systems in early 2008 (Mendonça et al., 2010). This program is generally applied for encouraging decentralized production of solar electricity. However, the program can theoretically be implemented for many other renewable energy sources.

3.4.6.2. Quantity-driven incentives

The concept of quantity-driven incentives involves fixing the quantity of renewable energy but allowing the price to be determined through demand and supply dynamics. This method is a more market-driven approach in comparison with the price-driven method (Kilinc-Ata, 2016).

Competitive bidding process involves the regulator specifying the reserved market for a certain amount of renewable energy and allocating the amount to producers of renewable energy through an auction. The utility companies are required to buy renewable energy from selected manufacturers of renewable energy. A bidding company that makes the best offer is awarded the tender and gains the special right to produce power and benefit from the contract. The financial support is based on the total cost of producing electricity per unit or the total investment amount. The competitive bidding process results in a better assessment of the project by public bodies. They are able to better evaluate the project using different criteria that include electricity production costs, quality of the project, and benefits to the economy based on job creation and contribution to the gross domestic product. Competitive bidding results in improved competition, enhanced project competitiveness and improved ability of the government in selecting the best offer.

Another benefit of the bidding process is that it results in optimized price discovery. Nowadays, the tender systems that are used in different countries depend on independent electric power producers. The United Kingdom (UK) was the first country to create a mechanism for bidding as per the Non-Fossil Fuel Obligation (NFFO) in 1991. Similar schemes exist in France, such as the EOLE 2005 project[32] introduced in 1996. In Denmark, the Promotion of Renewable Energies Act was introduced in 2008 to promote electricity production through wind energy.

3.4.6.3. Quotas

The quota-based mechanism involves a legislator that obliges a certain market player, such as the producer, the consumer, or the supplier to provide a particular part of the production of electricity through renewable energy. The market design influences the choice of the obliged market actor. The obliged actor can either buy electricity from other manufacturers or produce green electricity. To improve the flexibility of the system, the obliged party generally has the option to meet the share of clean energy through traditional certificates that serve as proof of compliance with legislation (Buckman, 2011).

[32] Electricite de France, the Agency for Environment and Energy Management (ADEME), as well as the Ministries of Research and Environment are participating in this program. The purpose is to create an initial market in France for wind power generation in order to evaluate the cost-effectiveness and the competitiveness of the wind energy compared to other energy sources by 2005. The installed capacity will reach at least 250 MW and possibly 500 MW.

3.4.6.3.1. Quotas with Tradable Green Certificates

Tradable Green Certificates (TGC) can be combined with quota-based programs. TGCs verify that the electricity is produced through renewable energy sources. Generally, a certificate proves the generation of 1MWh of green electricity. The certificates that verify the source of energy are tradable but are exchanged separately from the production of renewable energy (Schmalensee, 2012).

3.4.6.3.2. Quotas with carbon credit

Carbon credits are based on the notion that trading the commodity internalizes the tax market externalities. Carbon credits are tradable and attribute to the project owner a credit certificate equal to the amount of reduction in environmentally damaging pollutants. The owner of the certificate can freely trade the certificate for a profit. However, the credits alone are not enough to encourage investors to invest in the clean energy sector in the MENA region or anywhere else. However, the credits in addition to other incentives attract investors, especially those who contribute to a large amount of GHG without any contribution from the public money. Creating a market for carbon credit trading is closer to the market economy compared to other incentives such as FiT. Renewable energy is supported by many OECD countries of electricity through credit certificates. For instance, Sweden and Poland exclusively use TGCs. The certificates are also used in many other countries, such as Italy, the UK, Japan, the US, or Norway. The TGCs are used at the state level as the main support instrument for encouraging renewable energy production in addition to FiTs that support small power producers or those firms that rely on grants and other tax incentives. TGC schemes are in place in different regions, with some regions having a fixed price (Kilinc-Ata, 2016).

3.5. REVENUES RISKS

The variability in the financial income represents market and sales risks. This type of risks can occur due to many reasons, such as variation in the electricity production prices and not being able to sell power to the regions mainly because of the oversupply in the regional grid, which is known as curtailment risk (Turner et al., 2013; Balks & Breloh, 2014; Jin et al., 2014). There is hardly any risk in countries with grid operators that are required to buy renewable energy electricity from a producer of clean energy, which is the case in Germany under the feed-in tariffs. The default for grid operators or counterparties can lead to great losses from the renewable power purchase contracts that will be explained in the next subsection. Moreover, resource and weather risks are highly relevant in projects like wind energy, due to wind energy fluctuations in the year will result in a high risk that will also affect the profitability of wind power plants (Martinez & Prados, 2007; EWEA, 2013). For these reasons, this section analyses market and sales risks for wind power projects as an example of renewable energy projects.

3.5.1. Fluctuation of revenue because of weather or resource risk

Wind power plants revenues can significantly fluctuate, due to the variable wind speed during a year with the variability of about 15% to 20% in the US. In contrast, the variation in solar power output is about 5%. The annual variation is higher in the case of onshore wind power plants in comparison with offshore plants (Turner et al., 2013). If the financing of renewable energy involves debt, the debt needs to be paid regularly, due to which there is a need for a minimum debt coverage ratio that can be multiple of a yearly payment of the debt (Turner et al., 2013). This is important because of the capital intensive nature of renewable power products and high leverage ratios between 70% to 80% (Turner et al., 2013). Another risk occurs when the factual power plant capacity is different when predicted during the pre-construction assessment that suggests a shortfall in the production and revenues. This risk is foreseeable to increase due to the dangers of climate change (Watts, 2011).

Insurance is used as a risk management tool to cover the minimum revenue in the case that the power output goes below a critical threshold because of insufficient wind (Watts, 2011). This coverage is provided by the Munich Re for land and wind coverage. Another option to reduce risks is to create contracts similar to the KLIMA risk policy introduced by the HDI-Gerling in Germany. This contract can be bought to gain fixed sum insurance against adverse weather. Moreover, energy derivates that are known as weather-contingent electricity price hedging are an option to reduce the variation risk due to unexpected weather. However, the pricing of renewable energy may become more complex with the increase in the share of clean energy (Turner et al., 2013; Watts, 2011).

To a large extent, electricity service providers also take measures to reduce the risk of insufficient wind, due to adverse weather conditions. According to the EWEA (2013), there has been a recent shift in the guarantees that are available, such as guaranteeing wind park operations in order to meet the output targets. An example is the Active Output Management service contract that involves using an extensive maintenance and service program to achieve the highest possible production that enables stability in revenue (EWEA, 2013).

Recent portfolio-based risk reduction methods include diversification in terms of the geographic location of the wind power plants as well as in terms of technologies. An illustrative example is investing in both low volatility solar power plants and high volatility wind power plants that can result in a reduction in the overall volatility, due to adverse weather conditions (Turner et al., 2013; Watts, 2011). Moreover, the storage capacity (if available and efficient) would result in increased flexibility (Bird et al., 2016), and an appropriate assessment of the weather conditions before construction of wind power plants to estimate the impact of poor wind should be carried out using advanced assessment techniques (EWEA, 2013).

Lastly, the financing structure can be improved by reducing the risk of default on debt payments through the use of alternative mezzanine debt structure with fluctuating debts that are consistent with the outputs. However, this risk reduction technique is more expensive compared to the fixed coupon loans (Turner et al., 2013; Watts, 2011).

3.5.2. Fluctuation of revenue because of grid availability or curtailment risk

Revenue from renewable energy production also depends on grid availability. The curtailment risk refers to the risk that energy output cannot be sold, which will be resulting in

losses in regions that do not have fixed support schemes, such as the FiT. This risk occurs in the event of excess wind energy generation in addition to insufficient capacities of the grid system, due to distribution or transmission congestion and insufficient demand in the region due to regional grid oversupply (Jacobsen & Schroder, 2012). The output of excess energy during windy days can result in an imbalance in the energy system that needs to be resolved through short-term balancing techniques by the grid operator using techniques, such as restriction of the project output, dispatch-down or re-dispatch, selling excess energy to neighbouring regions, negative spot prices, and counter trading or restriction in power output (Turner et al., 2013; Watts, 2011). For example, the grid capacities in Germany are at present not able to balance the output of power during windy days by the distribution of the excess power from high production areas in the north to the high demand areas in the south. Increasing the capacities may take more than ten years, while wind plants have to be created in about three years. The cost of curtailment risk in Germany where the FiT system is enforced is transferred to the end consumer. However, in the case of China, the costs of the curtailment risk remain with the owners of the project, despite the fact that they are not able to control this risk (Watts, 2011; Turner et al., 2013;).

Reducing risks require improving the techniques to forecast weather, bidding less power (given storage), or selling of extra capacity on the spot market as per the storage capacity (Turner et al., 2013; Watts, 2011). Moreover, the power purchase agreements (PPAs) can help in mitigating the risk that is generally the case in the US and the UK. The lower price represents the cost of balancing for the grid operator (Turner et al., 2013; Watts, 2011). Moreover, the geographic and portfolio diversification is important, as explained in the previous subsection. Thus, diversifying the generation of power across different regions and technologies, such as solar and wind, can lead to minimizing the income risk. This is because of curtailment by aggregating the estimated undersupply in one market or technology to the other resulting in reduced net balancing costs (Watts, 2011; Turner et al., 2013).

PPAs are a risk transfer form that involves a term that ranges from 10 to 20 years. During the contract period, the buyer agrees to buy energy from the electricity producer that can help minimize the investors risks, in particular, the policy risks if the support from the government programs are reduced (Watts, 2011). The reduction of the curtailment risk and the significant costs requires investment by the government in power grids to develop the infrastructure and increase the grid capacity, which can take more than ten years (Jacobsen & Schroder, 2012; EWEA, 2013; Turner et al., 2013).

3.5.3. Fluctuation of revenue because of price volatility

Regions, where there support schemes are not provided, are facing more market risks since the demand of energy depends on the price (Dinica, 2006; Solangi et al., 2011). If in addition to or in place of a policy support scheme, a market-based mechanism is used the variation or reduction in prices of energy can represent a serious risk in case of the energy output is sold at a reduced price compared to the reference value. The same situation happens in Germany after the guaranteed FiT period of 20 years or when moving back and forth has to be declared in advance or when switching to the market premium model. This situation applies when there is a lack of storage opportunities that suggests mandatory sales that are independent of the prevalent prices. Energy derivatives, such as futures contracts, are generally used as a risk transfer technique, in which the behaviour of electricity price may change when there is an increase in the percentage of renewable energy as abovementioned (Turner et al., 2013; Watts,

2011). Concerning the transfer of risk, long term PPA or private contracts can help guarantee a fixed rate of power output (Dinica, 2006; Turner et al., 2013). According to Waissbein et al. (2013), possible shortcomings may occur regarding the design of PPAs or/and the bidding process, due to important clauses need to be clear and well-designed by including provisions for curtailment, termination, and currency denomination (Waissbein et al., 2013).

3.6. CONSTRUCTION PHASE RISKS

This section of the study sheds light on the transport, construction and completion risks of renewable energy investments. Given that this phase is similar in different projects, the analysis discusses this group of risks for wind energy projects as an illustrative example.

The risks related to distribution, construction, and completion of green power projects generally concentrate on the first stage of the life cycle. Thus, the period of construction is considered to have the highest risk (EWEA, 2013; Turner et al., 2013). In general, risks include the loss of income due to delays in the start-up and the risk of damage during distribution, which due to the intensive nature of the capital of the project can be expensive and costly (Balks & Breloh, 2014; Liebreich, 2005). Furthermore, completion risk can occur due to problems regarding the grid connection. The grid and bottleneck risks are particularly relevant to offshore clean energy projects due to the complexity of the construction and transportation processes (EWEA, 2013; Markard & Petersen, 2009). For example, the grid infrastructure provider was not responsible for providing the grid connection until 2012 (EWEA, 2013). This suggests a significant mismatch of timing that resulted in project delays. The grid operator was compelled because of serious issues concerning offshore connection to compensate the wind park constructor for the delay in connection until 2012. Moreover, the use of different specialized transport mediums, such as cranes, road vehicles, jack-up vessels, pontoons, and handling of equipment at different locations increases the transport risk. The bottleneck risk also increases owing to the limited availability of specialized construction vehicles since they may be booked years in advance (Turner et al., 2013).

Monitoring of weather is important when the materials and components are transported to the building lot at an offshore location. However, the required know-how for offshore wind products cannot be easily transferred from expert countries, such as the UK and Denmark to other countries. For instance, offshore wind energy plants in Germany have to be installed in the Wadden Sea with a minimum distance from the shore that implies the difference in the depth of water (Markard & Petersen, 2009). The soil conditions and the foundation design risk also need to be assessed when creating a plan for offshore wind energy plants (EWEA, 2013).

Wind energy projects require a lot of capital. Any damage to the assets can have a considerable effect on the overall cost of the project. The construction of the wind power plant is considered to be the riskiest phase due to the possibility of accidents when installing wind turbines and solar panels. These risks can be minimized through careful planning, due diligence, and effective project management. Moreover, contractors seek insurance coverage for any damage during the construction of renewable energy plants. Some contractors also buy

coverage for any delay in the start of the construction or profit loss that allows them to reclaim the loss of profit due to delays. The accidental damage insurance coverage helped London Array to complete a 1GW offshore wind energy project located in the Thames estuary within the specified budget without much delay due to financial constraint (Turner et al., 2013). The weight of an installation rig had damaged a power cable located on the seabed. Repairing of the damaged cable took four months, but the insurance covered the costs due to which the damage did not negatively affect the profit of the project. Moreover, contingency planning allowed the project to be completed within the specified time. The financial losses due to a project delay could also have been covered through the delay in start-up coverage. The insurance coverage value would also have likely to remain aligned with the new build annual capacity. The new build-rates across the six focus regions are expected to remain the same except the offshore wind projects with growth fuelled by ambitious policy targets (Turner et al., 2013).

Therefore, losses due to project construction delays and other risks are likely to be covered through insurance coverage. In general, the insurance companies require that the inspection of construction and transportation process was carried out by marine warranty inspectors for coverage of offshore wind projects. Moreover, the insurance companies may offer operation and maintenance (O&M) contracts in the form of full-service agreement offering joint contingency coverage for profit loss, project delays, and other risks, due to adverse weather conditions during installation, construction, and transport of grid infrastructure (EWEA, 2013). Other risk management strategies include careful planning, contingency planning, effective project management, and recovery criticize using what-if analysis (EWEA, 2013; Watts, 2011). Moreover, before the construction of wind-power plants, monitoring of weather conditions is important to assess the geographical suitability and the best time for the start of the project. The EWEA (2013) recommends that grid connection risk can be minimized through an effective assignment of responsibilities regarding the development of grid and harmonization of intentions of the project managers with relevant offshore wind power contractors. This risk becomes irrelevant after the construction of the wind power project and, therefore, it does not require consideration when investing in the project after the construction of the plant (brownfield in case of onshore) (EWEA, 2013).

3.7. OPERATIONAL PHASE RISKS

This section deals with the operation and maintenance group of risks by applying it to one type of renewable energy project as an example, such as a wind energy renewable project. Different risks may arise after the wind power plan is completed. Thus, this section discusses some of the pertinent and important risks that may arise once the wind power plant is operational.

3.7.1. General operation and maintenance risks

Physical assets damages because of negligence, accident, or wear and tear are included in the general operation and maintenance risks (Turner et al., 2013). Moreover, losses due to flaws

in the design, component failure, and unexpected closure of the plant due to unavailability of critical resources are included in the risk category that negatively affects the profitability (Watts, 2011). Technology risks are also highly relevant for offshore wind power plants that refer to unreliable performance, due to unproved design and technologies (blade, bearings and gearbox risks) (EWEA, 2013).

Maintenance risks are also associated with offshore wind power plants, because of the distance from the shore and the special vehicles (ship) that is required for repairs. The limited availability of repair parts is also a big concern regarding offshore power projects. In addition, wear and tear risk is high in the maritime environment (e.g., salt water, humidity). Furthermore, weather risks create problems regarding offshore power projects. During inclement weather conditions, offshore wind plants may not be accessible, particularly during the winters in the case of high winds that can lead to significant losses in revenue (Turner et al., 2013).

Lastly, accumulation risk can also lead to reduced profitability when different wind turbines relay transfer power to the same relay station. Any damage to the power outcomes could cut the power supply resulting in huge losses for the wind electricity supplier. The risks are particularly relevant in the case of submarine cables that transmit energy from the offshore plants to the mainland grid. For example, undersea cables running through the German North Sea Cost needs to be assembled with connecting offshore wind plants to the main grid. In this case, the grid connection should be compatible with the nature that represents a significant accumulation risk. Owners of the wind power plants, investors and insurance companies need to identify potential risks due to the location of offshore wind power plants in areas with exposure to natural hazards. These risks can be minimized through complex risk management strategies for offshore wind power projects.

In general, insurance coverage is available for uneventful situations, such as damage because of negligence, design flaws, wear and tear, accident, and natural hazards regarding onshore wind power plants. However, the coverage is limited for offshore power plants, mainly due to unproved and novel technologies. Moreover, in most cases it covers only partially the loss due to the high costs related to the turbines, transport and other issues (EWEA, 2013; Turner et al., 2013). In general, insurance companies include specific clauses in the contracts even for serial losses and other terms. Therefore, manufacturers of wind turbines provide long-term guarantees of specific components of the turbine for up to five years. Furthermore, insurance companies may force the owners of wind power projects to maintain the wind turbines through O&M service contracts or require installation of wind power plant monitoring systems to assess the condition of the plant.

Wear and tear risks due to harsh weather conditions can be partly mitigated through O&M service contracts for a specified period (EWEA, 2013). The warranty contracts for onshore turbines run for two to five years and consist of limited availability guarantee as wind park continue to be operating for a certain period of time. O&M service contracts offer limited period maintenance, service, and parts replacement (Turner et al., 2013). The warranties for offshore turbines are limited, they may not provide replacement coverage, and they offer limited maintenance service due to adverse maritime weather. One common problem with wind turbines replacement guarantees occurs due to the insolvency of the manufacturer that means that replacement may not always be possible. For example, British Petroleum (BP) had to lower the sales price to sell wind power parks in the US that used components made by a defunct manufacturing company Clipper Windpower (Turner et al., 2013).

Other risk minimization strategies during the operation phase relevant for offshore wind power plants include the implementation of structural health monitoring (SHM), and conditional monitoring system (CMS) for assessing the status of the parts and know the status of wear and tear. This helps in efficient recognition of the reasons for component parts and the changes and estimates regarding the duration of further operation. It allows effective maintenance planning, including for times when weather conditions are better, as well as it can help minimize the maintenance costs. An effective planning for maintenance of critical components is essential for the efficient operation of onshore and offshore wind power plants. Moreover, technological risks can be minimized through the reliance on proven technologies that have been manufactured by established firms, such as those coming from Switzerland and Germany, according to Watts (2011). Technologies for offshore power plants should be made by well-established suppliers, and information regarding operating and testing should be gathered by the supplier (Watts, 2011). In addition, weather conditions should be closely monitored using reliable equipment to predict the effect of bad weather during the operation of the power plant. Moreover, diversification regarding wind turbine manufacturers can help reduce technical risks and deficiencies and resource replacement risks.

3.7.2. Damages caused by natural hazards and severe weather conditions

The adverse weather conditions represent a risk, particularly for wind power products. Storms, strong waves, winds, and tides could cause significant damage to the wind turbines, especially at offshore locations. Moreover, the operation of the wind power plant may be affected due to hail or ice formation (e.g., through spray). Lightening is also a natural hazard for offshore power plants that are located at the highest point at sea. Moreover, earthquakes that occur due to the movements of the tectonic plates could trigger tsunamis that represent a significant risk for offshore wind power plants.

Insurance companies provide coverage against natural hazards, as mentioned in the previous subsection. According to Turner et al. (2013), adequate coverage of the risks requires coverage by globally diversified and large insurance companies. For example, HDI-Gerling KLIMA risk policy in Germany offers fixed amount coverage for parametric weather index that is contractually defined. It includes wind, rainfall, temperature, and that falls or exceeds a certain benchmark including, but it is not limited to them. Moreover, the aforementioned weather derivatives that are based on parametric indices and catastrophe bonds are used by some companies to reduce the risk of adverse weather conditions. However, high basis risk may be present for risk mitigation instruments that are based on parametric indices or industry loss if available for the locations (Gatzert & Kellner, 2011).

3.7.3. Damages caused by serial losses

The serial loss of faulty components or turbines represents a significant risk with wind power plants (Martinez & Prados, 2007). Serial risk is particularly relevant to offshore wind power plants due to their cost-intensive nature with a high cost of replacement and repair at sea. For example, Munich Re provides specific insurance coverage against serial loss. Another option abovementioned is diversification of the supplier to reduce the risk of multiple wind power plants. The risk occurs from the application of novel but untested technologies that has been the case with early wind power turbines. For instance, losses due to wind turbine damages in 2002 resulted in an increase in the premiums and the exit of many insurance companies providing wind energy protection. The development of wind power plants, particularly in

China, requires an evaluation of serial risks from untested and imperfect technologies and concepts (Jin et al., 2014).

3.7.4. Revenues losses caused by business interruption

Interruption in business because of damages (see 3.7.1), and curtailment and grid availability risk (see 3.7.1), and natural hazards risks including high wind speed and shutdowns (see 3.7.2), and serial risks (see 3.7.3) suggest significant risks to profitability of a company that can be increased by the risks of accumulation that have been explained in the previous sections (Turner et al., 2013).

Business operation interruptions are significant for offshore wind power plants as aforementioned. Unexpected downtime due to high waves or winds can be covered through O&M contracts and insurance. The coverage is very relevant for offshore wind power projects because of the high loss likelihood that can far exceed the cost of components (Turner et al., 2013).

According to EWEA (2013), offshore wind power plants have limited access to coverage for earning losses. This risk is partially covered through O&M contracts and contractual warranties and guarantees[33], in which the exact coverage will be depending on the balance sheet of the provider with a utility that is usually a counterparty and not the government or the country. For instance, some companies like Ørsted offers guarantees for renewable energy project earnings which is incentivising institutional investments (EWEA, 2013)[34].

Additional risk mitigation strategies are required to reduce the risk of interruption and delays. The risk strategies should focus on preventive maintenance, design and technology, effective weather monitoring system, and replacement of parts on standby (Turner et al., 2013).

3.8. FINANCIAL STRUCTURE RISKS

The deployment of renewable energy technologies (RET) at a commercial scale have various risks and obstacles that explain the slow rate of introduction of the technologies, particularly in low-income countries (LICs). One of the most obvious risks is the high cost related to RET compared to traditional electricity sourced from fossil fuels. The cost of RETs will remain higher compared to traditional technologies as long as internalities are not properly internalized by energy prices, particularly the impact of the local and global environment on different technologies and the contributions to minimizing the volatility of energy prices and security. This will prevent the use of renewable energy, especially in LICs.

Energy prices do not properly reflect other advantages of RETs, such as reduced reliance on imported fossil fuels that may be subject to price changes and interruptions, and the location

[33] For more detailed information about the difference between both terms, please consult https://www.difference.wiki/warranty-vs-guarantee/

[34] For more and detailed information, please consult https://orsted.com/en/investors/news/company-announcements.

of energy source close to the demand centres that reduce the need for costly transmission grid network. The lack of experience with the development of RETs also represents a major hurdle in most LICs. Policymakers, financiers, spongers and off-takers (power purchasers) are not able to confidently evaluate the practicality, viability, feasibility, and associated risks, due to which they are reluctant to introduce the RETs resulting in a low-level equilibrium trap. A lack of expertise and capacity resulting RETs prevent the development of a portfolio of profitable projects even in places where there are suitable opportunities. In turn, this lack of viable projects means that capacity and expertise in RETs cannot be developed that serve as a fundamental barrier, which cannot be overcome through public financing. There is a need for large reforms in the regulatory and policy framework, as well as in developing institutional capacity for RETs.

Financial instruments can help in overcoming specific risks and barriers that prevent the development of opportunities for RETs, even where the framework is supportive. The specific risks and barriers that can be overcome by financial instruments can be categorized into two groups. The first group consists of obstacles and risks in the underdeveloped financial markets that prevent obtaining the funds at reasonable costs. While these barriers are applicable for most projects, they are significant for RET infrastructure projects in LICs. The second group consists of risks that are applicable only to RET projects. This group includes risks that are related to the regulation of the renewable energy sector that is enhanced by the specific nature of a RET project. Risks concerning the performance of the RET technology are not included in this group as they are addressed through warranties and guarantees from contractors and suppliers instead of through financial instruments.

3.8.1. Financing barriers

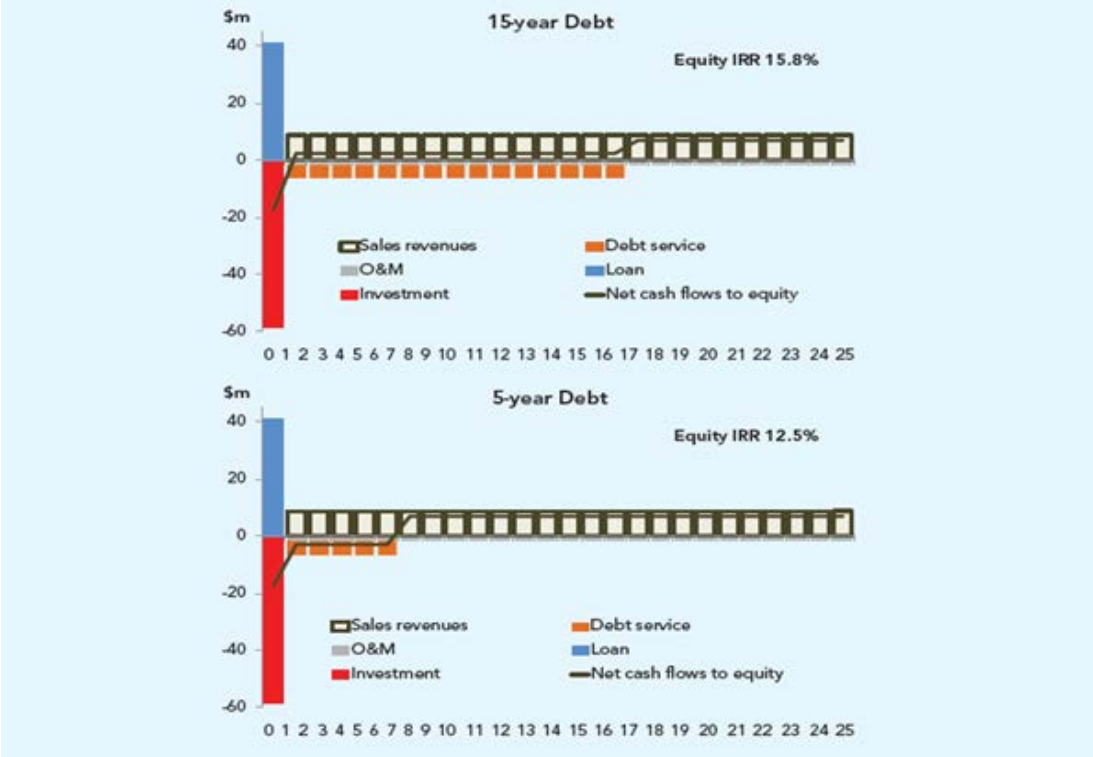
3.8.1.1. Lack of long-term financing

The high upfront costs along with low ongoing costs are the characteristics of RET projects. This suggests the strong need for long-term financing, because without this type of financing investment decisions are likely to be biased for traditional technologies. However, long-term financing is usually hard and sometimes even impossible in most LICs, mainly due to restrictions regarding long-term lending. In addition, most potential financiers will not be able to assess the relevant risks due to a lack of experience regarding RETs that will result in mismatched funding sources.

In general, the availability of long-term funds depends on the investor requirement for long-term assets that match their liability profile, such as retirement funds. However, these funds are generally not available or popular in LICs, mostly due to the purchase of low-risk government bonds. The lack of capital market funds is also the main financial barrier in the smallest LICs. This lack of availability of funds means that investment is diverted to projects with the highest returns in the short term duration with minimum risks, criteria that are not met by RET (Hussain, 2013).

Figure 3.2 shows the cash flows for a 35MW onshore wind project that reflects the importance of access to long-term financing for the development of RETs. The two examples show 5-year and 15-year debts for a RET project. The 5-year debt results in a deficit for the first five years after completion of the renewable energy project that requires financing of USD 15 million from the sponsor and for reducing the equity return less than the viability threshold. This figure also shows that the equity IRR of long-term debt is higher compared to the short-term debt by about 3.3%.

Figure 3.2: Illustrative Cashflow Profiles for RETS



Note: O&M = Operations and Maintenance
Source: Hussain (2013, p. 4)

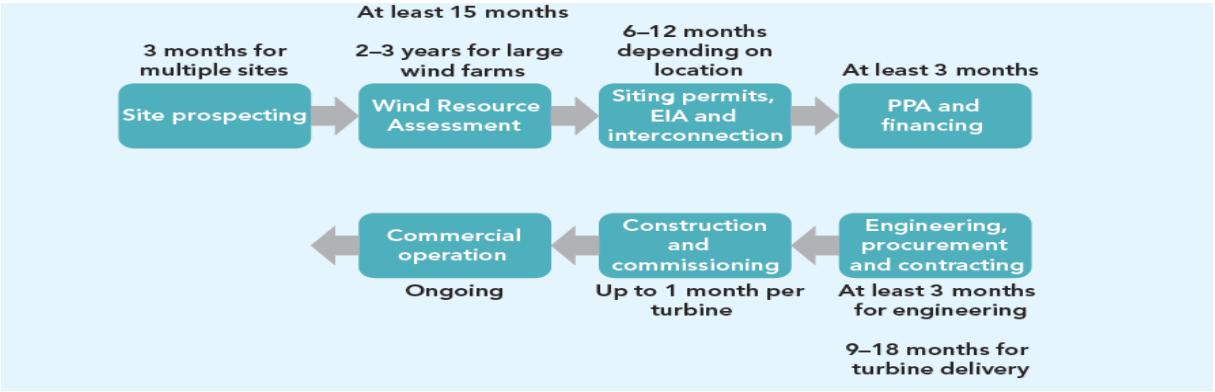
3.8.1.2. Lack of project financing

Renewable energy projects will require access to funds on a project basis apart from duration basis. The projects require funding through equity and loans. The security for the loan comes in the form of future estimated cash flows with the requirement of no or little collateral. RET project costs are spread over the duration of the project in this type of limited or non-recourse funding. The up-front costs of the RETs are funded from the positive cash flow that is generated during the operations. Another option is to rely mostly on equity finance whereby payments which might be delayed for almost a year after the start of the project.

Attracting equity and corporate financing for RETs is hard compared to traditional technologies. RET projects are generally affected by a lack of project financing compared to traditional projects, since the share of capital costs is high in comparison with the total cost. This is mainly because of the high capital investment required by RETs and less familiarity with the technologies compared to traditional technologies.

Figure 3.3 shows the timetable for the project development of a typical wind power plant. In general, RET projects take 2 to 3 years to close with resource assessment and site evaluation taking the most time. Significant pre-investment financing is required to cover the expenses to the point of revenue generation and to cover the risk of delays (Pramod, 2011).

Figure 3.3: The project development timetable for wind



Source: Pramod (2011, p. 5)

3.8.2. Interest rate risk

3.8.2.1. Definition

Interest rate risk has to be managed to minimize the impact of fluctuations in the rate on the profitability of an organization, according to CPA Australia Ltd[35] (2008). Non-financial firms should adequately manage financial risks; thus, the focus is on the provision of core services and goods, while minimizing the financial risks.

Negative or wrong movement in interest rate risk may lead to decreasing investor returns, increasing borrowing costs, decreasing the profitability of banks and other financial services providers; and decreasing a firm net present value (NPV,) because of the changes in the discount or interest rate on hedges, investment value, and project returns.

3.8.2.2. Sources of interest rate risk

The sources of interest rate risks can be summarized as follows (CPA Australia Ltd, 2008): interest rates re-setting on a firm loan from lending firms; and fluctuation in interest costs due to changes in the rates during the duration of the loan.

Changes in interest rate affect the value of liabilities and long-term financial instrument. For instance, the bond value will decrease as rates increase due to which borrowers will benefit initially. Moreover, a decrease in the rates will result in an initial loss for investors of long-term funds due to an increase in their liabilities. The profits and losses will only be realized if the liability or investment is completed before maturity. Furthermore, economic loss or gain provides an opportunity at the time when the interest rates have changed (CPA Australia Ltd., 2008). The types of opportunities that can be occurred are the following ones:

[35] CPA Australia Ltd is the sixth largest professional accounting body in the world. For more information consult the website: cpaaustralia.com.au.

- Resetting of rates on short-term duration investments, such as commercial paper, bank deposits, bills, and others.

- The value of derivatives, including interest rate swaps, will fluctuate according to the changes in interest rates, which represents an opportunity of a profit or a loss.

- Financial firms are mainly interested in rates on liabilities and assets resetting at different durations, which is also known as a re-pricing or mismatch risk. For instance, a greater increase in the interest rates as compared to the liabilities will result in an increase in the profit for a firm and vice-versa.

- Differences between domestic and foreign interest rates can affect forward foreign exchange rates. In some countries, an increase in interest rates relative to offshore rates will increase the cost of hedging imports and decrease the cost of hedging exports.

- And discount due to an early payment that is offered and received. For instance, discount rates that are provided in case of early payment could be higher compared to the cost of funds for the organization.

3.8.2.3. Impact of falling rates on investors

On one hand, borrowers are generally concerned about increasing rates, since it affects the market value, profitability, paying dividends, probability of violating the borrowing covenants, ability to undertake capital expenditure, borrowing margins because of the impact on financial ratios, and NPV or the net value will be higher initially because of the high discount rates that is applied to fixed interest loans and relevant hedges. On the other hand, investors are generally interested by falling rates as the reduced cost of funds impacts the market value, profitability, capacity to pay to stakeholders such as unitholders in a trust, competitive and attractive returns, ability to attract investors, ability to meet future outgoings like superannuation, NPV or the net value/unit prices because of the lower discount rate that is applied to investments and relevant hedges (CPA Australia Ltd, 2008).

3.8.2.4. Methods to measure interest rate risk

Many different measures can help in measuring the interest rate risk that ranges from simple to mathematically complex. Some of the most important methods that are used by organizations to measure interest rate risks are presented in this section.

3.8.2.4.1. Sensitivity analysis

Sensitivity analysis is a financial model that determines how to target variables are affected based on changes in other variables known as input variables. This model is also referred to as what-if or simulation analysis. It is a way to predict the outcome of a decision given a certain range of variables. By creating a given set of variables, an analyst can determine how changes in one variable affect the outcome. There are several tests or analysis that can be carried out, as the following ones:

- Simple analysis: This method involves calculating the impact of slight interest rate changes on the economic or accounting income value, such as assessing the impact of an interest rate increase by a certain percentage on the accounting income in the future or for few years to come. In general, spreadsheet software is used for simple sensitivity analysis.

- Advanced analysis: The advanced sensitivity analysis involves calculating the impact of variability in the rates and some other factors on the financial health of a firm. For instance, if the firm is hedged by 50%, and if the rate of interest increases by 2%, while the earnings fall by 20%, how will the firm interest cover ratio be affected.

- Stress test: Stress test modelling involves assessing the impact of a significant change in the rates on the investments or borrowings in terms of risk outcomes and accounting terms. In general, this method is used by large financial firms.

- Repricing profiles: For entities, this may be a graphical representation of the interest repricing of assets or liabilities over time.

3.8.2.4.2. Methods to manage interest rate risk

Firms should create a policy to manage interest rate risks after assessing the risk tolerance of important stakeholders. This policy should guide the use of financial instruments for managing interest rate risk. In this regard, CPA has issued guidelines in its publication titled Understanding and Managing Financial Risk. Various methods can help in managing the interest rate risks, which are the following (CPA Australia Ltd., 2008):

- Borrowers ask the lenders for fixing the interest rate of the loan during the duration of the loan.

- Investors can invest assets with float rate or fixed rate and use the interest swap to fix the rates. Generally, fixed-rate assets offer a better rate of return for investors. But investors should remain aware that if they terminate the investment prior to maturity, they may suffer from significant losses in case the rate rises.

- Borrowers can protect against rising interest rates by using a derivative to convert fixed-rate loan to a floating rate loan.

- Interest rate swap is a reliable method to manage floating rates, where the lender allows the borrower to fix floating rates for a period ranging from one to five years. While an upfront fee is not required, the borrower must pay to the counterparty the difference in case the rate decreases.

- Option or interest rate cap can help a borrower that has funds with floating rate to protect against rising rates. The method basically is a protection against rising interest rates as the borrower benefits when the rates rise. Moreover, the borrower retains the benefits of clearance in rates in case the rates decrease. The borrower pays a premium for this protection for fluctuation against price changes.

A serious shift is required to put the economy on the path of renewable technologies. The shift requires a large investment in technologies that help produce electricity through renewable energy sources that are called green energy technologies hereinafter. Interest rate is a key decision factor for investment in renewable energy projects since the cost of capital is significantly affected by the rate[36]. Due to the quantitative easing policies that have been implemented in many developed nations since 2008 financial crisis, the rates have been low in many countries resulting in a lower cost of capital for investment in green energy projects in

[36] The term interest rates refer to the long-term rates since the short-term rates play an insignificant role, due to the long-term investment horizon of renewable electricity generation projects.

these countries[37]. Whether the low interest rate environment is conducive to energy transfer towards renewable is dependent on the different magnitude of the extent of its impact on the costs of green and brown energy technologies[38].

An estimation of the competitiveness of green energy versus brown energy projects for different rates was provided for different renewable energy projects in a discussion note of the Council of Economic Policies (CEP, Switzerland). These results show that renewable energy projects are competitive when interest rates are kept low. This report also shows that the costs of green energy projects show high volatility to changes in the rates in regions with a low-interest rate. This implies that the risk related to the high-cost fluctuations may partially offset the benefits of low-interest rates for investment in renewable energy projects (Monnin, 2015).

3.8.3. Exchange rate risk

The developing countries seek billions of foreign investments every year for the development of the infrastructure, while investors in rich countries seek investment avenues for new savings of trillions of dollars. This suggests great promise by private foreign investment. However, foreign investors have to face exchange rate risks of the currencies of developing countries. The attempts to hedge exchange rate risks have led to many problems, but a lot of problems have also been resolved. In this context, investors should pay attention to the exchange related risks, which will mean higher tariffs charged to consumers. The conventional advice that exchange rate risk should be managed by a firm that specializes in managing the risks has contentious implications in private infrastructure projects.

Exchange rate risk should be borne by three parties that include private investors, host country government, and customers. The private investors can be local, foreign creditors or equity holders. On one hand, the government should bear the risks, because it is the government responsibility to influence exchange rate risks through macroeconomic policies (Irwin et al., 1997). On the other hand, investors or the ultimate stakeholders should bear the risk, since they can create portfolio strategies to diversify the risk. In addition, the consumers of the service should bear the risk, since they have to pay for the service (Mas, 1997; Matsukawa , Sheppard, & Wright, 2003). The impact of the exchange rate risk can be largely reduced when it is shared by a large number of people.

In general, exchange rate risk is allocated through formulas for tariff adjustment that adjust the tariffs over a period of time to reduce the risk. The tariffs can better reflect the exchange rate in many different ways if the indexation is allowed, including the following ones:

- Revenue or prices can be partially or fully indexed to the currency exchange rate.
- Contracts allow renegotiation of revenues or prices in case the exchange rate crosses a specific point.
- Cost of input that is influenced by the exchange rate, which can be considered as pass-through allowing customers to pay the actual input costs.

[37] According to the Monthly Monetary and Financial Statistics of the OECD, the long-term rate in July 2019 was -0.16% in Japan, 0.36% in the Euro area, 0.83% in the UK and 2.06 % in the US.
[38] Green energy comes from natural sources, such as sunlight, wind, rain, tides, plants, algae, and geothermal heat. These energy resources are renewable. Brown energy is energy that comes from conventional fossil fuels, such as oil or coal.

Argentina can be considered as an example of the risk-sharing spectrum that has effectively indexed the entire dollar value. The consequences of these actions are not being felt by both the investors and the government that did not allow an increase in the tariffs after the devaluation of the currency. In most of the other countries, the hybrid approach is taken for adjusting the tariffs by indexing part of it to the dollar inflation, local inflation, and considering some costs as straight pass-through. However, there is a debate regarding the share of the cost base that needs to be indexed to inflation and international costs. The mechanisms for adjusting tariffs are not the only approach taken by the government that provides guarantees for protection against exchange rate risks for repayment of foreign debt (Gray & Irwin, 2003).

3.8.3.1. Nature and sources of exchange rate risk

An inquiry into the effects of exchange rate risk is not possible without investigating first the nature and sources of the related risks. Exchange rate risks refer to unexpected variations in the project value or an interest in a particular project, due to an increase in the exchange rate risks. The risks can be divided into the following two types: financing related risks and project-related risks (Irwin et al., 1997; Mas, 1997; Gray & Irwin, 2003; Matsukawa et al., 2003). These two types are explained next:

- Financing related risks influence the exchange rate risk that is borne by different stakeholders, including creditors, shareholders, taxpayers, and customers. Foreign loans that require repayment in different currency expose the stakeholders to variation in exchange rates. Shareholders may try to influence the arrangements of the contract to pass some of the risks to the customers or the government. In this case, they can use guarantees of exchange rate or the indexation of the tariff to the exchange rate.

- The other type of risk is related to the project exchange rate that happens when the input or output of a project depends on the rate of exchange. In general, infrastructure projects sell the output local; therefore, these projects are valued in local currency. The revenues are usually not exposed to the currency rate risks. However, foreign input will have a global price even though the input is not imported; thus, the costs that are measured in the local currency will be inversely related to the rate of exchange. As a result, the fuel costs for running the generator expose the project to exchange rate risk.

Firms can manage the exchange rate risks in different ways through optimal resource allocation (Irwin et al., 1997; Mas, 1997; Gray & Irwin, 2003; Matsukawa et al., 2003):

- Firms can have an impact on the sensitivity of the project value or the associated interest rate to manage the risk. For instance, sponsors of the projects can minimize the sensitivity of the shareholding value to the exchange rate by minimizing reliance on foreign loan.

- Firms can influence the source of risks. For instance, governments can reduce the depreciation rate and fluctuations in the exchange rate by keeping the inflation low and budget deficits small.

- Firms can diversify or hedge the risk through different approaches. A hedge of the exchange rate risks is only possible in developed countries and some developing countries. However, most of the foreign shareholders include individuals with pension plans, mutual funds, and life assurance who can diversify the savings. Therefore, exposure to an exchange rate risk in a country as defined above is limited.

Therefore, the optimal allocation principle can be stated since currency risks should be distributed to the parties depending on their ability, incentives to influence the rate of exchange or change the sensitivity of the project value or the associated interest to the exchange rate, and to diversify or hedge the risks. Due to the fact that the principle involves different management types, the implications are not clear (table 3.4).

Table 3.4: Ability of customers, shareholders and government to manage exchange rate risk

	Customers	Shareholders	Government
Project risk			
Influence over exchange rate	None	None	Great
Influence over sensitivity of project to exchange rate	Limited, but can change consumption in response to changes in the cost of tradable inputs	Limited, but can sometimes change inputs in response to changes in the cost of tradable inputs	Little
Ability to cope with risk by hedging or diversification	Little	Great (through diversification)	Little
Financing-related risk			
Influence over exchange rate	None	None	Great
Influence over sensitivity of value of investors' interest in company to exchange rate	None	Great (through choice of financial structure)	None
Ability to cope with risk by hedging or diversification	Little	Great (through diversification)	Little

Source: Gray & Irwin (2003, p. 3)

The influence over the currency exchange rate is an important reason for allocating the financing and project-related risk to the government. However, allocating risk to the government will not necessarily result in improved decision making to influence the risk, due to the complex relationship between the financial position of the government and the exchange rate. Many factors affect the relationship since the government responds differently to financial incentives in comparison with individuals and firms. This means that the risk has to be shared by the investors (shareholders) and the customers. Both of them cannot have an impact on the exchange rate risks. Therefore, the focus should be on the other two factors, namely project and financing related exchange rate risk. In general, customers can influence the sensitivity of the value of the project to the exchange rate risk through varying consumption levels as a response to the change in the cost of the inputs that will help in minimizing the effect on the value of the project of the exchange rate risks. In some cases, investors will have a better position to minimize the risk of exchange rate fluctuations. The investors may change the input mix using more hydro energy and less fuel oil-based energy to reduce the impact of depreciation. Moreover, shareholders can reduce the risk by diversifying or hedging the risk of exchange rate fluctuations using derivations or changes in the equity portfolio. In other words, project exchange rate risk can be distributed between the consumers and investors, according to their ability to effectively respond to changes in the currency exchange rate with the investors having a greater ability due to their capability to hedge the risks through diversification. However, the project exchange rate risk is insignificant for many renewable energy projects. The financing related risks are more significant. Therefore, it is important to understand if customers or investors should bear the risk.

On one hand, customers are not in a good position to manage financing related risk, since they cannot impact the sensitivity of the interest of the shareholder and the value to the currency

exchange rate fluctuations[39]. In addition, customers cannot hedge against the currency rate fluctuations, and there are no opportunities to diversify the risks in most developing countries. The value of the currency falls during macroeconomic crises due to which they are not likely to be able to pay higher tariffs. On the other hand, investors have more choices to reduce financing-related currency exchange risks. They are well-positioned to diversify most of the financing risk related to the exchange rate fluctuations (Gray & Irwin, 2003).

3.8.3.2. Implications for financing and prices

In general, investors have to face most of the financing and some project related exchange rate risk. However, they still have to recover the costs and ensure that the returns are reasonable according to the risks. No protection for investors commonly means higher tariffs for consumers. In case of the tariffs are not related to the currency rate risk, they have to be linked to the local inflation index and adjusted to reflect the input costs. This is due to electricity tariffs could be attached to an index, and the price of fuel in this index has a higher weight than in the consumer price index. The effect on the prices over the long term will be the same regardless of whether the tariffs are linked to the exchange rate or inflation. However, considering the relationship with local inflation, the exchange rate risk will not cause a significant rise in prices.

An important question is what the consequences for financing will be if the government does not protect investors from financing related risks concerning exchange rate fluctuations. If there will be no implicit subsidies in the form of customers or taxpayers bearing the risk, or explicit subside for renewable energy projects provided by the government, the following options could be envisaged (Gray & Irwin, 2003):

- Less financing will be raised for projects with higher initial rates and shorter terms.
- In countries with high saving rate,s such as in East Asia, the prospect for attracting capital and debt for financing renewable energy projects seem promising. However, in countries with low saving rates, raising the required financing will be difficult. In this regard, governments can help through strengthening financial markets and saving institutions and ensuring that the tariff formula does not discourage investing by local investors.
- Traditional financial deals that include debts denominated in dollars representing a major part of the project will be less feasible resulting in more use of debts in local currency and foreign investment resulting in higher rates of returns and project prices.

Foreign capital is important, despite the drawback of debts in foreign currency. The debts can be used to finance infrastructure projects that are not possible with limited availability of local equity and debt. The problem with most of the debt deals is that the share of foreign capital in the form of debts denominated in dollar is too high that shifts the demand for allocating the currency exchange rate risk to the local governments. Although the allocation of the risks in this way keeps the initial cost of financing low, the long-term implications will be high. Private finance allocated for privatizations and greenfield projects during the 1990s in developing countries were limited when the reliance on foreign debt is reduced. Moreover, the initial cost

[39] They have no control over whether the investors decide to use financing that creates exchange rate risk.

of financing will be high. However, the benefits will outweigh the risks and fluctuations of developing markets will be overcome through more robust investment (Gray & Irwin, 2003).

3.8.4. Inflation rate risk

Inflation rate along with interest rates risk is a macroeconomic risk that is a typical external factor, whose effects on a project can be significant over time. Moreover, they cannot be influenced either by the private or the public sector. Although the interest rates affect the debt burden of private agents, inflation is like a double-edged sword for both private and public agents in addition to the financial supporters within a Public-Private Partnership (PPP). The level of coverage for inflation rate fluctuations (up to 100%) and the contractual agreements can have a significant impact on the costs and revenues of private firms in both real and nominal terms that decreases or increases the financial or economic margins. The same case occurs with the indexation of costs and revenues. The risk premiums on equity and debt tend to rise during macroeconomic crises, such as the 2008 financial crisis, because of the credit tightening measures after the economic slump. The leverage falls both in terms of absolute value and the time duration, while most investors prefer short term investments. Inflation would increase discount rates and future cash flow when no taxes are assumed (Nelson, 1976; Rappaport & Taggart, 1982). The risk of inflation significantly affects the entire project financing (PF) model with a negative effect on the real returns to private investors and sponsoring banks that may create problems with debt servicing.

Assessing the effect of inflation on economic revenues and future cash inflows and outflows is a difficult and challenging issue with significance and intrinsic relevance. The problems arise since inflation is not considered a stable, unique, and easily measured concept. The harmonized index of consumer prices, which represents the combined rate of various baskets of products, is commonly used to measure general inflation. However, in project financing, the products and services that form part of the investment perimeter depend on the infrastructural investment. For instance, transportation of PF investments consists of an inflation factor that is markedly different from the traditional fuel oil investments, and in which each investment requires customized indexes.

Inflation rate, interest rate and foreign exchange rate are related formulas, such as interest rate parity, spot and forward parity, and purchasing power parity. The models highlight the interaction of the variables resulting in estimated currency exchange rates. However, arbitrage is not possible when the interest and inflation rate differentials are related to the forward or spot currency exchange rate adjustments, due to which the local debt underwriting cost should be similar to the cost of foreign debt. The changes in the currency exchange value are related to the local currency, due to which the investment of foreign investors will be protected, even when the revenues are in domestic currency (Dailami & Leipziger, 1998). The developing countries commonly have higher inflation and interest rates in comparison with stable developed countries but compensated by currency devaluation. The underwriting of foreign debt may seem to be cheaper, but currency deflations effectively cancel out the advantage that makes servicing of debt expensive.

3.8.4.1. Asset-liability management and sensitivity to interest, currency, and inflation risk

The financial and economic model of the project financing investment consists of three interactive spreadsheets that include the profit and loss account, asset and liability account, and

cash flow statement. The Asset-Liability Management (ALM) model highlights the accounting context and relates it to the interaction of the cash flow statement and profit and loss statement with the balance sheet that presents the basic core document. The basic method makes possible to estimate the impact of currency and interest rate differentials that arise from the liabilities and assets. Currency and interest rates are related to the expected inflation rate by the models. As a result, risk occurs due to the sensitivity or mismatches of the currency to fluctuations in the market interest rate that is measured by the duration of the debt. The mismatch in asset and liability arises when they are not related, which results in erosion of the differential as measured by net equity with the imbalance in the profit and loss, creating a net loss. In the case of high volatility, the profit and loss imbalance results in a net loss. This issue becomes more significant in the case of high volatility and a decrease in liquidity that commonly happens during recessions and economic crises. The imbalances are generally due to the different sensitivity and nature of individual/operative and financial assets, revenues, liabilities, cash flows and expenses.

The conventional hedging practices include balancing of liabilities and assets exposure to common risk factors that are influenced by external shocks with insignificant influence on the cash flow and profit and loss margins. Currency risk and interest rate exposure arise mainly due to imbalances in the sensitive liabilities and assets. The mismatched maturities have different price pressures.

Duration matching that creates a zero-duration time period can help reduce the risk of currency and inflation risk that ensures that a change in the interest rate will have no effect on the value of the equity. The duration becomes less over time as the maturity of the debt approaches that result in maximum exposure to risk with the declining debt that generally happens at the end phase of the construction and thereafter declines slowly. The foreign cost of the capital problem may be generalized conveniently within the framework of assets and liabilities, where the mismatch between different currencies will affect not just different currency values, but also exposure to the local and foreign interest rates that will increase the cost of capital.

The exposure to fluctuating currency exchange rate is unavoidable when the PF investments are financed at least in part with a stable foreign currency-denominated debt. Due to the strong link between interest rates, currency exchange rates, and inflation, the interaction between these rates has a significant impact on the transaction. This mismatch in currency exchange values affects the profit and loss account, balance sheet, and cash flow. The misalignment happens when the investments are not balanced through corresponding amounts in addition to matching maturities in the local currency, and not due to foreign denominated instruments that make the entire system vulnerable to elastic shocks.

The extent to which the assets and liabilities are exposed differently to changes in the interest rates affects the influence of adverse imbalance on the economic marginality that erodes the equity position and absorbs cash to the extent that it results in depletion of equity or cash. The important point is not the exposure of a liability or asset to the varying interest rates, but the balance (or un-balance) due to their exposure to fluctuations in rates. The impact will be limited if the values move in the same direction due to consistent elasticity. However, this is not the case in most PF cases whereby assets are commonly not sensitive to interest rate changes and is represented by the costs of construction with its cumulative and fixed type, short-term working capital and liquidity, which by definition is not sensitive to price changes.

On the other hand, debt that represents most liabilities in typical 80-20 asset to liability leverage is more sensitive to interest rate, thereby, resulting in potentially harmful imbalances. In case that the debts are long term with a fixed rate, the duration that measures the sensitivity to interest rate declines. In general, floating rate (indexed) debt is short duration with the time-limited to re-pricing span and taking into account its fixed part that is represented by the spread. The variable rate and short-term investment commonly have limited time period with balloon payments, in which the principal debt is paid and have higher duration compared to fully amortized regular periodic payments. The management of assets and liability will be more effective through trying to soften the sensitivity to shocks and fluctuations in the value of assets and liabilities as well as reducing the duration of debts. While the extension of debt payment is manageable depending on the financial needs of the project, duration remains fixed when the flexible rates with low spreads are preferred to fixed rates. Overall, project financing is more complex than the alternative modes of financing, and ALM risk management requires great sophistication. The sharing and transfer of risk from the public sector to the private consumers and investors is an important factor with the co-parenting and principal risk allocation being the main philosophy of project financing. Risk transfer, which is a key factor to manage the risk, is deeply related to the proper allocation as per the rule that it should be managed with the party that can best minimize the risk (Farrell, 2003).

3.8.4.2. The impact of inflation risk on economic marginality and financial sustainability

In general, the revenue and costs of private entity are fully or partially indexed to the current inflation rate. Indexation increases the economic marginality when the revenues have a positive margin over expenses. Inflation may also be positive for the private entity, particularly, when it increases beyond the expected rates and the debt is not fully indexed, which reduces the real face value.

Contractual inflation is different in comparison with market inflation due to the fact that risk is agreed upon by the public and private parties and always considering even the sponsoring banks of the latter. However, the market risk has a more multilateral and wider exposure to the inflation rate that is not always regulated through contracts. The inflation has an insignificant impact on the economic and financial margins, depending on the scope, goals, and design of the investment regarding the hot and cold categorization of revenues. Cold revenues occur for the private parties with no relation to the market trends, due to which they bear the inflation that is regulated with a revision method mentioned in the PF agreement with full indexation or a (small) discount. In contrast, the cold commercial revenues are completely driven by the market.

The costs taxonomy is even more complex with cold costs related to the fixed contractual investment returns and hot costs related to the hot revenues. Moreover, costs complexity exists due to the depreciation[40], taxes[41] and negative interest rates[42]. In addition, interest rates are related to the inflation, and the changes are represented in the form of real rates to the extent that the rate of interest is not completely flexible; for instance, fixed rates or the floating rates with a fixed spread. The private entity that owns the debt makes a real gain since the debt is devaluated. Concerning the preparation of a financial plan, a fixed rate of inflation over the

[40] Regardless of inflation, if it is calculated on fixed assets and the historical cost has not been reassessed.
[41] Calculated on a taxable basis, they are reduced at higher interest rates -inflationary- but also increased by impairment - non-indexed - depreciation and higher economic margins.
[42] Sometimes they float with basic rates and inflation.

entire concession period for management and construction is commonly considered. This does not represent the real rate of inflation that will happen over time and used contractually and economically. The bankability of the debt may be evaluated even when this provisional and formal parameter is considered to have been replaced by real inflation over a period of time. Van Horne (1971) had concluded that in allocating capital to investment projects, optimal decisions are unlikely to be reached, unless the expected inflation is included in the cash flow projections. Since infrastructural project financing models are long term (up to 30 years or even more), the cumulated real inflation and inflationary changes from the expected values are more important. Inflation is reflected in the costs and revenues most likely with different rates since each item has an inflation rate, but, in practice, the typical modelling involves a quick and dirty standard rate.

Inflation rate risk negatively influences the expenses before interest and taxes (EBIT[43] or EBITDA[44]) when the rate decreases particularly in comparison to the ex-ante modelling, which is based on granted bankability. As a result, a reduction in inflation may paradoxically represent the inflation rate risk for the private sector instead of an increase in the rate. The EBIT(DA) differential between operating costs and revenues decreases when costs and revenues are re-priced timely every year at a lower rate in comparison with the expected rate that may negatively affect the bankability.

3.8.5. Capital flows

A gradual trend toward liberalization of cross-border capital flow has been noticed in recent years among developed and developing countries. The trend has been significant in Europe, but also noticed in many key developing countries, such as China and India. The liberalization has been moderated to some extent recently in the face of the global economic slowdown. However, this trend has generally been of increased liberalization to flow of capital across the border. Authorities have taken measures to influence the liberalization of capital flows by temporarily targeting specific capital flows and not through re-regulation of a fixed significant section of the capital account[45].

Capital flow measures (CFMs) can impose certain costs on the economy[46]. They can tighten constraints to financing by limiting access to foreign capital, reduce discipline in public finances and financial markets, and limit options for residents to diversify the assets (Forbes, 2003, 2005a, 2005b; Aizenman & Glick, 2009; Greenwood, 2008). They can also encourage rent-seeking behaviour, corruption, a costly mentoring system, and promote repression of the financial sector that distorts capital allocation and prevents financial development.

The shift towards liberalization represents recognition by the governments of the benefits of the flow of capital. Capital flows can improve resource allocation efficiency at a macroeconomic level and the competitiveness of the local financial sector. In addition,

[43] EBIT is a company net income before income tax expense and interest expense have been deducted.
[44] EBITDA refers to earnings before interest, taxes, depreciation, and amortization.
[45] For instance, the government in some countries has aimed to redirect the flow of capital into instruments with longer maturity (Indonesia, Thailand, Brazil, and Uruguay).
[46] CFMs mean capital flow management through liberalization or the removal of measures that prevent smooth flow of capital. This concept consists of an underlying transaction and related transfer or payment that suggests unrestricted ability to covert local currency in foreign transactions. The liberalization legislation does not eliminate temporary re-imposition of trade liberalization under some cases. Moreover, the liberalization does not remove the need of maintaining prudential measures for stability of the financial system or ensuring national security.

advanced financial systems are required as countries develop that usually coincide with cross-border flow of capital.

Empirical evidence of the link between growth and financial development has been presented by Levine (2005). According to Obstfeld (2009), despite the uncertain link between growth and liberalization, a possible explanation for the trend towards increased liberalization of capital flow is that the development of the financial sector is associated with growth, and the financial sector growth in the economy with trade liberalization cannot be isolated from the cross-border flow of capital.

Capital flows can also result in the transfer of management practices and technology, especially in the form of FDI. The flow of capital can have collateral or indirect advantages in achieving short term goals, such as the discipline of the macroeconomic policy, financial sector development, and economic and trade efficiency (Kose et al., 2009; Parsad et al., 2003). At a macroeconomic level, the flow of capital allows countries to finance imbalances in the current account, for example, for productive investment or consumption smoothing. In addition, the imbalances can result in portfolio diversification (Ishii et al., 2002; Kose & Parsad, 2004; Dell'Ariccia et al., 2007; Henry, 2007; Chen, Jonung, & Unteroberdoerster, 2009; IMF, 2012a). Several studies have empirically verified the relationship between growth and flow of capital for FDI and capital equity flows particularly for undeveloped countries, but this relationship is vague for debt-creating capital flows (Edwards, 2007; Henry, 2007; Kose, Prasad, & Terrones, 2009; Aizenman & Sushko, 2011).

Effective liberalization of capital flows can help countries to realize the advantages of the flow of capital, support important economic goals, and reduce the costs of CFMs. However, some countries, such as India and China, have experienced sustained high growth rates regardless of closed capital accounts. Nevertheless, the flow of capital has played a key role in the growth in a few cases, like China with a large inward flow of foreign capital over decades contributing to increased technology, capital, and managerial expertise. Nowadays, several developing economies are introducing reforms to increase liberalization of capital flow, such as financial sector reform.

Capital flow liberalization benefits are larger in countries with developed institutional financial markets (Ishii et al., 2002; Dell'Ariccia et al., 2007; Parsad & Rajan, 2008; Kose et al., 2009; IMF, 2012a)[47]. The financial systems should allow free flow of capital, ensure that the firms have access to the required capital for investment projects, and allow individual investors and firms the capacity to diversify their investment and manage the risks. A strong financial system will help countries to manage and absorb the capital inflows and outflows, resulting in improved financial prospects for all the players. Liberalization of capital flow could be more successful when it is supported by strong monetary, fiscal, and currency exchange rate policies. Moreover, flexibility in the exchange rate would help support the real economy and boost resilience against the volatility of capital flow. Capital flow liberalization can be supported through increased trade opening that can enhance the ability of a country to attract direct foreign investment and supplement local demand with foreign demand that can reduce the effects of financial crises and economic slowdown. Moreover, liberalization of capital flow

[47] These authors suggest that financial development, macroeconomic stability, trade openness, and institutional quality are preconditions for successful liberalization of capital flow. Although the thresholds are different for these factors in different studies, the general conclusion is that advanced nations benefit more from liberalizations.

involves certain risks that are enhanced when the institutional and financial markets are not developed, leading to increased vulnerability to economic crises and macroeconomic issues.

Financial liberalization can serve as an incentive for firms to take more risks, particularly when there is not adequate financial supervision and regulation, resulting in increased capital flow volatility. Liberalization of capital flow has historically been followed by the financial crisis and significant output losses[48]. Although the causality is not easy to assess due to econometric problems for estimation, past events suggest risks related to financial liberalization in addition to the required prerequisites. Moreover, countries with CFMs have experienced infection that negatively affects the economy (Henry, 2007; Ishii et al., 2002). In addition, poor fiscal and macroeconomic policies can worsen the crises. In this context, full liberalization cannot be considered as ideal for all countries. The extent of liberalization of a country at a particular time depends on the circumstances, especially institutional and financial development. Careful measures to liberalize flow of capital would result in significant advantages over the long run. The countries can take a large step towards increasing liberalization of capital flow before all the required threshold for institutional and financial development are reached for institutional and financial development that will spur the growth in this dimension (Dell'Ariccia et al., 2007; Mishkin, 2009)[49]. In addition, trade liberalizations should be managed effectively especially when the thresholds are unmet due to higher risks (Kose et al., 2009). Exceeding important thresholds for the institutional and financial development does not reduce the risks related to capital flows. In fact, the 2008 financial crisis has suggested that volatile and large flow of capital can present risks, even when countries have developed market and liberalised policy and have also benefited from the flows of capital. In most developed countries, for instance, financial regulations and supervision have failed to avoid long term asset bubbles and increased domestic demand due to availability of cheap financing options. Past experiences suggest the requirement for policy makers to remain cautious of the risks. There is a continuous need for implementing effective frameworks for managing the risks of inflow of capital that can worsen due to financial innovation (Aspachs-Bracons & Rabanal, 2009; IMF, 2009, 2012a, 2012c). Most countries with extensive and long term CFMs would still benefit from increased liberalisation. For instance, significant growth has been experienced by emerging economies due to enhanced liberalizations. Macroeconomic support factors have resulted in increased growth, high foreign reserves, and low inflation in emerging economies. The outflow of capital consists of relatively higher share of equity and FDI flows. In addition, financial development shows the growth in the financial market depth and improved supervision and regulation with improved governance and institutional quality, and openness in trade over a period of time (IMF, 2011b, 2012c, 2012e). Global capital flows can be affected through liberalization of larger economies that could negatively affect the global outflow of capital similar to the diversion of flows in some economies with new CFMs or limited liberalization to more open markets (IMF, 2012b). The extent of the multilateral event is not clear and requires further inquiry (IMF, 2011e).

[48] Examples include Turkey (1994 and 2000 crisis), Mexico (1994-95 crisis), the Asian crisis of 1997-1998, Korea (1997 twin crisis), Russia (1998 crisis); Iceland, Estonia, Ireland, Lithuania, Latvia, and others during the 2008 global financial crisis.

[49] Many different countries with under developed financial markets, such as Kenya, have benefited from financial liberalization. According to Mishkin (2009), financial globalization spurs financial development through reduction in incentives for repression, encourage fiscal reforms including better requirements for accounting standards and disclosure of financial information, and improve efficiency of the financial sector to compete with foreign banks.

3.8.5.1. Inflows

One of the main problems faced by most economies in the presence of institutional setup and policies that can help effectively absorb the capital inflows and divert them to productive investment projects. Capital inflows supplement the domestic savings that can help support local investment, enhance trade finance and involve technological spill-overs (particularly through green-field FDI). Reforms in the infrastructure can allow economies to absorb the inflow of capital. They include measures to increase domestic security markets, develop financial products, and improve the financial supervision and regulation, while streamlining the rigidities (IMF, 2011a, 2011c). For instance, investment in improving the infrastructure needs large and long duration funds that can be supplemented by foreign investment. The availability and intermediation of the financial resources are possible through a well-developed and integrated financial security market[50]. In general, a deeper capital market would result in an increase in the capital recipient country absorptive capacity in the face of inflow surges reducing the fluctuations in capital flow (Burger & Warnock, 2007). However, addressing the surges can be problematic for policymakers (Bank for International Settlements, 2008; IMF, 2011b). Capital flow surges can result in macroeconomic and financial volatility that could overwhelm the local financial markets and stretch the capability of the macroeconomic policies addressing these changes. The surges can also result in increased volatility in asset prices and bubbles, credit boom, currency rate appreciation, disturbances in the money market, unsustainable decrease in the risk premia, and disrupted monetary policy transmission. The problems can result in an increase in the balance sheet and many weaknesses over time, as discussed before in terms of actions that happened during the recent crisis. The surges can result in reversal or sudden stops to the inflow of capital.

3.8.5.2. Outflows

Sustained, sudden, or large outflow of capital can also pose significant challenges for policymakers. The capital outflows are natural outcomes of liberalization since foreign investors attempt to boost their returns, and local investors expand their operations or diversify their portfolio. These outflows can sometimes be disruptive, and they can lead to an economic crisis. The disruptive capital outflow can be a result of domestic factors, but they can also be fuelled by international factors, including the international appetite for risk, liquidity, and increased income. Moreover, the disruption can arise due to contagion effects, investor confidence, as well as financial and trade linkages (Fratzscher, 2002; Claessens & Forbes, 2004).

The disruptive outflow of capital can result in severe problems, such as currency value collapse, reserve depletion, output loss, and financial stress. The sustained and large outflow of capital can pose a challenge for policymakers to stabilize exchange rates and finance availability (Magud, Reinhart, & Rogoff., 2018).

Creating financial and economic resilience is critical for managing and affording safe outflow of capital. The structural and macroeconomic policies should attempt to enhance the resilience of a country to the outward flow of capital. The past historical record demonstrates the importance of devising strong macroeconomic policy for avoiding large capital flow imbalances and dependence on international financing. However, large stock imbalances can worsen vulnerabilities to the balance sheet and increase crises risk, as it happens in the case of

[50] The development of the security market requires a benchmark yield curve, and other structure reforms to improve monitoring of third-party, credit like bond insurance and credit bureaus, effective systems for new security offerings, and effective hedging tools for investors.

countries with a significant reduction in international investment in many CEE and countries in southern Europe, during the years before the recent global financial crises.

Capital outflows need to be handled mainly with structural, macroeconomic, and financial policies. With the outflow of capital without any possibility of a crisis, policymakers have larger scope to adjust the financial and macroeconomic policies to focus on the implications, such as Russia, Korea, and South Africa between 2009 and 2011 (IMF, 2012a). The policies are required to ensure external adjustment and address the multilateral and domestic costs of CFMs that avoid damage to the market perceptions.

3.8.6. Financial policy bias

During the past decade, annual investment in renewable energy projects has increased from USD 50 billion to USD 250 billion. However, doubling the present investment is required for the energy-related emissions of greenhouse gasses to peak by 2020 and then reduce them. The transportation, agriculture, and water sectors also require a significant increase in sustainable investment instead of traditional methods focused on profit. Nevertheless, the investment in upgrading the infrastructure only accounts for 1% of the asset allocation for a retirement fund, and just 3% of this investment is for renewable energy projects.

Regulation of financial institutions and retirement funds, including the ownership structure for the assets and the accountability of public finance can hinder investment in green energy projects in three different ways. Firstly, the economy remains restricted to legacy assets, since investors are discouraged from investing in the development of the required infrastructure, due to which pollution levels remain the same. Secondly, a bias in capital investment, due to high up-front costs results in a de factor bias against green energy. Thirdly, regulations concerning green energy investment may favour traditional instead of sustainable energy technologies (Bloomberg New Energy Finance, 2013).

Some of the crucial issues to understand the obstacles to green energy investment are the following ones (Blomberg New Energy Finance, 2013):

- Regulations regarding Solvency II that govern the requirement for insurance firms to hold capital in low-risk and liquid instruments, such as government bonds and equities, can reduce the risk appetite for the firms to invest in long-term projects, where there is not yet a developed market, even when the developed market is established, and the performance potential is understood.

- Basel III rules limit the financial firm ability to offer non-recourse long-term financing. Although these rules affect available capital for all types of infrastructure projects, renewable energy projects are particularly affected since they require high up-front costs. The rules increase the cost of short-term loans that form the core role of the financial firms. Banks have become overly restrictive in advancing loans due to concerns about securing long-term finance.

- Regulations regarding the fiduciary responsibilities of trustees of the pension fund have forced financial firms to take on a narrow risk-adjusted focus on returns. However, the funds do not require trustees to consider the systematic risks, including environmental pollution and climate change without focus on governance and social dimensions, due to which investors tend to avoid the investment projects. In particular, the

write-down risks, due to the adverse environment that would reduce the value of the investment are not considered.

- Pension funds represent an important potential for investment in clean energy. However, existing rules on matching the liabilities and assets tend to force the trustees to take on a more conservative approach for allocation of the asset. In addition, the rules for determining the pension protection fund fees can discourage investments.

- Laws and regulations regarding risks disclosure by public companies, commonly do not require risk identification concerning extreme weather, climate, and the overall environment. However, this type of risk can be a significant risk similar to other risks that have to be disclosed, like upcoming regulation and disputes.

- Legal structure existing in many developed countries, such as Canada and the US, allows private investors to avoid double taxation, including limited partnerships and investment trust. However, this legal structure tends to be focused on certain assets, and there might include a lag for new types of assets, including renewable energy projects and aggregated energy efficiency and distributed generation portfolios.

- Public sector accounting rules can provide the incentives and choices available for policymakers to promote the deployment of clean energy. Liabilities regarding the feed-in tariffs, which are also known as green certificates, may be included in the spending or tax amount, even when the costs are to be borne by the end consumer. This may force the treasury department to provide limited support for renewable energy projects.

- Rating agencies are commonly used as an agent to protect investors from investment risk that may discourage investment in clean energy projects. The methodologies that are used by rating agencies focus on near-term risks that are quantifiable instead of longer-term systematic risks. The reliance of the rating agencies also prevents cross-border investment in countries with low rated investment projects.

- Regulations regarding the aid by the state can prevent the public financial sector from offering the required support for the development of the infrastructure. New technologies that require high capital such as marine power, carbon collection and storage, and second-generation biofuels need support for initial deployment, but banks that offer the required loans infringe on the regulations.

It is worth noting that the Dodd-Frank law in the US[51] has not affected the investment in renewable energy projects. This highlights the fact that tighter rules do not always constrain investment in green energy. The investment bias that discourages the financing of green energy projects needs to be identified and eliminated to attract investment for sustainable infrastructure upgrading for renewable energy investment projects (Bloomberg New Energy Finance, 2013).

3.8.7. Tax regime and tax incentives

Different tax incentives have been offered around the world to encourage the development of green energy. These incentives are mainly in the form of tax credits and deduction. By

[51] The Dodd–Frank Wall Street Reform and Consumer Protection Act (commonly referred to as Dodd–Frank) is a United States federal law that was enacted on July 21, 2010. This law reformed financial regulation in the wake of the Great Recession and introduced changes that affected almost all federal financial regulatory agencies and almost every part of the country financial services industry.

removing some of all the tax, the investors can be encouraged to invest in renewable energy projects. These incentives indirectly help in reducing the cost of clean energy production. The impacts of the tax incentives are immediate, and they are easy to implement and manage.

Tax incentives are often confused with direct government subsidies for producing renewable energy. However, the tax incentives are different and only related to the reduction of taxes owed by investors, companies, and consumers that have different tax liabilities and some of them may not fully benefit from the incentive. This is the case when the taxes owed are not sufficient, due to which the tax rebates tend to be insignificant. It can be a serious disadvantage of the use of incentives for encouraging renewable energy investment, as well as the reason for that the tax incentives are commonly supplemented by other renewable energy policies. Ten common incentives that are used to encourage renewable energy investment are discussed in the following subsections (Clement et al., 2005).

3.8.7.1. Investment tax incentives: large-scale applications

Investment tax incentives include deductions or credits to income for a percentage of the investment made in renewable energy equipment, fixtures, and land. Deductions in income tax result in reduced taxable income, while credits offset taxes payable. The application of tax credits to large scale renewable energy projects is only available to institutional investors, but not to individuals who purchase solar or wind power equipment. In some cases, a maximum or minimum is fixed for the amount of investment to be qualified for tax incentives. For instance, in the case of Ireland, investments of up to 50% of the project cost of 7.5 million pounds (whichever is less) qualify for the tax incentives. In many countries, large scale application of tax incentives requires certification of clean energy equipment for performance and safety.

One common criticism of tax incentives for renewable energy investment is that they encourage the installation of renewable energy plants, and do not encourage electricity production. For example, during the 1980s, companies in California had rushed to invest in wind turbine installation to benefit from the tax incentives that lead to the inefficient installation of turbines, due to the lack of assessment of the ideal geographical location. In some countries, production-based tax incentives have been introduced to encourage efficient production of green energy. Investment tax incentives still remain the preferred investment incentive, particularly for smaller clean energy faculties (Clement et al., 2005).

3.8.7.2. Investment tax incentives: customer-sited applications

Tax incentives generally apply to customer-sited small renewable energy projects. The incentives award clean energy equipment that is installed onsite for the generation of electricity to commercial or residential buildings. The tax incentive usually includes the cost of equipment installation and the cost of the equipment itself. The cost of installation of the systems represents a significant share of the total costs. That is why the tax credit offers strong incentives for businesses and consumers to purchase clean energy. While some countries use production-based incentives, the cost of monitoring the performance can be significant. Therefore, the tax incentives in most countries have remained investment-based. These incentives are provided for buying renewable energy equipment and incentives (Clement et al., 2005).

3.8.7.3. Production tax incentives

Production-based tax incentives offer tax credit at a fixed rate per kilowatt-hour (kWh) that is produced by the renewable energy company. According to the Oak Ridge National

Laboratory in the US, the 1.5 cents/kWh federal production tax credit can reduce the levelized life cycle cost of wind power by 25%. The production tax incentive has become popular particularly for large-scale clean energy facilities since it encourages efficient production of renewable instead of large-scale installation of facilities. This tax incentive system can help ensure that the main goal of the clean energy tax incentive policy of efficient and sustainable clean energy production is achieved (Hadley, Hill, & Perlack, 1993).

3.8.7.4. Property tax reduction

Reduction in property taxes is another tax incentive that can result in the elimination of the entire property taxes on land that is dedicated to the renewable energy facility. The tax incentive can be particularly effective for capital incentive renewable energy projects since most of the time property taxes lead to a higher cost burden that is ultimately borne by the customer. Property tax reduction incentive can help in creating tax parity with traditional fuel oil-based electricity facilities.

3.8.7.5. Value-added tax reductions

A lot of countries have value-added taxes (VAT) apart from income taxes. In general, the incentive protects renewable energy producers from giving taxes on up to 100% of the value that has been added between the purchase and the sale of renewable energy equipment. The countries that offer VAT incentives reduce the VAT rate for the locally assembled equipment used for renewable energy production. In other countries, only a share of the VAT on renewable energy equipment is eliminated.

The implementation of VAT can prevent investment in clean energy projects in the case of the VAT is charged on inputs to the energy production instead of the outputs. When it is compared to traditional electricity generation technologies, renewable energy projects require a lot of capital. As a result, companies have to pay a large VAT in the case of the tax is imposed on the capital equipment. The problem is increased when the VAT is paid on the production inputs instead of on the outputs. Companies in many countries pay VAT on the inputs that they buy and collect the taxes on the output that are sold. The net tax is paid to the tax collection agency at the end of the period. In the case of the price is fixed and no VAT is collected, the producer of the renewable energy cannot recover the tax paid on inputs resulting in lower earnings and cash flow (Hadley et al., 1993).

3.8.7.6. Excise tax reductions on sales

Reductions in excise tax make possible for customers to avoid payment of the sales tax on the purchases of clean energy and its related equipment. The tax incentives that can eliminate up to 100% of sales tax influence the levels of demand for clean energy. In some countries, the electricity consumption is taxed with an exception for electricity that is produced from clean energy. In other countries, the purchase of clean energy equipment and the plant is exempted from taxes. Moreover, tax discounts are offered in some countries on the purchase of renewable energy systems and equipment. This tax incentive type is more appropriate when it is related to performance and technology standards.

3.8.7.7. Import duty reductions

Reductions in import duty can encourage investment in renewable energy projects. The incentive is effective in the early phases of renewable energy development in a country before the host country gains the required technological know-how and develops its own

manufacturing facility. Import duties can depend on technology based on the status of local manufacturing. The duties should be in accordance with the rules of the World Trade Organization (WTO). Import duties on the entire system, as opposed to the duties on components, influence the local manufacturing and transfer of technology regarding green energy manufacturing. The local renewable energy industry in a country starts through the manufacturing of renewable energy parts and then progress to the development of complex systems and components and later entire systems. The countries that intend to develop the renewable energy industry commonly impose lower import duty for renewable energy components compared to duties for the entire systems. This leads to increase and develop local manufacturing of components and parts and discourages the import of the entire systems.

3.8.7.8. Accelerated depreciation

Depreciation expenses represent the decline in the value of capital assets over time due to wear and tear. The non-cash expense is deducted from the balance sheet that reduces the taxable income. Electricity production plants are generally depreciated over a period ranging from 20 to 30 years that represents the estimated useful life of a capital asset. Investors of renewable energy systems are allowed to reduce the expenses at a faster rate – usually at 15% – than allowed for other assets. The accelerated depreciation helps in reducing the income used for tax calculations during the life period of the asset resulting in reduced taxes. That is why accelerated depreciation can be a strong investment incentive for renewable energy investment. Accelerated depreciation tax incentive tends to be front-loaded since income during the projects first five years is weighted more compared to the income that is received during later stages. Due to depreciation shields income received during the early stages more than at later stages, accelerated depreciation has a strong impact on investment decisions since it affects the net present value of a project. The tax incentive is particularly effective for projects requiring large up-front capital like renewable energy projects.

3.8.7.9. Other types of tax incentives

In addition to the previously mentioned types of tax, which are very common and well known, there are other types of tax that could rarely be used, including for instance the tax incentives for research, development, and demonstration (RD&D) aimed to accelerate the process of technological innovation in the domestic market. This type of incentive encourages firms to take greater risks of investing in RD&D for technological development of cost reductions. The main emphasis of RD&D programs on targeting specific issues concerning the domestic market. Moreover, the tax credit for increased research helps in creating the capacity of the local market to compete in foreign markets.

A lot of countries tend to provide RD&D funding instead of tax incentives. Providing funding for RD&D is a common type of support for the development of renewable energy in many countries. The funding allows governments to have a greater influence on the type, size, and quality of research carried out for the development of renewable energy. The problem with government support is that the funds tend to be cut that negatively affects renewable energy projects. In contrast, RD&D tax credits encourage increased private sector investment resulting in the development of innovative technologies without any influence or oversight of the government. It should be noted that investment in research of the renewable energy technologies is not likely without support of the government in countries with undeveloped renewable energy equipment manufacturing industry. Tax credits are effective in encouraging RD&D only in countries where the renewable energy industry is large and profitable. In the

case of the industry is at the development stage, the tax incentives will not have a significant effect in encouraging investment in RD&D projects. In this situation, government funding is likely to have a greater effect compared to tax credits. The countries that offer tax credits for RD&D include Japan, Canada, France, the UK, and the US. However, the tax credits are not commonly influenced by the policy of the government in encouraging renewable energy. In the collected sample, South Korea was the only country that provided RD&D tax credits for research in the development of renewable energy technologies (Hadley et al., 1993).

3.8.7.10. Tax holidays

Tax holidays refer to limited time exemptions from certain taxes, such as property, excise, VAT, or income. In general, the tax holidays are offered as an incentive for a specific time period and expire at the end of the exemption period ends, after which income is taxed at a regular rate. Like accelerated depreciation and other tax exemption options, tax rebates and tax reductions have front-loaded benefits. In other words, the benefits of the incentives are more pronounced during the initial stages and influence the net present value of the clean energy project.

3.8.7.11. Taxes on conventional fuels

Tax on fossil fuels is similar in most countries. The taxing of fossil fuel emissions that contributes to pollution indirectly acts as an incentive for renewable energy development. The taxes on fossil fuel vary among countries. Thus, some countries exempting renewable energy manufacturing companies from paying taxes on traditional fuels. The taxes may be different depending on the emissions or imposed at a flat rate. The Kyoto Protocol that was framed in 1997 and signed by 84 countries extended the 1992 United Nations Framework Convention on Climate Change (UNFCC), including aims to reduce harmful greenhouse gases. The UK imposed the Climate Change Levy on a number of businesses that were designed to be revenue natural, where the revenue collected was to be recycled back to businesses through lowering the National Insurance Contributions (NICs) and also increase the capital allowance for investment in the energy sector. Other European countries, notably France, Finland, Czech Republic, Germany, Norway, Sweden, and Spain, have also increased taxes on traditional fuels. However, the shift has been controversial since the taxes have negatively affected the global competitiveness of the local products. Some European countries have taxed fuel oil products heavily as per the Kyoto Accord but have imposed low or no tax on coal (Hadley et al., 1993).

3.9. ENVIRONMENTAL AND SOCIAL RISKS

Since this study aims at analysing different risks associated with renewable energy projects and related investments, it should be discussed another group of necessary and possible risks that can face these projects. These are the environmental and social risks. This topic is one of the relevant issues to be discussed by different researches because it does not only concern energy researchers, but also researchers from different scientific fields, such as economics, sociology, political sciences, law, engineering, energy, environment, or health, among others.

3.9.1. Environmental impacts of renewable energy technologies

While fossil fuels have an important impact on the environment by increasing CO_2 emissions and air and water pollution, renewable energy projects, such as wind, solar geothermal, biomass and hydropower, have an impact on our environment. The impact of renewable energy projects on environment mainly depends on different factors, such as the type of technology used and the geographical location in addition to some other factors. By understanding the current and potential environmental issues associated with each renewable energy source, we can take steps to effectively avoid or minimize these impacts since they become a larger part of the electric supply.

3.9.1.1. Wind energy

Wind farms installed on land reserved for agriculture have the lowest impact on the environment. They occupy less area per kWh power produced than other energy sources, except rooftop solar panels without significantly impacting lands used for crops. They have an operational life between 20 to 25 years producing energy within just three months of construction, and involving minimum greenhouse gas and air pollution (Hunt, 2001). No pollution or emissions are produced during the operation of wind power plants and substituting the base-load. In comparison with coal or diesel power generation, it will result in a net reduction in emissions of harmful greenhouse gases and ensures biodiversity with minimum noise impact and risk to birds since wind turbines rotate slowly in terms of revolutions per minute (Macintosh & Downie, 2006).

Wind turbine technology has improved significantly, which results in more energy efficiency and reduced noise. Designers have focused on reducing the noise since it results in reduced energy output. Siting of turbines, operational management, and approval process allow management of noise levels near residential areas. For wind farms, the noise limit is 35 A-weighted decibels, only 5 A-weighted decibels more than a quiet country village and the background level noise (NSW Department of Environment Climate Change and Water, 2010). Infrasound and low-frequency sounds, which is usually below the threshold of human hearing, can be heard in all places around. The sounds are emitted naturally by resources like rivers and wind and by artificial sources, such as air conditioning and traffic. Modern wind turbines have blades located upwind rather than downwind that greatly reduces the infrasound. Health authorities and scientists have confirmed that the low levels of sound generated by wind turbines pose no health risk (Leventhal, 2006). A slight shadow might be created by the turbines on nearby areas when the sun goes behind the turbine. It could be easy to prevent this problem by installing the wind turbine at a location where unacceptable shadow flicker is avoided or shutting off the turbine for a period of time when the sun is at a position that results in a flicker. The New South Wales (NSW) Department of Planning assesses shadow flicker to ensure any potential impacts are resolved when installing wind farms ((NSW Department of Environment Climate Change and Water, 2010).

Several studies have investigated the impact of wind turbines on birds, bards, and other avian species (Sovacool, 2009; Willis et al., 2010). Birds could smash into the stationary or moving turbine blades, and collide with nacelles, towers, and distribution lines. These risks are increased when the wind turbines are placed on upwind slopes, ridges, or near the birds migration routes. Some avian species like bats face significant risks, due to low air pressure near the blades that can result in internal haemorrhaging (Baerwald et al., 2008). An assessment of mortality rates of bids near wind, nuclear, and fossil fuel power plants in the US was carried

out by Sovacool (2013). The risks to birds appear to be the main risk for wind turbine blades and towers. The most significant risk from fossil fuel related to the climate change that could destroy natural habitats of the birds. The risk of nuclear power plants is at uranium mine sites and cooling structure. However, on aggregate fossil fuel are about 17 times more harmful to birds per GWh in comparison with nuclear and wind power plants.

For turbines that are no longer in use, the decommissioning is a standard process that does not involve many costs. A lot of old wind power plants are being replaced with more efficient new power plants in Europe. Present wind sites have a lot of value with established local community acceptance for electricity transmission and generation (NSW Department of Environment Climate Change and Water, 2010).

3.9.1.2. Solar energy

Solar power has been accepted as a safe and effective technology for the generation of electricity. The photovoltaic (PV) technology used in a solar power plant can produce much more electricity during the estimated useful life in comparison with the electricity used in its manufacturing. A 100W PV panel will help reduce the emissions by up to two tons of carbon-di-oxide. PV systems do not make any noise or pollute the environment during operation. The technology poses far less environmental risks in comparison with other sources of electricity. However, chemicals that are used in the manufacturing of PV could release in the air, groundwater, and surface water in the plan of manufacturing, site of installation, and recycling or disposal facility (Klugmann-Radziemska, 2011).

Different chemicals are used in the process of manufacturing PV devices. The types of amount of chemicals used in producing PV panels differ depending on the type of panels manufactured. However, according to the Toxic Release Inventory System (TRIS) database of six PV production companies prepared by the US EPA, the chemicals are not entirely released in significant quantities. Chemicals released into the air from PV facilities have been reported to form a pile of air and fugitive air emissions. All six PV manufacturers reported air stacks emissions for some chemicals used in drilling and cleaning. The compounds released during the manufacturing of the PV devices are acetone, isopropyl alcohol, ammonia, methanol, and trichloroethane (Electric Power Research Institute, 2003). The size of the device determines the impact on the environment.

Large solar power plants could impact the habitat due to land degradation. The negative impacts of solar power plants can be reduced by sitting them at locations that will have a minimum impact on the environment, such as transmission corridors and abandoned mines. While water is not used for generating electricity through solar devices, it is required for the manufacturing of PV parts. Thermal electric plants, such as concentrated solar power plants (CSP), use water for cooling. The use of water depends on the plant location, design, and cooling system.

3.9.1.3. Geothermal energy

Geothermal power that is generated and stored in the Earth is a relatively safe energy source that has minimal impact on the environment. On a global scale, the use of geothermal energy is increasing every year, and nowadays it has become a popular alternative to burning fossil fuels. The generation of electricity results in reduced harmful gas emission in comparison with electricity sourced from fossil fuel. According to the International Atomic Energy Agency

(IAEA), the global warming impact is reduced by almost 95% when 1 kWh of fossil power is replaced by 1 kWh of geothermal power.

Geothermal power is mostly harmless to the ecology; however, the power source has certain shortcomings particularly when there are no appropriate risk minimization efforts and monitoring and any large drilling and construction project can have an impact on the landscape, ecology, and economy. Moreover, geothermal development could have certain negative impacts if appropriate mitigation actions and monitoring plants are not in place. Strict regulations have been enforced in certain countries to reduce the environmental effects associated with the geothermal power generation. The regulations are strict in certain regions, while they are lax in other regions. Issues that are generally addressed through government policies include quality of air, noise, geologic hazards, waste disposal, water quality, and wastes (Goff, Brophy, & Goff, 2009). Groundwater protection is critical during the drilling phase of the project. The water needs to be managed in a sustainable manner since it forms a vital part of livelihood. Thus, groundwater is a critical part of the eco-system that sustains the habitat. The main impact during the construction stage of the plant occurs due to the drilling rig. However, once the construction is completed, and the plant becomes operational, the plant does not pose an environmental risk. Geothermal plants meet strict local and international clean air regulations and the emissions are commonly below the critical threshold (Dumas et al., 2013). Environmental regulations tend to create several obstacles but are necessary for groundwater protection. The regulations should also address pressure issues, micro-seismicity, soil protection, and surface issues. Legislations concerning manufacturing, work safety, and operations drilling, mining, construction, fracking, and related activities should also be applied to geothermal power generation.

3.9.1.4. Biomass

Generating energy from biomass involves combustion of a feedstock similar to fossil fuel power plants and involve similar environmental concerns related to harmful gas emissions and water usage. Water is required for biomass plants similar to natural and coal power plants for cooling. Moreover, the impact of biomass plants on emissions and land use depends on the type of feedstock (energy crop or a waste stream) used for power generation. Growing, transporting, harvesting, and gasifying or burning biomass feedstock results in harmful emissions. Previously, biomass power production was considered to cause zero power emissions since the biomass harvested absorbed carbon that was released by combustions. Nevertheless, biomass power production from certain feedstock is now known to cause significant harmful emissions. Corp residues like wheat straw and corn stover are less harmful biomass sources, energy crops that do not take on land used for food crops, industrial and municipal wastes, and forest and sustainable wood residues (Spath & Mann, 2004).

3.9.1.5. Hydroelectric power

Hydropower represents one of the green energy resources that commonly does not affect the quality of air. However, dams constructed for the generation of hydropower could have a significantly negative impact on the surrounding ecology, including fish and the depending wildlife. Large dams in flat basins result in flooding of large areas of land that destroy natural habitats. A large number of people would also have to be relocated for the construction of dams. In addition, construction of dams leads to anaerobic decay of the plant life, and the migratory pattern of fish like trout and salmon is disturbed. Dams also prevent the flow of sediments downstream to fertile lands and the intrusion of saltwater into the delta creates scarcity of water

for irrigation. Moreover, large dams pose a health risk as they become breeding ground for mosquitoes. Furthermore, loss of habitat is experienced downstream since water in the dams is warmer as compared to normal river water[52].

3.9.2. Social acceptance of renewable energy technologies

Social acceptance was one of the main research topics of energy social scientists (Devine-Wright, 2011; Sovacool & Lakshmi Ratan, 2012; Hofman & Van Der Gaast, 2014). Evaluation of social acceptance is important, just like the economic and technical assessment of renewable energy projects (Musall & Kuik, 2011; Batel et al., 2013). Public opposition to measures for promotion of economically and technically feasible renewable energy technologies in a given location or time period may prevent successful implementation of green energy projects. The opposition to clean energy development could result in a delay or prevent completion of a clean energy project creating problems in achieving societal or environmental goals concerning the reduction of the harmful emissions (Devine-Wright et al., 2017).

All power generating technologies have a negative impact in one way or another. While renewable energy projects are deployed in many locations without any incident, there have been clashes with the public in some locations (Dütschke & Wesche, 2014). For instance, the efforts of the French President Macron to promote clean energy by increasing taxes on fossil fuel has been met with great opposition by the yellow vests (gilets jaunes) mainly from the rural areas, who face high costs due to long commutes. Acceptance of policies for promoting clean energy can be low since the measures are perceived as disruptive. Wind energy plants have been opposed in some location due to shadow flicker, noise, and impact on the local landscape and ecosystem. Moreover, some criticize green energy to be too expensive and inefficient. The low acceptance of clean energy initiatives represents a significant obstacle that should be overcome to promote the production of energy from less harmful sources (Dermont et al., 2017).

Acceptance involves a reaction to something proposed by an external party, and the act of acceptance refers to giving an affirmative reply to an issue. Public acceptance can be defined as a positive view of an initiative or technology resulting in reduced resistance and leading to supportive behaviour when required (David Musall & Kuik, 2011; Huijts et al., 2012; Hitzeroth & Megerle, 2013). Acceptance without the required behavioural support can be defined as tolerance.

The success of clean technology largely depends on social acceptance. That is why a clear understanding of the elements that affect public viewpoints is necessary. The elements of social acceptance mentioned in the 1st Policy Brief in POLIMP are the following ones (Hofman & Van Der Gaast, 2014):

- Recognition of negative impact and knowledge of different technologies (such as renewable energy);
- Domestic context;
- General assessment of risks, costs, and advantages of technologies;

[52] Sanguri, M. (2013). "What are the negative effects of building large hydroelectric dams?" (https://www.brighthubengineering.com/geotechnical-engineering/71200-negative-impacts-of-hydroelectric-dams/).

- Equality and justice in the decision-making process; and
- Belief in stakeholders and decision-makers.

3.9.2.1. Awareness

Awareness of the negative impact of traditional power generation technologies and knowledge of clean energy alternatives affect social acceptance. A positive relationship exists between awareness of the environmental impact of climate change and the preparedness to make the desired change. In general, increased awareness results in improved willingness to oppose the technologies that lead to climate changes thereby resulting in acceptance of green technologies (Spence, Poortinga, & Pidgeon, 2012; Strazzera, Mura, & Contu, 2012; Thøgersen & Noblet, 2012).

The public should not only be aware of the dangers of traditional fuel oil-based technologies, but also become familiar with the alternatives that do no or little harm to the environment. The public should be provided complete, timely and balanced knowledge about the new technologies, including related benefits, risks, and costs. Renewable technologies are not considered if the public is not made aware of the technologies (UNDP, 2010).

3.9.2.2. Fairness

The decision-making fairness and preparatory process affects the attitude of the public towards a project to promote renewable energy technologies. The public perceived the decisions to be fair if they are open and transparent and the stakeholders are allowed to give feedback, and their input is valued by the decision-makers (Terwel et al., 2011). Raising awareness of technologies is critical to allow all stakeholders to participate in the decision-making process. If decision-makers are considered by the public to be trustworthy and honest, the perceived fairness will be higher. The inclusive and fair process will result in increased trust of the decisions makers. Moreover, many studies highlight the fact that commute co-ownership or joint ownership of projects can result in increased social acceptance (Dütschke & Wesche, 2014; Strazzera et al., 2012).

The WISE power project[53] is related to the social acceptance that introduced five values that should be respected to enhance procedural justice, particularly for wind energy projects. The principles consist of the following elements (Musall & Kuik, 2011):

- Responsiveness: hearing the concerns of stakeholders;
- Openness: information sharing;
- Flexibility: open to amending decisions and procedures based on local requests; and
- Accountability; participation, monitoring and evaluation ongoing processes.

[53] WISE Power is an European project about the social acceptance of wind energy, aiming at significantly improving local engagement and support for wind turbines, while enhancing local community participation in the planning and implementation of wind energy projects.

3.9.2.3. Assessment of cost, risks, and benefits

A proper analysis of costs, risks, and benefits can help increase knowledge of renewable energy that will lead to social acceptance of the project. The evaluation of renewable energy should ideally be objective, but it is actually subjective because of the lack of full information regarding the technologies. The evaluation is commonly based on the level of awareness or an evaluation by a government, project developer, or an interest group. While full rationality is assumed in the assessment of risks, costs, and benefits, evaluation is not based on rational assessment alone. Ethics, emotions, and social needs influence the overall evaluation of renewable energy technologies. Therefore, the evolution should be regarded in the context of particular fears and emotions, such as the local context, level of trust, and other subjective issues.

3.9.2.4. Local context

In general, the public has a positive view of renewable energy projects. However, public resistance occurs in some localities. The resistance to change is normal in the environment due to personal fear of the loss in the quality of life (Sijmons & Van Dorst, 2012). The local views should not be regarded as “Not in my back yard” (NIMBY) behaviour, and both the emotional and rational parts of the debate need to be identified, assessed, and addressed (De Boer & Zuidema, 2015).

There is a disproportionate percentage of the negative influence of the development by the local community. Therefore, a strategy needs to be devised for sharing of the benefits that can include local (co-)ownership, financial compensation, and in-kind benefits (direct local improvements) (Dütschke & Wesche, 2014).

It should be noted that in some countries, such as Denmark, the successful involvement policies for local communities in the renewable energies projects, including possible ownership provided a concrete example on the acceptance at the local level (Anshelm & Simon, 2016; Hvelplund, Østergaard, & Meyer, 2017).

3.9.2.5. Trust as a cross-cutting issue

Trust is an important element that impacts the acceptance of the decisions by the policymakers. The public perception of organizational integrity and competence influences trust in decision-makers. The trust element can be regarded as cross-cutting issues since it affects as well as influenced by the four other elements that have been mentioned in the previous subsections.

PART II: EMPIRICAL ANALYSIS

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CHAPTER 4:

OBJECTIVES, HYPOTHESES, AND METHODOLOGY

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4.1. INTRODUCTION

The study methodology is considered a major hub from which to accomplish the practical side of this research. From it, the data needed to conduct a statistical analysis to come up with results that are interpreted in the light of the literature study on the subject of the study are obtained. Thus, it achieves the intended objectives.

Based on the nature of the study and the proposed objectives, this research uses the descriptive analytical method, which is based on the study of the phenomenon as it is in fact. Moreover, it is interested in describing it precisely and expressed it in a qualitatively and quantitatively way, This approach does not content with the collecting information on the phenomenon in order to investigate its manifestations and its different relations, but it also extends to the analysis, connectivity and interpretation to reach the conclusions on which to build the proposed scenario. Therefore, this works contributes to increases the stock of knowledge on the studied field.

This chapter presents the objectives and hypotheses of this research, a description of the used methodology, as well as the population and the study sample. It also tackles the used tools and the method of its preparation and the way of its construction and development, and the extent of its persistence. Moreover, it also includes a description of the procedures carried out by the researcher in designing and codifying the study tool, and the tools used to collect the data of the study, and the chapter ends with the processors that have been used in the statistical analysis of the data and the conclusions extraction.

4.2. OBJECTIVES AND HYPOTHESES

The financial sums involved in a rapid shift to low-emission energy systems are large. According to the Global Energy Assessment (GEA, 2012), global investment in energy efficiency and low-carbon energy generation will need to increase to between USD 1.7 and 2.2 trillion per year over the coming decades to meet the combined challenges of energy access, energy security and climate change, in comparison with the present levels of about USD 1.3 trillion. In order to successfully scale-up renewable energy in most countries, private sector investment should be at the forefront. In principle, with enabling policies and investment practice aligned, global capital markets amounted to some USD 212 trillion in financial assets in 2011 (Roxburgh et al., 2011), while it accounts for USD 177.5 trillion in 2019 (SIFMA, 2019). Thus, it has the size and depth to step up to the investment challenge. However, project developers in most countries often face difficulties to access to the large amounts of financing that they need. When available, the financing cost of this initial investment is substantially higher than in developed countries, translating into higher power generation costs for renewable energy technologies. Getting the world on a 2° C emissions path would mean a different investment landscape. After the Paris Agreement in December 2015 during the COP21, it is estimated that the world will require USD 54 trillion in cumulative investment to 2035. This

quantity is divided around USD 40 trillion in energy supply, which means a figure comparable to the New Policies Scenario by IEA but with lower fossil fuels and higher renewables; and USD 14 trillion in energy efficiency. It is estimated that investment in low-carbon energy supply will rise to almost USD 900 billion by 2035, while the spending on energy efficiency will exceed USD 1 trillion (IEA, 2014).

Rather than a problem of capital generation, the key challenge of funding the transition towards a low-carbon energy system is to address existing investor risks that affect the financing costs and competitiveness of renewable energy in most countries. The task of addressing these investor risks has inspired the development of a wide array of public instruments over recent years.

While policymakers can use a broad range of different instruments to address renewable energy investment risks and their underlying barriers, certain types of instruments have achieved larger relevance than others. Thus, they are often referred as cornerstone instruments. A cornerstone instrument targets key investment risks and is the foundation upon which all complementary policy and financial instruments are built.

Taking into account the work that has been done in the last years within different platforms, mainly international and regional organisations, the main objective of this thesis is to investigate and understand the relationship between renewable energy investments and several risks categories associated with this type of investments, as well as to approach the possible tools to reduce and eliminate those risks. In this context, this study is trying to find out the characteristics of the renewable energy sector in the Middle East and North Africa countries, what types of investments promoting policies are used by the governments of the MENA countries, the main risks and barriers associated with the private energy investments in the renewable energy sector in the MENA countries and to provide a set of recommendations to promote renewable energy investments in the MENA countries.

The main aim of this thesis is to analyse the risks and barriers facing renewable energy investments in the MENA region. It also approaches the relation between renewable energy investments and several risks categories which associated with this type of investments and the possible tools to reduce and eliminate those risks. In addition, the study addresses to provide policy advice for a more effective design and implementation of policies that promote and support investments in the renewable energy sector in the MENA region.

To accomplish this aim, the thesis specific objectives are the following ones:

1. To analyse the state of the renewable energy sector in the MENA region.

2. To analyse the global trends in renewable energy investments with a special focus on the MENA region.

3. To identify and describe the risks associated with renewable energy investments.

4. To analyse the risks affecting renewable energy investments in the MENA region.

In order to fulfil these aims, the following questions are proposed:

1. What is the status of the renewable energy sector in the MENA region?

2. What are the worldwide renewable energy investments trend, in particular, in the MENA region?

3. What are the benefits from deploying renewable energy sources in the MENA region?

4. What are the policies supporting renewable energy implemented in the MENA region?

5. What are the different risks that affect renewable energy investments and what is their impact on renewable energy investments?

To achieve these objectives, the proposed hypothesis to test based on the literature review (see Chapter 3) are the following ones:

- Hypothesis 1: Risks related to the political situation have a negative effect on renewable energy investments.
- Hypothesis 2: Risks related to the renewable energy business environment have a negative effect on renewable energy investments.
- Hypothesis 3: Risks related to renewable energy framework have a negative effect on renewable energy investments.
- Hypothesis 4: Risks related to revenues have a negative effect on renewable energy investments.
- Hypothesis 5: Risks related to the construction phase costs have a negative effect on renewable energy investments.
- Hypothesis 6: Risks related to the operational phase costs have a negative effect on renewable energy investments
- Hypothesis 7: Risks related to the financial structure have a negative effect on renewable energy investments.
- Hypothesis 8: Risks related to environmental and social issues have a negative effect on renewable energy investments.

4.3. METHODOLOGY

Based on the nature of the study and the addressed objectives, this research combines the theoretical and empirical analysis. The theoretical approach is based on the literature review about the research questions, as well as the analysis of sectoral information and reports. Concerning the empirical analysis, the research integrated the qualitative and quantitative research approaches. It should be underlined that the research uses a comprehensive questionnaire to collect primary data from the field as the main tool for the survey. Moreover, it uses a descriptive-analytical method, which is based on the study of the phenomenon as it is.

Concerning the secondary sources, the research uses the data published in books and Arab and foreign-related references, periodicals, books, academic papers, articles, reports, the previous research and studies on this subject, and specialized websites. With regard to the primary sources, the design of a questionnaire to collect data underlines as one of the main contributions of this research in order to address the analytical aspects of the studied topic. It is worth noting that the questionnaire was distributed in the middle of 2018, and the information was collected for three months.

To achieve the proposed research goals, this thesis combines both qualitative and quantitative data analysis methods, using the Statistical Package for the Social Science (SPSS) for analysing the data. The study uses as main statistical tools the frequency and descriptive analysis, the Kolmogorov-Smirnov test of normality, the Pearson correlation coefficient for validity, the Cronbach alpha coefficient and the Split-half coefficient for reliability statistics, and the one-sample T-test, and the population and sample statistics.

Concerning the Pearson coefficient, it should be mentioned that the critical value of correlation coefficient (R) value that is used for comparison in the tables from 5.22 to 5.29 is 0.349, which is the critical value of correlation coefficient at a significance level (α)=0.05 and freedom level (v)=30. Thus, the results will show a significant correlation if the calculated (R) is higher than 0.349.

To analyse the data collected through the questionnaire, the study uses the parametric tests (one-sample T-test) to find whether the mean scores of the responses considered a Class 3 neutrality or not. The T-test is used to determine the average response to all items and the results are shown in the tables presented in this section.

The empirical analysis help test the hypotheses. In this procedure, two main hypotheses are proposed concerning the relationship between two of the analysed variables. Both hypotheses are the following ones:

- Null hypothesis: There is no statistically significant relationship between the two analysed variables.

- Alternative hypothesis: There is a statistically significant relationship between the two considered variables. If the significance measured by the p-value is higher than the significance level $\alpha \leq 0.05$, the null hypothesis cannot be rejected. Thus, there is no statistically significant relationship between the two analysed variables. However, if the p-value is less than the significance level $\alpha \leq 0.05$, the null hypothesis is rejected and the alternative hypothesis is accepted. Therefore, there is a statistically significant relationship between the two analysed variables.

4.4. POPULATION AND SAMPLE

This study aims at analysing the risks and barriers faced by investors in the renewable energy sector in the MENA region. Therefore, the target population of the survey focuses on the companies that are investing in the renewable energy sector in the MENA region. Therefore, the study identified the companies based on the only publicly available report that list all the registered companies that invest in the renewable energy sector. This report was published in 2017 by the League of Arab States, and it lists 413 companies, including both private and state-owned enterprises (League of Arab States, 2017). It should be noted that there are some countries in the MENA that were not reachable for various reasons. Hence, this research focused on the following 15 MENA countries: Algeria, Bahrain, Egypt, Jordan, Kuwait, Lebanon, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Sudan, Tunisia, and United Arab Emirates.

The population of this study accounts for 413 companies, which are the companies working in the renewable energy sector in the MENA countries. In order to identify the right size of the sample out of the population of the study, which should be targeted with the questionnaire survey tool, the study is based on Krejcie & Morgan (1970). Thus, the sample size required to obtain a 95% confidence level and a range of error of 5% is 384. The study sample is selected based on the Moore (2003) equation. Hence, the sample size is calculated from the following equation:

$$n = \left(\frac{Z}{2m} \right)^2 \quad \text{… (Equation 1)}$$

Where:

Z: is the standard value corresponding to a given level of significance (for example, Z=1.96 for α=0.05).

m: is the margin error and expressed as decimal (±0.05).

Then, the sample size is corrected in the case of the final communities from the following equation (2):

$$\mathrm{n} = \frac{\mathrm{nN}}{\mathrm{N+n-1}} \quad \text{… (Equation 2)}$$

Where:

N: is the sample size.

Using Equation (1), it is found that the sample size is equal to:

$$n = \left(\frac{1.96}{2 \times 0.05} \right)^2 \cong 384$$

Since the study population N=413, according to Equation (2):

$$\frac{384 \times 413}{413 + 384 - 1} \cong 199 \; {}_{\text{new}}n$$

Thus, the appropriate sample size in this study is at least 199.

4.5. TOOL DEVELOPMENT AND DESIGN

This research has elaborated a survey tool to check the concerns and risks related to renewable energy investments in the Middle East and North Africa countries. For the purpose of developing this tool, called the questionnaire, the study has followed the next steps:

1. Reviewing the literature and previous studies relevant to the subject of the research, and take advantage of them in the construction of the questionnaire and the formulation of its clauses.
2. Consulting with many experienced people in determining the dimensions of the questionnaire and its clauses.
3. Identifying the key areas to be covered by the questionnaire.
4. Determining the elements that fall under each factor
5. Designing the questionnaire
6. Sending a pilot questionnaire to some experts in different fields as referees
7. Developing the final structure of the questionnaire.

The study questionnaire, which is presented in Annex II, consists of two main parts as it follows:

- Part I: This part includes the personal information of the respondents and demographic information about several items, such as sector of activity, type of institution, ownership, level of involvement, type of renewable energy technology, total number of employees working and annual revenue corresponding to 2018, position of respondents, respondent level of education, and institution age.

- Part II: This part contains the elements regarding the main themes of the study. It includes questions concerning the factors that are tested in this research. These factors are distributed into eight groups of questions, each of which addresses one of the proposed hypotheses of the study. Table 4.1 shows these categories and the number of items related to each category in the questionnaire.

Table 4.1: Distribution of the items on the resolution factors

Risks category	Number of items
Political risks	5
Business environment risks	11
Regulatory framework risks	13
Revenues risks	6
Construction phase costs risks	6
Operational phase costs risks	7
Financial structure risks	12
Environmental and social risks	5
All items	65

Source: Own elaboration based on the questionnaire

For measuring the responses of the correspondents to the questionnaire questions, a gradient scale is used. Table 4.2 shows the grading system that is used. In this context, it should be noted that the answers closer to 5 indicates a very high approval on what is stated in the concerned question and when the answer is closer to 1, it shows very low approval.

Table 4.2: Gradient scale of the study

Scale	1	2	3	4	5
Level	Very low	Low	Moderate	High	Very high

Source: Own elaboration based on the questionnaire

4.6. VALIDITY AND RELIABILITY OF THE QUESTIONNAIRE

4.6.1. Validity of the questionnaires

Validity expresses the degree to which a measurement determines what it purposes to measure. The validity of the questionnaire is verified in two ways:

1. A pilot questionnaire is presented to a group of specialists in different fields related to the main themes of this study in the areas of academic, administrative, professional, and statistical aspects. The profiles of these experts are listed in Annex I. As a result of this pilot test, the questionnaire is edited, modified, and developed according to the feedback and comments received from the group of specialists. Thus, the final form of the questionnaire is elaborated in light of their proposals (see Annex II).

2. The honesty of the questionnaire scale, which refers to how accurately the measures obtained from the research are actually quantifying what it was designed to measure. In this study, the honesty of the scale is tested in two levels: internal and structure validity, which is approached in this section.

Firstly, concerning the internal validity, it is tested by checking the consistency of each item of the questionnaire with the domain to which this item belongs. This study calculates the internal consistency of the questionnaire through the value of correlation coefficients between each item of the areas of the questionnaire and the total score of the field itself. Table 4.3 shows the results of the internal consistency test for all the categories of the questionnaire, where the correlation coefficient between each field of each factor or category of risks, and the total score of the field indicates a function at the significance level of $0.05 \geq \alpha$. Therefore, that field is honest to put the measure. The critical value of correlation coefficient (R) value that is used for comparison in the mentioned tables is 0.349, which is the critical value of correlation coefficient at a significance level (α)=0.05 and freedom level (v)=30. These results will show a significant correlation if the calculated (R) is higher than 0.349.

Table 4.3: Correlation coefficients of each risk category and field

Risks Category	Items	Pearson Correlation Coefficient	Significance
Political risks	Impediments due to war, terrorism and/or civil disturbance	0.898	0.000
	Political uncertainty due to poor governance	0.926	0.000
	High political instability due to the poor rule of law and institutions	0.934	0.000
	Unclear government policy	0.871	0.000
Business environment risks	Starting a business	0.897	0.000
	Concession rights	0.902	0.000
	Property rights/registration/transfer	0.890	0.000
	Labour issues	0.801	0.000
	Dispute resolution issues	0.866	0.000
	Business travel rules	0.841	0.000
	Trading across borders	0.845	0.000
	Protecting minority investors	0.905	0.000
	Enforcing contracts	0.943	0.000
	Resolving insolvency	0.944	0.000
Regulatory framework risks	Renewable energy regulatory framework reliability	0.809	0.000
	Efficient implementation of renewable energy regulations	0.839	0.000
	Independency of regulatory authority	0.898	0.000
	Regulatory decisions proposals period of pre-publishing	0.921	0.000
	Appealing process against regulatory decisions	0.871	0.000
	Rules favouring market opening to IPP (Independent Power Producer)	0.814	0.000
	Grid capacity and reliability	0.783	0.000
	Grid access rules	0.762	0.000
	PPA (Power Purchase Agreement)/FiT (Feed-in-Tariff) schemes	0.356	0.000
	Net metering	0.634	0.000
	Competing policies	0.856	0.000
	Institutional actors roles and responsibilities	0.813	0.000
Revenues risks	Revenue stability	0.894	0.000
	Availability of resource assessment studies	0.918	0.000
	Risk of curtailment	0.839	0.000
	Ease of profits repatriation	0.866	0.000
	Subsidization level	0.818	0.000
Construction phase costs risks	Construction permitting	.819	0.000
	Availability of local skilled workforce	0.716	0.000
	Availability of experienced local manufacturers	0.685	0.000
	Logistics	0.842	0.000
	Security	0.772	0.000
Operational phase costs risks	Operations and maintenance weight due to local conditions	0.904	0.000
	Availability of spare parts	0.905	0.000
	Availability of local skilled workforce	0.711	0.000
	Availability of experienced local manufacturers	0.841	0.000
	Logistics	0.821	0.000
	Security	0.705	0.000
Financial structure risks	Availability of long-term financing	0.840	0.000
	Availability of short-term credit	0.776	0.000
	Interest rate risk	0.876	0.000
	Exchange rate risks	0.858	0.000

Risks Category	Items	Pearson Correlation Coefficient	Significance
	Currency convertibility	0.890	0.000
	Inflation rate risk	0.910	0.000
	Flow of capital in/out	0.895	0.000
	Lack of renewable energy project financial skills	0.881	0.000
	Financial policy bias	0.857	0.000
	Tax regime and tax incentives	0.788	0.000
	Dedicated state renewable energy fund	0.542	0.000
Environmental and social risks	Clarity of environmental impact assessment procedures	0.836	0.000
	Lack of awareness of renewable energy projects	0.870	0.000
	Social resistance related to special interest groups	0.932	0.000
	Social resistance related to "Not in my back yard" concerns	0.914	0.000

Source: Own elaboration based on the questionnaire

Secondly, regarding the structure validity, honesty is a structural standard ratified tool, which measures the extent of success in achieving the intended goals and shows the extent to which each area of study is quantifying what it was designed to measure. Table 4.4 shows that all correlation coefficients in all areas of the questionnaire are statistically significant at the significance level of $0.05 \geq \alpha$. Therefore, all areas of the questionnaire are sincere to put the measure.

Table 4.4: Correlation coefficients of each factor

Risks Category	Pearson Correlation Coefficient	Significance
Political risks	.811	0.000
Business environment risks	.951	0.000
Regulatory framework risks	.954	0.000
Revenues risks	.958	0.000
Construction phase costs risks	.951	0.000
Operational phase costs risks	.910	0.000
Financial structure risks	.966	0.000
Environmental and social risks	.928	0.000

Source: Own elaboration based on the questionnaire

4.6.2. Reliability of the questionnaire

The consistency of the questionnaire means to give this questionnaire the same result if it is re-distributed more than once under the same circumstances and conditions. In other words, the stability of the questionnaire means stability in the results of the questionnaire, that it is to say that the results do not change significantly if it were re-distributed to individuals several times during certain periods of time. It is clear from the results shown in Table 4.5 that the value of Cronbach alpha coefficient is high for the axis of correlation coefficient of each field and risks related to the financial structure, ranging from 0.542 to 0.910, while the total for all considered areas is 0.989. The results are similar by the way of Split-half coefficient, given that the total for all areas accounts for 0.992.

Table 4.5: Comparison of risks categories between Cronbach alpha coefficient and Split-half coefficient

Risks category	Cronbach alpha coefficient	Split-half coefficient
Political risks	0.928	0.937
Business environment risks	0.967	0.957
Regulatory framework risks	0.945	0.952
Revenues risks	0.908	0.907
Construction phase costs risks	0.822	0.707
Operational phase costs risks	0.895	0.887
Financial structure risks	0.958	0.921
Environmental and social risks	0.910	0.886
Total	**0.989**	**0.992**

Source: Own elaboration based on the questionnaire

Thus, the final questionnaire, which is presented in Annex II, is available for distribution. The procedures used for its design and testing ensure the reliability and validity of a questionnaire study. Therefore, it can be confident on the veracity and suitability of the questionnaire to analyse the results as well as to answer the research questions and test the hypotheses.

Concerning the data analysis, the Kolmogorov-Smirnov test is used to test whether they follow the normal distribution or do not. These results are presented in Table 4.6, showing that the p-value to all fields of the study was higher than the level of significance (0.05). The distribution for each field is normally distributed; thereby, parametric tests are used to answer the research questions of this thesis.

Table 4.6: Normality distribution test

Risks category	Number of items	Kolmogorov-Smirnov Z	Significance
Political risks	4	1.167	0.131
Business environment risks	10	1.356	0.052
Regulatory framework risks	12	1.233	0.096
Revenues risks	5	1.042	0.228
Construction phase costs risks	5	1.253	0.087
Operational phase costs risks	6	1.055	0.216
Financial structure risks	11	1.127	0.157
Environmental and social risks	4	1.146	0.131
Total	**40**	**1.215**	**0.104**

Source: Own elaboration based on the questionnaire

CHAPTER 5:

DATA ANALYSIS AND DISCUSSION OF RESULTS

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5.1. INTRODUCTION

This chapter presents the analysis of the data collected through the questionnaire distributed to the sample identified according to the methodology described in Chapter 4. It provides a detailed analysis of the results of each risk category concerning renewable energy investments based on the answers to the questionnaire. These results are discussed in the light of the literature review on previous studies and the theoretical framework regarding each risks category as it is described in Chapter 3 of this study.

This chapter conducts an analysis of the main results of the questionnaire. Firstly, it provides the sample description and its demographics, including information regarding the sector of activity, type of institution, ownership, level of involvement, type of renewable energy technology, total number of employees working in the company in 2018, annual revenue in millions in 2018, position of respondents, respondent level of education, or institution age. Afterwards, the eight risks categories concerning renewable energy investments, which are political situation, renewable energy business environment, renewable energy framework, revenues, constructions, operations, financial structure, environmental and social issues are analyzed, as well as the items corresponding to each of these categories. A final systematic analysis of all the studied risks categories is approached. Statistical treatment of the data collected from the questionnaire is done, by using the SPSS program to get the results that are presented, analyzed and discussed in this chapter.

5.2. SAMPLE DESCRIPTION

The empirical analysis of this research is based on the own elaboration of a questionnaire, which is described in Chapter 4 and presented in Annex II. Table 5.1 shows the questionnaire statistics in terms of the number of questionnaires distributed according to the sample (199) and the completed questionnaires received. It is illustrated that 75.8% of the questionnaires were completely answered by the respondents, while 24.2% of the forms had not been completed and they were considered missing forms.

Table 5.1: Sample and frequency of response to the questionnaire

Questionnaire responds	**Frequency**	**Percentage**
Complete questionnaires	151	75.87%
Questionnaires (not completely answered)	48	24.12%
Total	199	100.00%

Source: Own elaboration based on the questionnaire analysis

Table 5.2 shows some statistics related to the sector of activity of the respondents to the questionnaire. It can be observed that out of the total number of institutions that completed the questionnaires, the most important sector is the industrial sector. Thus, 70 institutions are

working in the industrial sector, which means 46.36% of the sample. It is followed by the other professional sector, with 57 institutions and 37.75%. At a greater distance, it is found the financial sector, with 24 institutions, representing 15.89%.

Table 5.2: Distribution of the sample by sector

Sector	Frequency	Percentage
Financial sector	24	15.89%
Industrial sector	70	46.36%
Other professional sector	57	37.75%
Total	151	100.00%

Source: Own elaboration based on the questionnaire analysis

Concerning the type of institution, the results presented in Table 5.3 details the type of institutions of the respondents professional field of work. In this regard, institutions can be categorized by sector as it follows. Concerning the financial sector institutions, the local commercial banks represent the highest percentage in this category, meaning 75.01% of the total. The other financial sector institutions have the same weight of 8,33% each of the other three types, which are a local investment fund, multilateral development banks and international commercial banks. Regarding the category of industrial sector institutions, Engineering, Production and Construction (EPCs) institutions represent the highest percentage, with 47.14%; followed by Independent Power Producer (IPP) with 35.71%. At a certain distance, it can be found the technology providers, with 12.86%; and other, in particular, manufacturing PV, with 4.29%. Finally, in the category of professional sector institutions, the engineering institutions represent the highest percentage, with 42.11%, followed by management consulting with 28.07%; then legal, with 19.30%. The lower relative weights correspond to the types financial, which means 8.77%, and other, which include logistics services, with 3.51%.

Table 5.3: Distribution of the sample by type of institution

Sector	Type of Institution	Frequency	Percentage by type of institution
Financial Sector	Investment fund	2	8.33%
	Multilateral development bank	2	8.33%
	Local commercial bank	18	75.01%
	International commercial bank	2	8.33%
	Total	**24**	**100.00 %**
Industrial Sector	Technology provider	9	12.86%
	Engineering, Production, Construction (EPC)	33	47.14%
	Independent Power Producer (IPP)	25	35.71%
	Other (Manufacturing PV)	3	4.29%
	Total	**70**	**100.00 %**
Other Professional Sector	Financial	5	8.77%
	Legal	11	19.30%
	Management consulting	16	28.07%
	Engineering	24	42.11%
	Other (Logistics Services)	2	3.51%
	Total	**57**	**100.00%**
Total		**151**	**100.00%**

Source: Own elaboration based on the questionnaire analysis

Table 5.4 shows the distribution of the respondents among the MENA countries. Lebanon comes first, given that 17.88% of the respondents are from that country. It is followed by Egypt, which represents 15.23% of the respondents, and then, the UAE with 11.92%. In the last position comes Kuwait, meaning 1.32%. It should be noted that in terms of returned questionnaires percentage per country, Sudan response percentage was the highest, with 89%, followed by United Arab Emirates, with 85%, then Egypt with 82%, while the lowest response percentage was from Algeria with only 42% (3 questionnaires out of 7). It is worth noting that this country distribution indicates the importance and the degree of progress in terms of renewable energy and renewable energy investments in several countries as well as shed light for the reason of this importance. In the case of Lebanon, it is a poor energy resources country that imports most of its energy from outside, which made the renewable energy sector very important, while Egypt has many conventional energy resources, but not enough due to the population number. The situation is different in Kuwait as a major oil producer and where renewable energy plans are not well supported.

Table 5.4: Distribution of the sample by country

Country	Frequency	Percentage
Algeria	3	1.99%
Bahrain	3	1.99%
Egypt	23	15.23%
Jordan	9	5.96%
Kuwait	2	1.32%
Lebanon	27	17.88%
Mauritania	6	3.97%
Morocco	12	7.95%
Oman	9	5.96%
Palestine	10	6.62%
Qatar	5	3.31%
Saudi Arabia	6	3.97%
Sudan	9	5.96%
Tunisia	9	5.96%
United Arab Emirates	18	11.92%
Total	**151**	**100.00%**

Source: Own elaboration based on the questionnaire analysis

Another interesting aspect is the ownership of the institutions. In this regard, Table 5.5 shows the distribution of the institution ownership, where privately-owned institutions represent the highest percentage, meaning 64.24%. They are followed at a certain distance by foreign-controlled institutions, with 22.52%; then, state-owned institutions are found, representing 13.25%.

Table 5.5: Distribution of the sample by ownership

Ownership	Frequency	Percentage
Foreign controlled	34	22.52%
Privately owned	97	64.24%
State-owned	20	13.25%
Total	**151**	**100.00%**

Source: Own elaboration based on the questionnaire analysis

With regards to the level of involvement, Table 5.6 shows that 34.44% of the projects were at the screening phase, 27.81% at the project design phase. At a certain distance, it is found the financial disclosure phase (15.89%) and the construction phase (15.23%). Finally, 6.62% of the interviewees are involved in the operation phase.

Table 5.6: Involvement level of the respondents

Level of Involvement	Frequency	Percentage
Construction	23	15.23%
Financial closure	24	15.89%
Operation	10	6.62%
Project design	42	27.81%
Screening	52	34.44%
Total	**151**	**100.00%**

Source: Own elaboration based on the questionnaire analysis

Table 5.7 shows the type of renewable energy technology used in the projects. Small scale PV represents the highest percentage, with 39.74%, followed by large solar PV with 21.85%, and then wind technology with 16.56%. At a certain distance, CSP represents 11.92%. Finally, the lower relative weights correspond to the categories of hydro (meaning 3.31%); and geothermal (6.62%).

Table 5.7: Distribution by type of renewable energy technology

Type of Renewable Energy Technology	Frequency	Percentage
Concentrated Solar Plan (CSP)	18	11.92%
Geothermal	10	6.62%
Hydro	5	3.31%
Large Solar (PV)	33	21.85%
Small Scale (PV)	60	39.74%
Wind	25	16.56%
Total	**151**	**100.00%**

Source: Own elaboration based on the questionnaire analysis

Concerning the total employment number, table 5.8 depicts the distribution of institutions for their size with the data of 2018. Most of the institutions (82.12%) had less than 100 employees, while 17.88% of the institutions had more than 100 employees.

Table 5.8: Distribution of institutions by employment in 2018

Size by number of employees	Frequency	Percentage
Less than 100	124	82.12%
More than 100	27	17.88%
Total	**151**	**100.00%**

Source: Own elaboration based on the questionnaire analysis

Regarding revenues, Table 5.9 shows that the annual revenue of 41.72% of institutions was less than 1 million USD. This first group is followed by 27.81% of institutions that account for an annual revenue between 1 and 10 million USD. Then, 13.91% of the institutions amount a revenue between 11 and 20 million USD. It should be noted that 7.95% of them exceeds 50

million USD, while 5.96% of the institutions have a revenue between 41 and 50 million USD, and 1.99% show revenue between 21 and 30 million. Finally, 0.66% of the interviewed institutions account for a revenue between 31 and 40 million USD.

Table 5.9: Distribution of institutions by annual revenue (in millions) in 2018

Annual revenue (in millions)	Frequency	Percentage
Less than 1 Million USD	63	41.72%
1–10 million USD	42	27.81%
11–20 million USD	21	13.91%
21–30 million USD	3	1.99%
31–40 million USD	1	0.66%
41–50 million USD	9	5.96%
Over 50 million USD	12	7.95%
Total	**151**	**100.00%**

Source: Own elaboration based on the questionnaire analysis

The results regarding the positions of respondents in the institutions are displayed in table 5.10. They show that most of the respondents are CEO or managing directors, representing 54.97% of the total. This position is followed by public relations manager, meaning 21.19%, and marketing managers, with 18.54%. The lower relative weights correspond to purchasing managers (0.66%), production managers (1.99%,) and deputy managing directors (2.65%).

Table 5.10: Position of respondents in their institutions

Position of Respondents	Frequency	Percentage
CEO/Managing Director	83	54.97%
Deputy Managing Director	4	2.65%
Marketing Manager	28	18.54%
Production Manager	3	1.99%
Public Relations Manager	32	21.19%
Purchasing/Logistics Manager	1	0.66%
Total	**151**	**100.00%**

Source: Own elaboration based on the questionnaire analysis

Concerning the education level of the respondents, table 5.11 shows that most of them have a Bachelor degree, meaning 65.56% of total respondents. It is followed by holders of master degree, which represent 21.85%; while PhD degree holders mean 12.58%.

Table 5.11: Education level of the respondents

Education level	Frequency	Percentage
Bachelor	99	65.56%
Master	33	21.85%
PhD	19	12.58%
Total	**151**	**100.00%**

Source: Own elaboration based on the questionnaire analysis

Finally, in terms of institution age, table 5.12 shows that most of the interviewed institutions are 10 or less years. Thus, almost half of the institutions are less than five years (49.67%). They are followed by 31.79% of the institutions aged from 6 to10 years. At a greater distance, 11.26%

of the institutions are aged from 11 to 15 years, while the age of 3.97% of the institutions is from 16 to 20 years. The lowest percentages correspond to the institutions with age from 21 to 25 years (1.99%) and those with age from 26 to 30 years (1.32%). The youth of most of the entities interviewed show the recent development of renewable energies

Table 5.12: Distribution of institutions by age

Institution Age	Frequency	Percentage
Less than five years	75	49.67%
6-10	48	31.79%
11-15	17	11.26%
16-20	6	3.97%
21-25	3	1.99%
26-30	2	1.32%
Total	**151**	**100.00%**

Source: Own elaboration based on the questionnaire analysis

5.3. DESCRIPTIVE ANALYSYS OF THE RENEWABLE ENERGY INVESTMENTS RISKS AND DISCUSSION OF RESULTS

This section presents the analysis of the results of the different risk categories based on the own elaborated questionnaire. It also discusses the results in light of the theoretical background and different works and research that studied one or more of the analysed risk categories.

To analyse the data collected through the questionnaire, descriptive statistics and the T-test are used. Moreover, it is calculated the relative weight to identify the trend or direction of the responses according to the following Equation 3.

$$\mathrm{Wr} = \frac{W}{\mathrm{Ws}} x\ 100 \ \ldots \text{(Equation 3)}$$

Where

W_r: is the relative weight.

W: is the value to find the relative weight.

Ws: is the total weight of the scale, which is 5.

5.3.1. Analysis and discussion of political risks

With regards to the political risks, the descriptive statistics presented in table 5.13 show that the relative weight of the total axis risks related to political situation reached a relative weigh of 46.8%, a mean of 2.34, and a standard deviation of 1.08. The main axis of the political risks category corresponds to the item high political instability due to the poor rule of law and institutions, which ranks first with a relative weight of 47.8%, an arithmetic mean of 2.39 and a standard deviation of 1.25. In contrast, the item impediments due to war, terrorism and/or civil disturbance ranks the lower relative weight (45.2%), an arithmetic mean of 2.26 and a

standard deviation of 1.12. These results suggest that the major concern of investors in renewable energy in the MENA region in terms of political risks is mainly associated with high political instability due to the poor rule of law and institutions. These conclusions are in line with the World Bank worldwide governance indicators. In this regard, Berg & Desai (2013) explained the importance of the rule of law and its implications on development including the field of investment in their overview on the Rule of Law and Sustainable Development for the Global Dialogue on Rule of Law and the Post-2015 Development Agenda. The Declaration of the High-level Meeting of the General Assembly on the Rule of Law at the National and International Levels of the United Nations adopted by the General Assembly in 2012 stressed the relevance of the rule of law for all sectors (United Nations, 2012). It should also be underlined the definition of Daniels & Trebilcock (2004) about the rule of law as a system in which the institutions of the legal system are reasonably fair, competent and efficient, judges are independent and impartial, governmental officials accept that the law will be applied to their own conduct, and the government seeks to be law-abiding.

Table 5.13: Descriptive statistics about political risks

Items	Mean	Standard deviation	Relative weight (%)	Test value	p-value
Impediments due to war, terrorism and/or civil disturbance	2.26	1.12	45.2	-6.667	0.00
Political uncertainty due to poor governance	2.37	1.30	47.4	-4.892	0.00
High political instability due to poor rule of law and institutions	2.39	1.25	47.8	-4.940	0.00
Unclear government policy	2.34	1.09	46.8	-6.123	0.00
Political risks category	2.34	1.08	46.8	-6.165	0.00

Source: Own elaboration based on the questionnaire analysis

5.3.2. Analysis and discussion of business environment risks

Concerning the risks related to renewable energy business environment, table 5.14 shows that the relative weight of the total axis risks related to renewable energy business environment reaches 55.0%, the mean is 2.75 and the standard deviation 0.94. This table also shows that the main axis of the renewable energy business environment risks category is resolving insolvency, which ranks first with a relative weight of 61.4%, an arithmetic mean of 3.07 and standard deviation of 1.24. On the contrary, the item protecting minority investors ranks last with a relative weight of 50.4%, an arithmetic mean of 2.52 and a standard deviation of 1.0. These results of the analysis indicate that the main risk element to be considered regarding the renewable business environment is resolving insolvency. This result agrees with the study conducted by Djankov, Hart et al. (2008), which found that despite the importance of debt enforcement, insolvency institutions are generally perceived to perform poorly mainly in developing countries. The results of this research are also consistent with the findings of several studies, such as Djankov, Glaeser, et al. (2003), Djankov, Hart, et al. et al. (2008), Franks & Loranth (2005), Gennaioli & Rossi (2008), and Ayotte & Yun (2009). These works found that all procedures related to solving insolvency are extremely time-consuming, costly, and inefficient; thus, only 36% of the countries achieve an efficient outcome. Furthermore, almost a half of the project values (48%) lost in debt enforcement including the transaction costs of debt enforcement, the delay cost of the proceedings, and the loss from reaching the wrong

outcome. In addition, legal origins and per capita income are the most important cross-country determinants of efficiency, as wealthier countries have a comparative advantage in more complicated procedures.

Table 5.14: Descriptive statistics about renewable energy business environment risks

Items	Mean	Standard deviation	Relative weight (%)	Test value	p-value
Starting a business	2.67	1.03	53.4	-3.218	0.002
Concession rights	2.58	0.98	51.6	-4.254	0.000
Property rights/registration/transfer	2.57	1.03	51.4	-4.142	0.000
Labour issues	2.79	0.94	55.8	-2.220	0.029
Dispute resolution issues	2.76	0.91	55.2	-2.632	0.010
Business travel rules	2.65	1.09	53.0	-3.194	0.002
Trading a cross borders	2.96	1.19	59.2	-.334	0.739
Protecting minority investors	2.52	1.00	50.4	-4.796	0.000
Enforcing contracts	2.92	1.19	58.4	-.674	0.502
Resolving insolvency	3.07	1.24	61.4	.560	0.577
Business environment risks	2.75	0.94	55.0	-2.671	0.009

Source: Own elaboration based on the questionnaire analysis

5.3.3. Analysis and discussions of regulatory framework risks

Regarding the renewable energy framework risks, table 5.15 depicts the results of the descriptive analysis. They show that the relative weight of the total axis regulatory framework risks category reaches 58.0%, the mean is 2.94, and the standard deviation 0.86. The main axis of this category is the item appealing process against regulatory decisions, which ranks first with a relative weight of 68.6%, an arithmetic mean of 3.43 and a standard deviation of 1.09. Whereas the item net metering ranks the lower relative weight (48.4%). These results show the significant importance that investors attributed to the appealing process against regulatory decisions and the risk related to this issue. It is consistent with Baldwin & Cave (1999) that present several mechanisms to improve openness, transparency, and accessibility. They also discuss the relevance of having a single or a collegiate regulator. The results are also in line with the World Bank *Report on the Public-Private Infrastructure Advisory Facility* (PPIAF) *Project for Brazil Power Sector* (Brown & De Paula, 2004), which explains that having the government deals with appeals of regulatory decisions removes any benefit from having an independent regulatory agency as in many jurisdictions parties can appeal government decisions to the courts (). Special or pre-existing tribunals deal with regulatory appeals in England, India, and Bolivia. Unless the special tribunal is judicial, its decisions could be subject to judicial review. Direct appeals to the courts have the benefit of fulfilling constitutional or other legal rights available to citizens. However, where independent regulation is a new concept, the judiciary is often unprepared to deal with such matters (Brown & De Paula, 2004). They also agree with Green (1999), which describes the UK utility regulations experience.

Moreover, Rodriguez-Ibeas (2002) states that enforcement can be performed in different styles and can use a variety of mechanisms. Some of them concern the application of fines in an administrative or, in other cases, in a judicial process. Rodriguez-Ibeas (2002) also discusses how litigation and its fines involve basic rules and principles that help to protect consumers. In addition to the lessons learnt from the Indian experience examined by Sundar et al. (2013),

which examined how regulatory agencies differ from government and the judiciary, Sundar et al. (2013) discuss the relationships among regulatory agencies, government, and the judiciary, considering judicial intervention and jurisdiction.

Table 5.15: Descriptive statistics about regulatory framework risks

Items	Mean	Standard deviation	Relative weight (%)	Test value	p-value
Renewable energy regulatory framework reliability	2.64	1.11	52.8	-3.228	0.002
Efficient Implementation of Renewable Energy regulations	3.03	1.21	60.6	0.248	0.805
Independency of Regulatory Authority	3.41	1.14	68.2	3.388	0.001
Regulatory decisions proposals period of pre-publishing	3.35	1.03	67.0	3.403	0.001
Appealing process against regulatory decisions	3.43	1.09	68.6	3.927	0.000
Rules favouring market opening to IPP (Independent Power Producer)	2.95	0.92	59.0	-0.540	0.590
Grid capacity and reliability.	3.16	1.16	63.2	1.368	0.174
Grid access rules	3.02	0.98	60.4	0.203	0.839
PPA (Power Purchase Agreement)/FiT (Feed-in Tariff) schemes	1.84	1.50	36.8	-7.753	0.000
Net metering	2.42	1.27	48.4	-4.605	0.000
Competing policies	2.97	0.98	59.4	-0.303	0.762
Institutional actors' roles and responsibilities	3.13	1.16	62.6	1.112	0.269
Regulatory framework risks	2.94	0.86	58.0	-0.702	0.484

Source: Own elaboration based on the questionnaire analysis

5.3.4. Analysis and discussion of revenues risks

Concerning revenues risks, table 5.16 depicts significant differences. These results show that the relative weight of the total axis revenues risks reaches 58.8%, the mean is 2.94 and the standard deviation 0.96. The main axis of this category is the item risk of curtailment with a relative weight of 61.8%, an arithmetic mean of 3.09 and a standard deviation of 1.0. On the contrary, the item availability of resource assessment studies shows the lower relative weight of 58.0%. This result shows that the major risk considered by investors in the renewable energy sector concerning the possible revenues is the curtailment risk, when the generated power cannot be sold, leading to losses in revenue. It is consistent with Jacobsen & Schroder (2012) results, which elaborated on possible reasons for curtailment, including insufficient network capacities. The results of this research are consistent with the study of Turner et al. (2013) that profiled the risks facing wind energy production. This study shows that excess of renewable energy production can cause an imbalance in the energy system, which could be controlled by the grid operator by restricting project outputs. It also describes that on the windy days of Germany, it is not possible to balance the power outputs peaks by transporting the excess power from the north to the south. Hence, the risk of curtailment is always present while the cost is to be transferred to the customers. In addition, Watts (2011) describes the different risks in the renewable energy sector, including curtailment risks. It suggests several ways of risk transfer that can be used. Curtailment risk is also among the main risks affecting revenues, according to EWEA (2013).

Table 5.16: Descriptive statistics about revenues risks

Items	Mean	Standard deviation	Relative weight %	Test value	p-value
Revenue stability	2.84	1.08	56.8	-1.469	0.145
Availability of resource assessment studies	2.90	1.02	58.0	-0.980	0.329
Risk of curtailment	3.09	1.00	61.8	0.895	0.373
Ease of profits repatriation	2.94	1.05	58.8	-0.570	0.570
Subsidization level	2.91	1.41	58.2	-0.633	0.528
Revenues risks	2.94	0.96	58.8	-0.636	0.526

Source: Own elaboration based on the questionnaire analysis

5.3.5. Analysis and discussion of construction phase risks

With regards to the risks related to the construction phase, table 5.17 shows the results of the descriptive analysis. The results show that the relative weight of the total axis construction phase risks reaches 59.0%, the mean is 2.95 and the standard deviation 0.87. The main axis of the construction phase risks category is the item availability of experienced local manufacturers, which ranks first with a relative weight of 67.0%; while the item logistics presents the lower relative weight of 53.4%. These results show that the non-availability of enough experienced local manufacturers is one of the most important risks among all constructions phase risks. It is in line with the conclusions of several studies carried out in the MENA region for all types of renewable energy projects, including solar PV, solar CSP and onshore wind (World Bank, 2011; GIZ, 2012; Vidican, 2012; Desertec Industrial Initiative, 2013; Mukasa et al., 2013; Vidican et al., 2013; IRENA & EIB, 2015; IRENA, 2018). These studies emphasized that there are no real, local manufacturers on the ground, no substantial increase of local manufacturing potential expected (economically not viable) and extreme international manufacturing competition exists, know-how to manufacture special components not really applied, and locally available production machines limit the turbine size to 2MW. In general terms, the local capacity is likely to remain limited in the medium-term on most of the countries.

For solar PV, international competition, especially for downstream components in the value chain, is quite high, while the local manufacturing of components like solar cells and wafers is limited. There has been a significant overcapacity on the world market (mainly influenced by Chinese producers) since 2013. To justify the investment in local manufacturing lines, the market potential must be raised significantly and be protected against international competition. For solar CSP, receivers for line focusing CSP systems are highly specialized components, requiring special production lines and in-depth knowledge. This market is dominated by only a few players with a long track record; while overcapacity has been observed since 2014. Based on the estimated market development, no linear receiver production is expected in Egypt over the next years. The power train for CSP-plants is a specialized component. Steam turbines are developed by only a few players worldwide, serving different applications and capacities. As the manufacturing lines require a significant annual capacity, no steam turbine manufacturing is expected within the next years.

For onshore wind, blade manufacturing is considered as a new manufacturing potential by both public and private players. According to the local players that were contacted, required skills, such as laminating, are available in Egypt. Nevertheless, the entrance in this industrial sector should be supported by joint ventures with international players (technological cooperation). With an increasing domestic market, the local manufacturing of blades could

reduce costs, but clear and stable market demand is necessary to justify the investment. The main barriers concern market size and technology development.

Table 5.17: Descriptive statistics about construction phase risks

Items	Mean	Standard deviation	Relative weight (%)	Test value	p-value
Construction permitting	2.79	1.12	55.8	-1.872	0.064
Availability of local skilled workforce	3.11	1.10	62.2	0.992	0.324
Availability of experienced local manufacturers	3.35	1.15	67.0	3.021	0.003
Logistics	2.67	1.06	53.4	-3.100	0.003
Security	2.83	1.25	56.6	-1.354	0.179
Construction phase costs risks	2.95	0.87	59.0	-0.572	0.569

Source: Own elaboration based on the questionnaire analysis

5.3.6. Analysis and discussion of operational phase risks

Concerning the risks related to the operational phase, the results presented in the table 5.18 show that the relative weight of the total axis operational phase risks reaches 59.8%, the mean is 2.99, and the standard deviation 0.92. The main axis of this risk category is the item availability of experienced local manufacturers, which ranks first with a relative weight of 66.0%. The item logistics shows the less relative weight of 52.6%. This result is consistent with the previous result in the table 5.16 and entirely in line with the conclusions of several studies, such as the World Bank (2011), GIZ (2012), Vidican (2012), Desertec Industrial Initiative (2013), Mukasa et al. (2013), Vidican et al. (2013), IRENA & EIB (2015), and IRENA (2018).

It is well known that in the phase of operations and maintenance, the operating companies should be supported by local service providers, including operating system manufacturers and developers. On this side, most MENA countries have not acquired capable technology providers or system developers. Design flows and component failure may result from technology risks that negatively impact operations (Liebreich, 2005; Martinez & Prados, 2007; Hitzeroth & Megerle, 2013; and Balks & Breloh, 2014). Besides, operations are always connected with maintenance and in particular with maintenance risks that refers to the damages of physical assets due to accidents, negligence or any other reasons (Turner et al., 2013). Most of the countries in the MENA region have operational skills and good manufacturers in cables or other small parts, while maintaining wind blades or big turbines would need international companies. The same happens regarding parts that are necessary for operations.

Table 5.18: Descriptive statistics about operational phase risks

Items	Mean	Standard deviation	Relative weight (%)	Test value	p-value
Operations and maintenance weight due to local conditions	3.20	1.12	64.0	1.773	0.079
Availability of spare parts	2.91	1.05	58.2	-0.853	0.396
Availability of local skilled workforce	3.10	1.19	62.0	0.838	0.404
Availability of experienced local manufacturers	3.30	1.12	66.0	2.669	0.009
Logistics	2.63	1.08	52.6	-3.397	0.001
Security	2.77	1.23	55.4	-1.858	0.066
Operational phase costs risks	2.99	0.92	59.8	-0.163	0.871

Source: Own elaboration based on the questionnaire analysis

5.3.7. Analysis and discussion of financial structure risks

Regarding the risks related to the financial structure, the results presented in the table 5.19 depict that the relative weight of the total axis of the financial structure risks reaches 62.11%, the mean is 4.35, and the standard deviation 1.20. The main axis of this risk category is the item inflation rate risk, which ranks first with a relative weight of 63.6%. On the contrary, the item dedicated state renewable energy fund presents the lower relative weight of 34.2%.

The results of this analysis show that the inflation rate is the most important macroeconomically risk affecting the financial structure of any project according to the investors in renewable energy projects in the MENA countries. This result is consistent with Nelson (1976) and Rappaport & Taggart (1982), which describe what happened since the 2008 recession as the risk premiums on debt and equity increased. This is due to the credit tightening following the economic slowdown and leverage decreases both in its absolute value and in its time extension; thus, shorter projects become increasingly fashionable. In a tax-less world, inflation would presumably only increase both future cash flows and discount rates by comparable amounts. Inflation risk pervasively also affects the whole project financial model, with potential damage to the real returns of the private investor; sponsoring banks may also be affected, to the extent that debt service is endangered. A proper factoring of inflation on economic margins and cash outflows and inflows is such a key challenge, with intrinsic relevance and significance. The results are also in line with Dailami & Leipziger (1998) description of the relation between debts and inflation rates, where the cost of domestic debt underwriting should equal that of foreign debt. To the extent that changes in the value of the local currency vis a vis foreign currency are related to domestic inflation, foreign creditors/investors will be covered, even if project revenues are in local currency. Comparing a high inflation developing country to a more stable mature economy, the former is likely to have higher interest and inflation rates, compensated by a devaluating currency. Consequently, foreign debt underwriting may seem formally cheaper, but its advantage is fully compensated by currency devaluations, which make foreign debt service more expensive.

Table 5.19: Descriptive statistics about financial structure risks

Items	Mean	Standard deviation	Relative weight (%)	Test value	p-value
Availability of long-term financing	3.13	1.14	62.6	1.137	0.258
Availability of short-term credit	2.97	1.16	59.4	-0.257	0.798
Interest rate risk	2.63	1.14	52.6	-3.236	0.002
Exchange rate risks	2.45	0.90	49.0	-6.193	0.000
Currency convertibility	2.54	1.12	50.8	-4.093	0.000
Inflation rate risk	3.18	1.14	63.6	1.566	0.120
Flow of capital in/out	3.07	1.09	61.4	0.640	0.524
Risks related to lake of renewable energy project financial skills	2.97	1.06	59.4	-0.281	0.779
Risks related to financial policy bias	2.69	1.03	53.8	-3.003	0.003
Tax regime and tax incentives	2.93	0.95	58.6	-0.732	0.466
Dedicated state renewable energy fund	1.71	1.08	34.2	-10.417	0.000
Financial structure risks	2.79	.90	55.8	-2.398	0.018

Source: Own elaboration based on the questionnaire analysis

5.3.8. Analysis and discussion of environmental and social risks

Concerning the risks related to the environmental and social issues, the descriptive statistics presented in table 5.20 show that the relative weight of the total axis environmental and social risks reaches 58.0%, the mean is 2.90, and the standard deviation 0.87. The main axis of this risk category is the item social resistance related to NIMBY concerns, which has a relative weight of 63.6%, the arithmetic mean is 3.18 and the standard deviation 1.05. While the item lack of awareness of renewable energy projects relatively weighs 54.6%, the lower value, being the arithmetic mean 2.73 and standard deviation 0.89. These results show that investors in renewable energy projects are facing difficulties with the social acceptance of these projects and especially a social resistance related to "Not-in-My Back-Yard" concerns. This result is consistent with the study of Dütschke & Wesche (2014), which states that all electricity generating technologies comprise negative impacts to a certain extent. As renewable energy plants are being deployed in many locations, due to the ongoing decentralisation process, increasingly there are clashes with local communities. Acceptance for this type of technologies, such as wind energy developments, can be low since there are often strong perceived disadvantages. The results also agree with Sijmons & Van Dorst (2012) that describe the attitude towards renewable energy projects. Although it is positive in general, individual projects regularly face resistance from the local community as people tend to resist change in their environment, out of a personal fear for a loss of quality of life. The results of this research also match with the recommendation of De Boer & Zuidema (2015) that instead of disregarding local views as "Not In My-Back-Yard" behaviour, both rational and emotional parts of the local debate should be taken seriously. Both rational objections to projects and specific fears and emotions should be identified, discussed and dealt with. Since a disproportionate share of negative impacts of development, such as a wind energy park, is for the local community, a strategy for sharing benefits may be employed. This can either be financial compensation, local (co-)ownership or benefits in kind (direct local improvements) (Dütschke & Wesche, 2014).

Table 5.20: Descriptive statistics about environmental and social risks

Items	Mean	Standard deviation	Relative weight (%)	Test value	p-value
Clarity of environmental impact assessment procedures	2.75	0.97	55.0	-2.555	0.012
Lack of awareness of renewable energy projects	2.73	0.89	54.6	-3.008	0.003
Social resistance related to special interest groups	2.95	0.98	59.0	-0.506	0.614
Social resistance related to "Not in my back yard" concerns	3.18	1.05	63.6	1.702	0.092
Environmental and social risks	2.90	0.87	58.0	-1.118	0.266

Source: Own elaboration based on the questionnaire analysis

5.3.9. An overall analysis of risks categories

Finally, once examined each of the risk categories, the analysis focuses on a global perspective of the eight different risks categories related to renewable energy investments. Table 5.21 shows the analysis of all risks in eight groups as they are categorized in the questionnaire. The relative weight of the total axis risks related to renewable energy investments reaches 56.4%, the mean is 2.82, and the standard deviation 0.86. The main axis of the different risks related to renewable energy investments is the risks category related to the operational phase costs, meaning a relative weight of 59.8%. However, the risks category related to the political situation has the low relative weight of 46.8%. The results also show that the most

important risk category (risks related to the operational phase costs) is followed by the risks related to the construction phase cost. Then, the regulatory framework and revenues risks rank third and fourth, respectively. In the fifth place are environmental and social risks, while and in the sixth and seven places are financial structure risks and business environment risks, respectively.

In contrast, this result is not consistent with the only publicly available survey that studied the risks in 4 southern Mediterranean countries in 2015 (Egypt, Jordan, Morocco and Tunisia). It tackled 36 items divided into five main areas, which are the following ones: legal framework enabling investments, risks affecting revenues, risks affecting costs, risks affecting financial structuring and environmental and social issues (RES4MED, 2016). The RES4MED survey results ranked first the risks affecting financial structuring, followed by risks affecting renewable energy framework, then risks affecting revenues. The last risks category in their ranking was the risks affecting the operational phase. It should be noted that risks affecting revenues are at the same ranking in both studies.

Table 5.21: Descriptive statistics on different risks categories concerning renewable energy investments

Items	Mean	Standard deviation	Relative weight %	Test value	p-value
Political risks	2.34	1.08	46.8	-6.165	0.000
Business environment risks	2.75	0.94	55.0	-2.671	0.009
Regulatory framework risks	2.94	0.86	58.8	-0.702	0.484
Revenues risks	2.94	0.96	58.8	-0.636	0.526
Construction phase costs risks	2.95	0.87	59.0	-0.572	0.569
Operational phase costs risks	2.99	0.92	59.8	-0.163	0.871
Financial structure risks	2.79	0.90	55.8	-2.398	0.018
Environmental and social issues risks	2.90	0.87	58.0	-1.118	0.266
Total risks categories	2.82	0.86	56.4	-2.068	0.041

Source: Own elaboration based on the questionnaire analysis

5.4. HYPOTHESES TEST AND DISCUSSION OF RESULTS

The eight hypotheses proposed by this research are developed based on the detailed literature review provided in Chapter 3. This section of the study tests the hypothesis in addition to a thorough discussion of the results considering the theoretical background of this research. It should be noted that due to the difficulty of measuring the risks with quantitative indicators, the hypotheses analyse the relationships between the good situation concerning the eight risks categories and renewable energy investments.

5.4.1. Hypothesis one concerning political risks

The first hypothesis states that risks related to the political situation have a negative effect on renewable energy investments. The results show a positive relationship between the political situation and renewable energy investments. Therefore, this result also shows that the risks which undermine the political situation negatively affect renewable energy investments. Hence, there is a negative impact on renewable energy investments due to the worsening of the political situation in the Middle East and North Africa countries, according to the first hypotheses. Therefore, there is a negative impact on renewable energy investments due to the worsening of

the political situation in the Middle East and North Africa countries according to the first hypotheses. Table 5.22 depicts that the correlation coefficient is equal to 0.811, and the probability value (significance) equals 0.00, which is less than the significance level of 0.05≥α. This indicates the presence of a statistically significant strong relationship between the political situation and renewable energy investments. Thus, the results show that political risks have a strong negative impact on renewable energy investments, which is consistent with the trends of investments according to the World Investment Report of 2018 (UNCTAD, 2018). These results match with several studies that emphasized the growing role of political risks and attempted to analyse that concept, such as Kobrin (1978), Fitzpatrick (1983), Simon (1984), Friedman & Jonghoon (1988), Chermack, (1992) and Jarvis (2008). Besides, these results coincide with the conclusions of Zink (1973), Green (1974), and Green & Korth (1974), since they state that the highest percentage of political risks will be found mostly in the underdoped or modernizing countries. The results are also in line with the conclusions of Root (1972), Brewers (1981), Jodice (1984) and Multilateral Investment Guarantee Agency (2011) that described the political risk as the probability of disruption of the operations of MNEs by political forces or events. They also agree with the works of Robock (1971), Thunell (1977) and Micallef (1982), where political risks were described as discontinuities in the business environment deriving from political change, which have the potential to affect the profits or the objectives of a firm. In addition, there is agreement with Green (1974) and Thunell (1977) as they concluded that political risks equated to political instability and radical political changes in the host country of the investments. In contrast, the results do not coincide with the definition of the political risk by Aliber (1975), Eitman & Stonehill (1973), Henisz & Zelner (2010). It should be noted that they defined the political risks as unwanted government interference with business operations, while the concept of the political risks in the questionnaire is referring more to the wars, political instability, and poor governance.

Table 5.22: Correlation between the political situation and renewable energy investments

Hypothesis 1	Pearson coefficient	Potential value (Significance)
Risks related to the political situation have a negative effect on renewable energy investments	0.811	0.000

Source: Own researcher elaboration based on the questionnaire analysis

5.4.2. Hypothesis two concerning business environment

The second hypothesis states that risks related to the renewable energy business environment have a negative effect on renewable energy investments in the MENA countries. Table 5.23 shows that the correlation coefficient is equal to 0.951, and the probability value (significance) equals 0.00, which is less than the significance level of 0.05≥α. This indicates the presence of a statistically significant positive strong relationship between the renewable energy business environment and renewable energy investments. Therefore, this result also shows that risks which undermine renewable energy business environment negatively affect the renewable energy investments. Hence, there is a negative impact on renewable energy investments due to risky renewable energy business environment in the Middle East and North Africa countries, according to the second hypothesis.

Table 5.23: Correlation between the business environment and renewable energy investments

Hypothesis 2	Pearson coefficient	Potential value (Significance)
Risks related to the renewable energy business environment have a negative effect on renewable energy investments	0.951	0.000

Source: Own elaboration based on the questionnaire analysis

On the one hand, this result is consistent with the Pigou public interest theory of regulation, which holds that unregulated markets exhibit frequent failures, ranging from monopoly power to externalities (Pigou, 1938). It also agreed partially with De Soto path-breaking study of entry regulation in Peru (De Soto, 1989), while unlike De Soto, this study analysed the official requirements, official cost, and official time, and it does not measure corruption and bureaucratic delays that further raise the cost of entry. It also agrees with the conclusions of Pigou (1938) that unregulated markets exhibit frequent failures, ranging from monopoly power to externalities. Even by being registered, new companies acquire a type of official approval, which makes them reputable enough to engage in transactions with the general public and other businesses (SRI International, 1999). Besides, Stigler (1971) concluded that industry always benefits from regulations. Furthermore, it is consistent with several research of the development of private credit markets across countries which suggest an important role of institutions in supporting these markets, such as legal investor protection and credit bureaus, e.g. Jappelli & Pagano (2002), and La Porta et al. (1997). In addition, it agrees with Djankov et al. (2008) empirical research that shows that stricter regulation of self-dealing is associated with greater equity investment and a lower concentration of ownership. This conclusion is in line with the view that stronger legal protections make minority investors more confident about their investments, reducing the need for concentrated ownership to mitigate weaknesses in corporate governance. The results also agree with Dahya et al. (2008), which concluded that if the laws do not provide such protections, investors may be reluctant to invest, unless they become controlling shareholders. It also coincides with efficiency theories of the labour market and its relevant research and studies, according to Demsetz (1967) and North (1982). Research studies carried out in 2002 and 2003 identified government intervention measures that are not prone to subversion and are cost-effective. Moreover, governments implement less strict labour intervention measures when public interference may cause distortions in order (to cut social enforcement costs). The efficiency theory on its own is too broad in scope and strongly influence regulations and whose effect is difficult to reject. There are two potential implications of the theory (Glaeser & Shleifer, 2002, 2003; Glaeser et al., 2003; Djankov, La Porta et al., 2003). The first one is that in case that efficiency is the appropriate model, different political factors like leftist power or government constraints will not result in efficient regulatory practices. The second situation applies when government labour market intervention system for the protection of employer rights is efficient. In such a situation, the interventions will not have a significant negative effect, like reduction in manpower, unemployment, and an increase in the unofficial economy (Glaeser & Shleifer, 2002, 2003; Glaeser et al., 2003; Djankov et al., 2003).

The results are consistent with Djankov et al. (2010) estimation of the effects of trade costs on trade and also with Hummels & Skiba (2004) work, which concluded that more efficient trade facilitation stimulates trade; in turn, trade is also likely to generate improved trade facilitation. It also matches with the conclusions of Romalis (2004), Cunat & Melitz (2007), and Levchenko (2007) , who examined the effect of endowments, institutions, and labour flexibility on trade, respectively. In addition, Montesquieu (1984) and Smith (1976) conclude that the security of property and the enforcement of contracts are essential for investment, trade,

and ultimately economic growth. Furthermore, the results concur with the conclusions of La Porta et al. (2002), where minority investor protections can have important implications for firm valuation. This research on 539 large firms in 27 economies shows that firm valuation is higher in economies with good investor protections than in those with poor protections. Kose, Litov, & Yeung (2008) show that corporate risk-taking and firm growth rates are positively related to the quality of the system of investor protections. Thus, better systems may drive corporations to undertake risky but value-enhancing investments. In addition, the results agree with the conclusions of Coase (1960) that economists have been generally most optimistic about courts as the institution securing property and enforcing contracts. They are also in line with the development theory, which holds that courts, like many other institutions, work better in countries that have richer and more educated populations (Demsetz, 1967; North, 1982). Moreover, the incentive theory holds that the efficiency of courts is shaped by the incentives of the participants in dispute resolution, including the judges, the lawyers, and the litigants (Buscaglia & Dakolias, 1999; Messick, 1999). The results are also in line with the study of Djankov et al. (2008), which investigates the enforcement of debt provisions concerning insolvent companies in 88 nations and presents the data regarding practitioners of insolvency in different countries with the case study similar to an insolvent firm.

On the other hand, these results are opposite to the conclusions of De Soto (1989), McChesney (1987), Shleifer & Vishny (1993, 2002), and Emery et al. (2000), which state that regulations are benefiting the politicians and bureaucrats, and those are using permits to get bribes. They are also contradictory with the study of Sa'adiah & Gul (2010) that analyses the effects of related-party transactions on companies listed on the Hong Kong Stock Exchange during 1998-2000. They find that the transactions led to significant losses in value for minority investors. Indeed, the mere announcement of a related-party transaction led to abnormal negative stock returns. Their research concluded that investors considered companies with a history of such transactions (including not prejudicial) to be riskier investments than those with no such history. The same research shows that related-party transactions carried out by family-owned firms are more likely to be used opportunistically to expropriate minority investors.

5.4.3. Hypothesis three concerning regulatory framework risks

Renewable energy framework has a relevant impact on renewable energy investments. Indeed, the third hypothesis deals with the relationship between these variables. Table 5.24 shows that the correlation coefficient is equal to 0.954, and the probability value equals 0.00, which is less than the significance level of $0.05 \geq \alpha$. This indicates the presence of a statistically significant positive strong relationship between the renewable energy framework and renewable energy investments. Therefore, this result also shows that risks which undermine renewable energy regulatory framework negatively affect the renewable energy investments. Hence, there is a negative impact on renewable energy investments due to risky renewable energy regulatory framework in the Middle East and North Africa countries according to the third hypothesis.

These results are in line with the OECD *Recommendation of the Council on Regulatory Policy and Governance* (2012), which offers a comprehensive framework for identifying an integrated government policy regulation (OECD, 2012). They are also consistent with OECD (2015) that described the systematic reviews mechanism of the main regulations, which should have clear objectives with a focus on benefits and costs to ensure that the respective regulations are cost-effective, up-to-date, cost-justified, consistent, and result in the desired outcome. It

also matches with the 2008 OECD *Introductory Handbook for Undertaking Regulatory Impact Analysis*, which details the main steps that are involved in designing regulations using the RIA-based approach (OECD, 2008). The OECD *Best Practice Principles for the Governance of Regulators* can also serve as a guide to help regulatory agencies in creating the framework for achieving these aims (OECD, 2014a). The results also agree with the 2014 OECD *Best Practice Principles for Regulatory Policy: Regulatory Enforcement and Inspections*, which focus on addressing the creation of policies, tools, and institutions for promoting compliance and reforming the inspection services for achieving the desired outcome (OECD, 2014b). Moreover, the results of this thesis concord with the OECD principles on digital governance, which acknowledges the role of technology in supporting the creation of more effective policies and development of more transparent, open, participatory, innovative, and trustworthy regulations.

Moreover, the results presented here coincide with Bloomberg New Energy Finance (2011) and Corfee-Morlot et al.(2012), which described the feed-in-tariffs market. Besides, these results agree with the Commission of the European Communities (2008) report that emphasized the importance of the feed-in-tariffs scheme as the most efficient incentive in the short-run for encouraging private renewable energy investment. Likewise, the conclusions of Mendonça et al. (2010) about feed-in-tariffs in developing countries are in the same sense. In addition, the approach of Mendonça et al. (2010) encourages decentralized production of solar electricity.

Table 5.24: Correlation between the renewable energy framework and renewable energy investments

Hypothesis 3	Pearson coefficient	Potential value (Sig.)
Risks related to the renewable energy framework have a negative effect on renewable energy investments	0.954	0.000

Source: Own elaboration based on the questionnaire analysis

5.4.4. Hypothesis four concerning risks revenues

The fourth hypothesis deals with revenues, which is one of the main elements affecting investments in general and renewable energy investments in particular. In this context, it is very important to study the relationship between these two variables, which was tested to understand the relation between renewable energy investments and revenues in MENA the countries. Table 5.25 shows that the correlation coefficient is equal to 0.958, and the probability value (significance) equals 0.00, which is less than the significance level of $0.05 \geq \alpha$. This indicates the presence of a statistically significant positive strong relationship between revenues and renewable energy investments. Therefore, this result also shows that risks which reduce renewable energy projects revenues negatively affect renewable energy investments. Hence, there is a negative impact on renewable energy investments due to unstable and small renewable energy revenues in the Middle East and North Africa countries, according to the fourth hypothesis.

These results are in line with the conclusions of Turner et al. (2013), Balks & Breloh (2014), and Jin et al. (2014) about the market and sales risks including curtailment risks. Likewise, the results are in line with Martinez & Prados (2007) and EWEA (2013) description of fluctuations and profitability of wind energy projects. They also coincide with the study conclusions of Turner et al. (2013) about the financing of renewable energy projects. The results

presented here also agree with the conclusions of Watts (2011) in terms of actual capacity and planned capacity and its implications on the revenues and the expectations that the difference between both capacities could increase in the future due to the climate change issues. Besides, the results coincide with the conclusions of EWEA (2013) about guarantees the output of targets and the need for an extensive maintenance and service program to achieve the highest possible output to stabilize the revenues. The results concur with the description of Jacobsen & Schroder (2012) of the curtailment risk that occurs in the event of excess wind energy generation, in addition to insufficient captivities of the grid system due to distribution or transmission congestion and insufficient demand in the region due to regional grid oversupply. The reduction of the curtailment risk and the signification costs requires investment by the state in power grids to improve the infrastructure and increase the grid capacity, which can take more than ten years (Jacobsen & Schroder, 2012; EWEA, 2013; Turner et al., 2013). Moreover, the results agree with Dinica (2006) and Solangi et al. (2011) description of the market risks in regions. Thus, the absence of support schemes, make them more exposed to the market risks since the demand of energy depends on the price (Watts, 2011; Turner et al., 2013). They also conclude that the behaviour of electricity price might change when there is an increase in the percentage of renewable energy. Furthermore, the results of this thesis are consistent with the conclusions of Dinica (2006), and Turner et al. (2013) about the importance of a long time PPA to secure a fixed rate of power outputs. In the same direction, Waissbein et al. (2013) recommend that the design of the PPA contracts should include important clauses and provisions for curtailment, termination, and currency domination to avoid possible shortcomings.

Table 5.25: Correlation between revenues and renewable energy investments

Hypothesis 4	Pearson coefficient	Potential value (Sig.)
Risks related to revenues have a negative effect on renewable energy investments	0.958	0.000

Source: Own elaboration based on the questionnaire analysis

5.4.5. Hypothesis five concerning construction phase risks

The fifth hypothesis states that risks related to the construction phase costs have a negative effect on renewable energy investments. The table 5.26 shows that the correlation coefficient between the construction phase and renewable energy investment is equal to -0.951, and the probability value (significance) is 0.00, which means less than the significance level $0.05 \geq \alpha$. This indicates the presence of a statistically significant negative strong relationship between the construction phase costs and renewable energy investments. Therefore, this result also shows that risks which increase the construction costs negatively affect renewable energy investments. Hence, there is a negative impact on renewable energy investments due to risks that increases the construction phase costs in the Middle East and North Africa countries, according to the fifth hypothesis.

Table 5.26: Correlation between the construction phase and renewable energy investments

Hypothesis 5	Pearson coefficient	Potential value (Significance)
Risks related to the construction phase have a negative effect on renewable energy investments	-0.951	0.000

Source: Own elaboration based on the questionnaire analysis

This result is consistent with the description about the risks related to distribution, construction, and completion of green power projects by EWEA (2013) and Turner et al. (2013) that generally focus on the first stage of the life-cycle, with the period of construction considered to have the highest risk. It also agrees with the conclusions of EWEA (2013) and Markard & Petersen (2009) that the grid and bottleneck risks are particularly relevant to offshore clean energy projects, due to the complexity of the construction and transportation processes. Furthermore, the result coincides with the conclusions of Turner et al. (2013), about the limited availability of specialized construction vehicles for some renewable energy projects since they may be booked years in advance. Besides, it agrees with the conclusions of Markard & Petersen (2009) about risks related to constructing renewable energy projects, especially offshore projects. The found result also concurs with the special attention that should be paid to certain project constructions like wind farms where the soil conditions and the foundation design risk also need to be assessed when creating a plan for wind energy plants (EWEA, 2013). Turner et al. (2013) also emphasize the importance of insurance in the construction phase as it is essential to guarantee the financial situation if any delay happened in the construction due to any problem.

5.4.6. Hypothesis six concerning operational phase risks

The sixth hypothesis discusses the relationship between the risks related to the operational phase of a renewable energy project and the renewable energy investments, considering a negative impact of these risks on such type of investments. Table 5.27 shows that the correlation coefficient is equal to -0.910, and the probability value (significance) equals 0.00. Since the significance level is $0.05 \geq \alpha$, it indicates the presence of a statistically significant negative strong relationship between the operational phase and renewable energy investments. Therefore, this result also shows that risks which increase the operational phase costs negatively affect renewable energy investments. Hence, there is a negative impact on renewable energy investments due to risks that increases the operational phase costs in the Middle East and North Africa countries, according to the sixth hypothesis.

Table 5.27: Correlation between the operational phase and renewable energy investments

Hypothesis 6	Pearson coefficient	Potential value (Significance)
Risks related to the operational phase have a negative effect on renewable energy investments	-0.910	0.000

Source: Own elaboration based on the questionnaire analysis

This result is consistent with the conclusions of Turner et al. (2013) about maintenance and operations risks. It also agrees with the description of Watts (2011) of risks that negatively affect the profitability including operational risks and possible problems including losses due to flaws in the design, component failure, and unexpected closure of the plant due to unavailability of critical resources. It is also in line with the study of EWEA (2013) about technology risks that refer to unreliable performance due to unproved design and technologies. Furthermore, the result concurs with Turner et al. conclusion (2013) about factors that affect operations and various conditions that can reduce or stop the operations. In addition, it agrees with Watts (2011) conclusions about inefficient or unreliable technology impacting operations and reliable technology manufacturers. Moreover, the result coincides with Martinez & Prados (2007) description of the serial loss of faulty components or turbines represents a significant

risk with power plants, and the recommendations of Jin et al. (2014) to reduce operational losses by evaluation of serial risks from untested and imperfect technologies and concepts.

5.4.7. Hypothesis seven concerning financial structure risks

The financial structure is one of the major decisions to be taken by an investor in all projects. Investors in renewable energy projects should form the best financial structure that is suitable for the kind of renewable energy technology that they are using, while taking into consideration different governmental policies and regulator decisions. Since the impact of the financial structure is very important for the profits and stability of the project, this hypothesis is developed to explore the relationship between these variables. Table 5.28 shows that the correlation coefficient is equal to 0.910, and the probability value (significance) equals 0.00, which is less than the significance level of $0.05 \geq \alpha$. This indicates the presence of a statistically significant positive strong relationship between the financial structure and renewable energy investments. Therefore, this result also shows that risks which undermine renewable energy financial structure negatively affect renewable energy investments. Hence, there is a negative impact on renewable energy investments due to unstable and risky financial structure in the Middle East and North Africa countries according to the seventh hypothesis.

Table 5.28: Correlation between the financial structure and renewable energy investments

Hypothesis 7	Pearson coefficient	Potential value (Significance)
Risks related to the financial structure have a negative effect on renewable energy investments	0.910	0.000

Source: Own elaboration based on the questionnaire analysis

This result is consistent with Hussain (2013) conclusions about the lack of availability of funds in low-income countries, due to the purchase of low-risk government bonds and lack of capital funds. It means that investment is diverted to projects with the highest returns in the short-term duration with minimum risks criteria that are not met by RET. It is also in line with Pramod (2011) finding about the renewable energy technology timetable, which as it was that significant pre-investment financing is required to cover the expenses to the point of revenue generation and to cover the risk of delays. Moreover, the result agrees with the report published by CPA Australia Ltd (2008), which concluded that interest rate risk has to be managed to minimize the impact of fluctuations in the rate on the profitability of an organization, according to CPA Australia Ltd. Non-financial firms should adequately manage financial risks; thus, that the focus is on the provision of core services and goods, while minimizing the financial risks (CPA Australia Ltd, 2008).

Furthermore, it coincides with the estimation of the competitiveness of green energy versus brown energy projects for different rates, which was provided for different renewable energy projects in a discussion note by the Council of Economic policies of Switzerland (Monnin, 2015). The results show that renewable energy projects are competitive when interest rates are kept low. Moreover, this report showed that the costs of green energy projects show high volatility to changes in the rates in regions with a low-interest rate. This implies that the risk related to the high-cost fluctuations may partially offset the benefits of low-interest rates for investment in renewable energy projects (Monnin, 2015).

In addition, it agrees with Gray & Irwin (2003) conclusions about the mechanisms for adjustment in tariffs, which were not the only approach taken by the government that provides guarantees for protection against exchange rate risks for repayment of foreign debt. The same study also showed that private finance allocated for privatizations and greenfield projects in developing countries would be limited when the reliance on foreign debt is reduced. Moreover, the initial cost of financing will be high. However, the benefits will outweigh the risks and vagaries of developing markets will be weathered through more robust investment. Likewise, it concurs with Oblath (1993) conclusions about convertibility and invertibility where convertibility refers to the exchangeability and the free use of the currency. This term can be defined for practical purposes as the freedom in carrying out currency exchange related financial transactions by economic agents. This study also describes that a country could select the appropriate time for declaring the de jure convertibility of the currency in line with the considerations of economic policy. Moreover, the result is in line with Nelson (1976) and Rappaport & Taggart (1982) conclusions, when they studied the risk premiums on equity and debt and concluded that this risk premium tends to rise during macroeconomic crises, such as the 2008 financial crises due to the credit tightening measures after the economic slump. The leverage falls both in terms of absolute value and the time duration with most investors preferring short term investments. Inflation would increase discount rates and future cash flow when no taxes are assumed. Furthermore, it agrees with Dailami & Leipziger (1998) conclusions about the relationship between interest and inflation rates differentials, and it impacts on the currency exchange rate adjustments, due to which the local debt underwriting cost should be similar to the cost of foreign debt. Changes in the currency exchange value are related to the local currency due to which the investment of foreign investors will be protected even when the revenues are in domestic currency. Besides, it coincides with the conclusions of several studies including Aizenman & Glick (2009), Forbes (2003, 2005a, 2005b), and Greenwood (2008) which described that capital flow measures (CFMs) could impose certain costs on the economy. They can tighten constraints to financing by limiting access to foreign capital, reduce discipline in public finances and financial markets, and limit options for residents to diversify the assets. They can also encourage rent-seeking behaviour, corruption, a costly mentoring system, and promote repression of the financial sector that distorts capital allocation and prevents financial development. Kose et al. (2009), and Parsad et al. (2003) state that the flow of capital could have collateral or indirect advantages in achieving short-term goals, such as the discipline of the macroeconomic policy, development of the financial sector, and economic and trade efficiency. According to Ishii et al. (2002), and Kose & Parsad, (2004), Dell'Ariccia et al. (2007), Henry (2007), Chen et al. (2009), and IMF (2012b), the flow of capital at a macroeconomic level allows countries to finance imbalances in the current account (for example, for productive investment or consumption smoothing). In addition, the imbalances can result in portfolio diversification. Some studies have empirically verified the relationship between growth and flow of capital for FDI and capital equity flows particularly for undeveloped counties, but this relationship is vague for debt-creating capital flows (Aizenman & Sushko, 2011; Edwards, 2007; Henry, 2007; Kose, 2008).

The BNEF report (Blomberg New Energy Finance, 2013) states that regulation of financial institutions and retirements funds including the ownership structure for the assets and the accountability of public finance could hinder investment in green energy projects in different ways, and investment bias that discourages financing of green energy projects needs to be identified and eliminated to attract investment for sustainable infrastructure upgrade for renewable energy investment projects. Clement et al. (2005) described the tax incentives and the case when the taxes owed are not sufficient, due to which the tax rebates tend to be

insignificant, which can be a critical disadvantage of the use of incentives for encouraging renewable energy investment. The results of this thesis are consistent with the conclusions of Clement et al. (2005) about the benefits of tax incentives for smaller clean energy facilities, and the incentives can encourage the installations of renewable energy plants. In the same way, Milford et al. (2012) conclude that state clean energy funds (CEFs) have emerged as effective tools that states can use to accelerate the development of energy efficiency and renewable energy projects.

5.4.8. Hypothesis eight concerning environmental and social risks

Environmental and social impacts of different projects became very pressing in the last decade; this is the reason why this hypothesis is developed. In line with the discussions being carried out for this issue, there are some risks associated with environmental and social issues that might have a negative impact on renewable energy projects. Table 5.29 shows that the correlation coefficient is equal to 0.928, and the probability value (significance) equals 0.00, which is less than the significance level $0.05 \geq \alpha$, which indicates the presence of a statistically significant positive strong relationship between environmental and social issues and renewable energy investments. Therefore, this result also shows that risks which increase social opposition and bad environmental factors negatively affect renewable energy investments. Hence, there is a negative impact on renewable energy investments due to risks related to environmental and social issues in the Middle East and North Africa countries, according to the eighth hypothesis.

Table 5.29: Correlation between environmental and social issues and renewable energy investments

Hypothesis 8	Pearson coefficient	Potential value (Significance)
Risks related to the environmental/social issues have a negative effect on renewable energy investments	0.928	0.000

Source: Own elaboration based on the questionnaire analysis

These results are consistent with several studies that described the possible impact of several clean energy projects on the environment. Thus, Macintosh & Downie (2006) describe the risks to birds by wind turbines. Several studies, such as Baerwald et al. (2008), Sovacool (2009) and Willis et al. (2010), also conclude that some avian species like bats face significant risks due to low air pressure near the blades that can result in internal haemorrhaging. Klugmann-Radziemska (2011) considers that despite that solar power has been accepted as a safe and effective technology for generation of electricity, the chemicals that are used in the manufacturing of PV could release in the air, groundwater, and surface water in the manufacturing plan, installation site, and recycling or disposal facility. Goff et al. (2009) research about geothermal projects concludes that geothermal development could have certain negative impacts if appropriate mitigation actions and monitoring plants are not in place. Strict regulations have been enforced in certain countries to reduce the environmental effects associated with the geothermal power generation. Besides, the results agree with Sanguri (2013), which concludes that hydropower represents a clean energy source that does not have any impact on air quality. However, dams constructed for the generation of hydropower could have a significantly negative impact on the surrounding ecology, including fish and the depending wildlife. In addition, the results concur with what Dütschke & Wesche (2014) describe clashes with the public in some locations where renewable energy projects were deployed. In the same sense, Hofman & Van Der Gaast (2014) state that the success of clean

technology depends to a large extent on social acceptance. This is the reason why a clear understanding of the elements that affect public viewpoints is necessary. Furthermore, the results coincide with several studies which concluded that the increased awareness results in improved willingness to oppose the technologies that lead to climate changes; thereby, resulting in acceptance of green technologies (Spence et al., 2012; Strazzera et al., 2012; Thøgersen & Noblet, 2012). It is also in accordance with UNDP (2010). The public should be provided complete, timely and balanced knowledge about the new technologies, including related benefits, risks, and costs. Renewable technologies are not considered if the public is not made aware of the technologies. Moreover, many studies have highlighted the fact that commute co-ownership or joint ownership of projects can result in increased social acceptance (Dütschke & Wesche, 2014; Strazzera et al., 2012). Furthermore, it agrees with Sijmons & Van Dorst (2012) work, which concludes that the resistance to change is normal in the environment due to personal fear of the loss in the quality of life. In addition, it is in line with the conclusions of De Boer & Zuidema (2015) about the local views and that it should not be regarded as Not-in-My-Back-Yard (NIMBY) behaviour.

Nevertheless, the results presented here disagree with Hunt (2001) that described the benefits of wind turbines in reducing greenhouse emissions. They also disagree with the conclusions of the NSW Department of Environment Climate Change and Water (2010) about the noise of wind farms and the turbines that is only 5A-weighted decibels more than a quiet country village and the background level noise. However, health authorities and scientists confirmed according to Leventhal (2006), that the low levels of sound generated by wind turbines pose no risk to the health. Moreover, Sovacool (2013) compares the environmental impact of wind turbines with fossil fuel energy plants and states that on aggregate fossil fuel are about 17 times more harmful to birds when compared on a per GWh basis with nuclear and wind power plants. It is also in contrast with the results of a survey by Electric Power Research Institute (2003) as the Toxic Release Inventory System (TRIS) database of six PV production companies prepared by the US EPA; the chemicals are not released in significant quantities. The chemicals that are released to the air from PV facilities were reported to be air stack and fugitive air emissions, harmful impact only can be from huge quantities of these materials.

5.4.9. An overview on the eight hypotheses

Once analysed the eight hypotheses, table 5.30 shows a summary of the hypotheses test results. It can be concluded the there is a strong and significant relation between all risks categories and the renewable energy investments. In addition, the discussion of the results of this study gives major support of the results by the literature review of this study.

Table 5.30: Synthesis of correlations between risks categories and renewable energy investments

Hypothesis	Independent	Dependent	Pearson coefficient	Potential value (Significance)	Status
H1	Political risks	Renewable Energy Investments	0.811	0.000	Supported
H2	Business environment risks		0.951	0.000	Supported
H3	Regulatory framework risks		0.954	0.000	Supported
H4	Revenues risks		0.958	0.000	Supported
H5	Construction phase costs risks		-0.951	0.000	Supported
H6	Operational phase costs risks		-0.910	0.000	Supported
H7	Financial structure risks		0.910	0.000	Supported
H8	Environmental and social risks		0.928	0.000	Supported

Source: Own elaboration based on the questionnaire analysis



CONCLUSIONS

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A. MAIN CONCLUSIONS

Most of the countries in the MENA region have announced targets for deployment of renewable energy projects, committed the Paris Conference of Parties (COP21) Agreement, and pledged support for a sustainable climate with a number of concrete measures that will contribute to achieving the Sustainable Development Goal 7 (SDG7) related to energy. However, only a few countries have officially sanctioned their plan. A number of challenges have been observed in the energy development program in the MENA region. The ambiguity regarding grid access and readiness of the grid infrastructure to support renewable energy have been the main barriers. In most countries, detailed renewable energy access conditions and grid maps are largely inaccessible by private power companies. Moreover, the capacity of the current grid infrastructure is insufficient to absorb renewable energy in many countries.

While MENA region is rich on renewable energy sources, and despite all ambitious plans of the countries in the region, to increase the renewable energy share in the overall installed capacity, the region is still on the share of 6%. Many gaps in regulations can be observed in most of the countries in the region including the lack of comparable national targets across the region. Moreover, many countries do not have a clear and officially endorsed targets that are adopted by higher political authorities, embedded in legally binding documents, and supported by a detailed strategy or action plan to achieve them. In addition, the absence of a clear renewable energy law creates uncertainty for investors as only a few countries have passed renewable energy laws.

It should be noted that the lack of clear signals from the governments on the total number of projects to be developed through the public competitive bidding process creates uncertainty for investors. In many countries, the public competitive bidding process is currently planned only for one or two renewable energy projects. In addition, the procedures for the public competitive bidding process are slow and lengthy. One of the main issues in the region, which affects the investment environment in renewable energy, is energy subsidies. Highly subsidised electricity tariffs for consumers make the investment in renewable energy more unattractive.

In the countries where electricity tariffs are low, net-metering without introducing preferential purchase prices for excess electricity is insufficient to create an incentive for investment in RETs. The current electricity prices are too low to motivate additional gains that could be achieved as a result of a net-metering policy. Regarding net-metering, many countries in the region also experience regular power outages, which prevent customers from feeding excess electricity to the grid and benefiting from the net-metering policy. Furthermore, no policy instruments other than net-metering exist in the region that would provide private renewable energy developers with the assurance that generated electricity will be purchased at a fixed long-term price with guaranteed access to the electricity grid.

Many countries in the region have not established well-functioning independent regulators with sufficient competencies in key areas, such as tariff-setting, license issuance, power sector monitoring and sanctioning. Besides, most electricity markets remain state-dominated with non-transparent management. In addition, most of the countries have not established designated renewable energy agencies capable of designing renewable energy policies, streamlining administrative procedures, assisting in the deployment of private renewable energy projects, and leading deployment of demonstration and other public renewable energy projects.

Almost half of the countries in the MENA region do not have fiscal measures (such as tax exemptions, tax credits, tax reductions, and customs duties exemption) to reduce the costs of renewable energy projects and support renewable energy development. Most countries in the region also lack well-funded renewable energy funds or other mechanisms that facilitate access to financing by private developers.

Most of the renewable energy projects are considered as national projects and implemented by the public authorities, while the level of participation of private investors in the renewable energy sector is very low. It can be observed that there is a low share of private investment and active policies able to attract local and/or international firms.

Renewable energy has not been sufficiently incorporated into the educational systems of the MENA region. Specialised programmes may exist in the science and engineering departments, but renewable energy has not yet been incorporated into management, policy, economics, and other social science programmes. Besides, there is a lack of support for R&D activities to investigate options of various renewable energy applications in the local context, and government agencies outside energy ministries and utilities are not sufficiently prepared to deal with renewable energy issues. Ministries of planning, finance, and education, among others, need capacity building in renewable energy.

Renewable energy capacity investment in the MENA region decreased by 8% to USD 15.2 billion in 2019, from the record total of USD 16.5 billion reached in 2018. Several countries that had become significant investors in previous years, including Jordan, Egypt, and Morocco, had sizeable falls in investment, mainly due to gaps in auction programs. Overall, this was the main reason for the decline in the region as a whole. Trade data suggest that some USD 5 billion of small-scale solar systems were sold to undisclosed customers in the MENA region last year. United Arab Emirates was, by a large difference, the main performer in renewables investment in the region in 2019. Its predominance is owed to the one giant project Al Maktoum IV, which amounts USD 4.3 billion. It is made up of 600MW of solar thermal power from a parabolic basin complex and 100MW from a solar tower, with a further 250MW from PV panels. The three most active renewables markets in MENA (Morocco, Egypt, and Jordan) accounted for a total of USD 15.7 billion invested during the five years from 2015 to 2019, but last year was relatively weak for all of them. The largest asset financings were USD 302 million for the 420MW ONEE Morocco PV portfolio, and USD 325 million for the 250MW Lekela Power West Bakr wind farm in Egypt.

The MENA region will need to install 88GW of generation capacity over the period 2019-2023. This is expected to translate into USD 142 billion for generation, and approximately USD 68 billion for transmission & distribution. The investments in renewable energy continue to grow throughout MENA (34% of total power investments), benefitting from tailored, flexible funding mechanisms. However, many countries are likely to fall below expected targets for technical and regulatory reasons.

This research focuses on analysing the relationship between renewable energy investments risks and renewable energy investments. For that purpose, an own elaborated questionnaire was carried out with different stakeholders interested in renewable energies in the MENA region.

High investment risk is inherent in sudden changes in applicable policies and instability in most of local currencies. In addition, the results show a statistically significant strong relationship between political situation and renewable energy investments which proves the negative impact of political risks on renewable energy investments. The respondents

institutions that are working in renewable energy projects considered the risk of high political instability due to the poor rule of law and institutions as the most important risk among political risks category, while the risk of impediments due to war, terrorism and/or civil disturbance risk is the least relevant item belonging to this category.

According to this study results, there is a statistically significant relationship between renewable energy business environment and renewable energy investments, which proves the negative impact of risks related to the renewable energy business environment on renewable energy investments. In this regard, the results also show that the respondents institutions that are working in renewable energy projects considered the risk of resolving insolvency as the most important risk among renewable energy business environment risks category, while the risk of protecting minority investors is the least important of that category.

The statistically significant relationship between regulatory renewable energy framework and renewable energy investments proves the negative impact of risks related to the regulatory framework on renewable energy investments. In this regard, the results also show that respondents institutions that are involved in renewable energy projects assessed the risk of appealing process against the regulatory decision as the most important risk among regulatory framework risks category, whereas the risk of net metering is the least important item of that category.

In terms of the relationship between risks related to the revenues and renewable energy investments, the study results show a statistically significant strong relationship between risks related to the revenues and renewable energy investments, which proves the negative impact of risks related to the revenues on renewable energy investments. In this regard, the results show that respondents institutions that are working in renewable energy projects considered the risk of curtailment is the most important risk among risks related to the revenues, while the risk of availability of resource assessment studies is the least important item belonging to this category.

While technical knowledge is limited and industrial chains are relatively weak and non-integrated, the results show a statistically significant relationship between construction phase costs and renewable energy investments, which proves the negative impact of risks related to the construction phase costs on renewable energy investments. In this regard, the results show that respondents institutions that are working in renewable energy projects deemed the risk of availability of experienced local manufacturers as the most important risk among the construction phase costs risks category, while the risk of logistics is the least important of this category.

Concerning the relation between the operational phase costs and renewable energy investments, the results show a statistically significant relationship, which proves the negative impact of risks related to the operational phase costs on renewable energy investments. In this regard, the results show that respondents institutions that are working in renewable energy projects considered the risk of availability of experienced local manufacturers the most important risk among operational phase costs risks category, while the risk of logistics is the least relevant item of this category.

Focusing on the relationship between the financial structure and renewable energy investments, the results show a statistically significant relationship, which proves the negative impact of risks related to the financial structure on renewable energy investments. In this regard, the results show that respondents institutions that are working in renewable energy projects

assessed inflation rate risks the most important risk among financial structure risks category, while the risk of dedicated state renewable energy fund is the least relevant item of this category.

Energy policy is usually set in the region by a small group of technocrats without consulting other stakeholders, such as environmental groups, consumer advocates and even elected parliamentarians. In this context, the results show a statistically significant strong relationship between the environmental and social issues and renewable energy investments, which proves the negative impact of risks related to the environmental and social issues on renewable energy investments. In this regard, the results show that respondents institutions that are working in renewable energy projects assessed the social resistance related to NIMBY concerns as the most important risk among environmental and social risks category. However, the risk of lack of awareness of renewable energy projects is the least relevant item of this category.

Concerning all risks categories, the results show that respondents institutions that are working in renewable energy projects considered that the risks related to the operational phase costs are the most important risk among all risk categories. In contrast, the risks related to the political situation are the least important group of risks.

The conclusions of the study provide important and useful inputs for the appropriate design and implementation of policies that help to promote renewable energy investments in the MENA region, as well as encourage the development of tools and procedures that reduce the risks related to this type of investments.

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B. POLICY RECOMMENDATIONS

In line with its national and international commitments, the countries in the MENA region should accelerate the preparation and implementation of renewable energy strategies that aim at a better deployment of renewable energy sources. It should be considered the requirements for better energy network and developed infrastructure that increase the grid capacity and allow renewable energy projects to feed the network. In some countries in the MENA region, identifying clear targets for the national renewable energy plans is needed. A better coordination between different actors in the field is also necessary to improve the strategies for the sector. In addition, the strategies or plans should be translated into forms of laws and regulations.

A detailed and clear renewable energy projects map should be designed and provided to the public, especially for the actors in the renewable energy from the private sector and the related associations. The related authorities should also increase the number of projects for each bidding process comparing with the current situation in many countries in the region.

One of the main concerns for energy investors and, in particular, for renewable energy investors refers to energy subsidies. The governments in most of the countries of the MENA region supposed to start implementing new energy policies that will gradually reduce all energy subsidies to make renewable energy projects attractive to investors from the private sector. In the same context, renewable energy supporting mechanisms, including net metering, cannot

work as an incentive, while the electricity tariffs are very low. Thus, the governments should redesign the tariffs policy in a way that could make the support mechanisms working efficiently.

Many countries in the MENA region are encouraged to establish an independent regulator for the energy sector. This will help in setting policies, tariffs, licensing, and monitoring of the sector in an independent way from political forces, which will improve the governance of the sector and can lead to more confidence from the investors side. It is also important to have a dedicated agency for the renewable energy sector that facilitate the implementation of policies and regulations in addition to streamline the administrative procedures.

In order to develop further the renewable energy sector and in particular to encourage more investments, tax incentives should be presented in many countries in the region. They may include tax reductions and customs duties exemptions, and this will not only encourage more investors, but also help the countries in achieving its renewable energy goals.

The availability of funding is one of the major concerns for investors. Therefore, the countries are encouraged to create the necessary funding instruments, including specific renewable energy funds, private-public financing instruments, and other means to ease access to finance for renewable energy projects. The countries in the region should further encourage the establishment of public-private partnerships to build and operate renewable energy projects

More incorporation of renewable energy in the educational system is crucial to achieve the sector goals, and to provide the local capabilities and graduates, which will participate in the implementation of renewable energy projects. It also helps to develop the industry around these projects. More specialized programmes in the universities should be introduced in addition to increasing the funds for R&D in the renewable energy sector. Training and capacity building to all agencies and authorities that are dealing with renewable energy projects should also be provided.

To mitigate the risks associated with the political situation, the countries in the MENA region are encouraged to introduce risk-sharing products by development banks to address political risks like political risks insurance (PRI) for equity investors, including the provisions of PRI that cover expropriation, political violence and currency restrictions.

With regards to the renewable energy business environment risks, the MENA countries are advised to:

1. Increase clarity and transparency of rules concerning start-up, including the procedures, times and cost.

2. Provide legal and administrative support for clients, who are intending to start a business.

3. Enhance transparency and clarity of judicial rules in the dispute process in terms of property rights.

4. Improve land concession schemes and enhance cadastral evidence showing property rights.

5. Enhance transparency and clarity of the judicial rules of the dispute process and shorten the dispute resolution time frame.

6. Incentivise local workers training of renewable energy technologies and employment in renewable energy projects.

7. Debts have to be enforced through a contract that depends on different legal institutions and processes, giving power to creditors to go after the defaulters assets and income without showing any aggression. The development of the efficiency of the institutions is also recommended and shorten the time frame of the insolvency or bankruptcy processes.

Concerning the renewable energy regulatory framework, the countries in the MENA region are encouraged to:

1. Develop the renewable energy framework by defining and improving a step by step implementation approach utilising both laws and by-laws.

2. Establish transparent, long-term national renewable energy strategy and targets.

3. Establish a harmonised, well-regulated and unbundled energy market, with cornerstone instruments to address price and market-access risk for renewable energy projects.

4. Reform fossil fuel subsidies with the target of phase-out/down from fossil fuel subsidies.

5. Design Grid Investment Plans to ensure capacity increase and RE integration, as well as develop a long-term national roadmap to include intermittent renewable energy.

6. Enhance clarity on procedures and related costs for grid connection.

7. Provide transparent information on grid capacity through mapping/monitoring activities.

8. Strengthen the operational performance of transmission companies, grid management and formulation of grid code, including the development of a grid code for renewable energy technologies, sharing of international best practice in grid management.

9. Develop the necessary mechanisms to improve openness, transparency, and accessibility of the regulator decision processes that guarantee the consultation with all parties, as well as implement clear rules for appealing to the regulator decisions before the regulator itself or any other responsible institution.

Based on the analysis of the risks affecting revenues, the MENA countries are advised to:

1. Improve the off-take price-setting mechanism for revenue stability.

2. Strengthen utility (electricity purchaser)/distribution company performance, including the establishment of international best practice in utility/distribution company management, operations and governance; implement sustainable cost recovery policy.

3. Define technical rules for curtailment and ensure floors for lost production or grid detachment.

4. Improve rules and standards for profits repatriation based on international best practice.

5. Make national resource assessment findings publicly available for companies and the investor community.

6. Disseminate the national resource assessment findings and provide grants and funding for on-site resource assessment in addition to the necessary capacity building for resource assessment.

In terms of the risks related to construction and operations costs, the countries in the MENA region are encouraged to:

1. Streamline processes for permitting by establishing one-stop shops for renewable energy permits and reduce the time for permitting procedures.

2. Contract enforcement and resource mechanisms by enforcing transparent practice, corruption control and fraud avoidance mechanisms.

3. Provide the necessary training programmes and capacity building for operational and management staff.

4. Support the growth of renewable energy technologies, local manufacturers through national incentives and also support international manufacturers establishment in the country.

5. Ensure the provision of security service by national governments, and when needed, cover security costs with Grant funding or national financial facilities.

6. Support the development of capillary coverage of technical assistance, and when necessary, support the development of strategic infrastructures with Grant Funding or national financial facilities.

7. Ensure within the off-take price the coverage of O&M costs when implied by the location weather conditions.

8. Organize industry conference; grant funding for pre-feasibility studies (depending on technology); training, apprenticeships, and university programmes to build skills (planning, construction, operations, and maintenance).

In light of the conclusions related to risks affecting the financial structure, the MENA countries are advised to:

1. Increase the availability of long and short-term financial resources to be committed in the field of renewable energy.

2. Promote the cooperation between multilateral banks and the governments through appropriate forms, including Memorandums of Understandings (MoUs) to ensure rapid and long-term financial mechanisms.

3. Enhance local short-term credit banks capacity/instruments for supporting international investors.

4. In some countries, open capital markets to players active in short term credit and allow easier cross border financial flows to support short term financial needs.

5. Establish a more transparent, clear and stable monetary policy from the central bank.

6. Encourage financial transactions, and when necessary draft PPA contracts with a more stable currency, like USD or Euro.

7. Promote the investments in the renewable energy field by establishing a favourable tax regime for renewable energy generation.

8. Financial sector policy reform and assess trade-offs between financial stability regulation and renewable energy objectives (e.g. liquidity treatment); promote financial sector policy favourable to long-term infrastructure, including project finance.

9. Introduce financial products by development banks to assist manufacturers in gaining access to funding depends on specific financial circumstances. It can include as necessary public loans, public loan guarantees, or public equity.

10. Provide government guarantees or backing for PPA payments, including counterparty guarantees offered by development banks, which can depend on specific circumstances and division of risks in PPA. It can also include as necessary partial risk guarantees on PPA, and counterparty guarantees as part of political risks.

11. The central bank should continue to monitor the inflation rate and use the financial tools available to stabilise the products price and the currency exchange rates as possible.

Focusing on risks related to environmental and social issues, the countries in the MENA region are advised to:

1. Reduce the administration steps to obtain full authorisation for renewable energy new projects in terms of environmental authorities.

2. Support re-development as an instrument to cover the local energy needs.

3. Encourage a more active and robust local communication, stakeholder dialogue and workshops with end-users, policymakers, and residents.

4. Enhance the consultation with the community to provide services in line with the renewable energy project building, such as in-kind services (energy access, local employment, etc.) or equity stakes in renewable energy projects.

C. LIMITATIONS AND FUTURE LINES OF RESEARCH

Although this study makes significant contributions to the understanding of the risks associated with renewable energy investments and related renewable energy projects, there are some limitations and more opportunities for future research.

An essential limitation of this study is that the analysed data are based on a companies community list that was issued in the last quarter of 2017. At the time of starting this study, it

was still the only available list publicly available of companies working in renewable energy projects in the Middle East and North Africa region. It makes sense to think this number of companies has changed during the period 2017-2019. Besides, there are some countries in the MENA region that were not reachable for various reasons, mainly focused on the lack of availability of data. Therefore, this research focused on the following 15 MENA countries: Algeria, Bahrain, Egypt, Jordan, Kuwait, Lebanon, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Sudan, Tunisia, and United Arab Emirates.

In addition, the analysed data are based on single respondent managers self-perceptive answers. Although most respondents were senior executives (corresponding to the CEO and deputy CEO levels) on the company level, and the questions were well designed and clear, bias arising from respondent subjectivity and misunderstanding is a possibility, since it is rare for one person in an organisation to supervise the entire processes and have a deep knowledge of all aspects.

Concerning the future extensions of this research, different issues arise. Firstly, this research analyses the relationship between each of the eight risks category and renewable energy investments. Nevertheless, a systemic approach that analyses the combined effect of the several risks categories is also noteworthy. Secondly, since this study intended to provide policymakers and governments with recommendations to reform their policies on several levels to tackle certain risks that are faced by the investors in the renewable energy sector, it might be necessary that another study or research to be conducted aiming at developing recommendations to the private sector in line with the conclusions of this study. Thirdly, as this study collected primary information about the renewable energy technologies used, further analysis with individual technologies could take place because the levelized cost of energy (LCOE) depends on the type of technology used and could have a significant impact on the cost structure. Fourthly, another future research line refers to study the trade-off between energy efficiency phasing out electricity price subsidies to foster renewable energy and social cohesion in the MENA countries given the percentage of population in poverty. Fifthly, a detailed analysis of each country in the MENA region could be developed based on the general lines of this study. Finally, from a comparative perspective, there is a lively debate between unbundling and privatisation process in the energy sector in Europe in order to foster a green transition. This question is key in the mobilisation of enough investment in situations in which the private sector is not able to allocate the required funds. In this sense, it should be addressed in the future, even in the MENA region.

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ANNEXES

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ANNEX I.

List of professional profiles involved in the questionnaire pilot samples

1. Prof. Dr. R. A, Professor of Finance
2. Prof. Dr. A. A, Professor of Management
3. Prof. Dr. S.A, Professor of Finance
4. Prof. K. M, Professor of Economy
5. Prof. Dr. A. T, Professor of IT
6. Prof. Dr. S. K, Professor of Economy
7. Prof. Dr. R. W, Professor of Marketing
8. Prof. Dr. S.D, Professor of Statistics
9. Professor. Dr. J.T, Professor of Climate Change
10. Professor. Dr. T. S, Professor of electrical engineering

In addition, 15 local focal points for renewable energy and energy efficiency of the Regional centre of Renewable Energy and Energy Efficiency (RCREEE) have been involved in the questionnaire pilot. They belong to the following countries; Morocco, Tunisia, Djibouti, Mauritania, Bahrain, Palestine, Egypt, Algeria, Libya, Iraq, Yemen, Sudan, Lebanon, Jordan and Syria.

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ANNEX II.

Questionnaire

Note: The information provided is confidential and exclusively used by the research group and aims. The data will be used only for analysis and the results are presented in aggregate.

How to complete the questionnaire:
The issues raised are of two types:

1. **Filling in the blanks**: a blank line like the following ----------, it should be completed by the word or the appropriate number.
2. **Rating Scales**: in this case, select ✓the option(s) that best represents your suggestion or opinion.

PART 1: INSTITUTIONAL AND RESPONDENT PROFILE

The questions in this section are used to obtain general information about your company.

SECTION A – GENERAL INFORMATION FROM THE INSTITUTION

A.1 Sector of Activity

☐ Financial Sector
☐ Industrial Sector
☐ Other Professional Sector

A.2 Type of Institution

- Financial Sector

☐ Investment Fund
☐ Multilateral Development Banks
☐ Commercial banks – Local
☐ Commercial Banks – International
☐ Other, please specify ……..

- Industrial Sector

☐ Technology Provider
☐ Engineering, Production, Construction (EPC)
☐ Independent Power Producer (IPP)
☐ Other, please specify ……..

- Other Professional Sector

☐ Financial
☐ Legal
☐ Management Consulting
☐ Engineering
☐ Other, please specify ……..

A.3 Ownership
☐ State-owned
☐ Privately-owned
☐ Foreign-controlled

A.4 Level of Involvement
☐ Screening
☐ Project Design
☐ Financial Closure
☐ Construction
☐ Operation

A.5 Type of Renewable Energy Technology
☐ Large Solar (PV)
☐ Small Scale (PV)
☐ Concentrated Solar Plan (CSP)
☐ Wind
☐ Other, please specify; ……..

A.6 Total number of employees working in 2018 in your company: ----------

A.7 Annual revenue (in millions):
☐ Less than 1 million USD
☐ 1-10 millions USD
☐ 11-20 millions USD
☐ 21-30 millions USD
☐ 31-40 millions USD
☐ 41-50 millions USD
☐ Over 50 million USD

A.8 Position of respondents:
☐ CEO/Managing Director
☐ Supply chain Manager
☐ Purchasing/logistics Manager
☐ Production Manager
☐ Marketing Manager
☐ Other, please Specify: ----------

A.9 Respondent Level of Education
☐ Bachelor
☐ Master
☐ PhD
☐ Other, please specify; ----------

A.10 Institution Age

☐ Less than 5 years
☐ 6-10
☐ 11-15
☐ 16-20
☐ 21-25
☐ 26-30
☐ Over 30

PART 2: RISKS ASSESSMENT

SECTION B - POLITICAL SITUATION RISKS

Please indicate the risk level associated with the following areas in your institution (1=Very low, 2=Low, 3=Moderate, 4=High, 5=Very High)	1	2	3	4	5
B.1 Impediments due to war, terrorism and/or civil disturbance	☐	☐	☐	☐	☐
B.2 Political uncertainty due to poor governance	☐	☐	☐	☐	☐
B.3 High political instability due to poor rule of law and institutions	☐	☐	☐	☐	☐
B.4 Unclear government policy	☐	☐	☐	☐	☐
B.5 Other, please specify: ---------- ---------- ---------- ---------- ----------					

SECTION C –RENEWABLE ENERGY BUSINESS ENVIRONMENT RISKS

Please indicate the risk level associated with the following areas in your institution (1=Very low, 2=Low, 3=Moderate, 4=High, 5=Very High)	1	2	3	4	5
C.1 Starting a business	☐	☐	☐	☐	☐
C.2 Concession rights	☐	☐	☐	☐	☐
C.3 Property rights/registration/transfer/	☐	☐	☐	☐	☐
C.4 Labour issues	☐	☐	☐	☐	☐
C.5 Dispute resolution issues	☐	☐	☐	☐	☐
C.6 Business travel rules	☐	☐	☐	☐	☐
C.7 Trading across borders	☐	☐	☐	☐	☐
C.8 Protecting minority investors	☐	☐	☐	☐	☐
C.9 Enforcing contracts	☐	☐	☐	☐	☐
C.10 Resolving insolvency	☐	☐	☐	☐	☐
C.11 Other, please specify: ---------- ---------- ---------- ----------					

SECTION D–RENEWABLE ENERGY REGULATORY FRAMEWORK RISKS

Please indicate the risk level associated with the following areas in your institution (1=Very low, 2=Low, 3=Moderate, 4=High, 5=Very High)	1	2	3	4	5
B.1 Renewable energy regulatory framework reliability	□	□	□	□	□
B.2 Efficient Implementation of renewable energy regulations	□	□	□	□	□
B.3 Independency of regulatory authority	□	□	□	□	□
B.4 Regulatory decisions proposals period of pre-publishing	□	□	□	□	□
B.5 Appealing process against regulatory decisions	□	□	□	□	□
B.6 Rules favouring market opening to IPP (Independent Power Producer)	□	□	□	□	□
B.7 Grid capacity and reliability.	□	□	□	□	□
B.8 Grid access rules	□	□	□	□	□
B.9 PPA (Power Purchase Agreement)/FiT (Feed-in -Tariff) schemes	□	□	□	□	□
B.10 Net–metering	□	□	□	□	□
B.11 Competing policies	□	□	□	□	□
B.12 Institutional actors roles and responsibilities	□	□	□	□	□
B.13 Other, please specify: ---------- ---------- ---------- ----------					

SECTION E –REVENUES RISKS

Please indicate the risk level associated with the following areas in your institution (1=Very low, 2=Low, 3=Moderate, 4=High, 5=Very High)	1	2	3	4	5
E.1 Revenue stability	□	□	□	□	□
E.2 Availability of resource assessment studies	□	□	□	□	□
E.3 Risk of curtailment	□	□	□	□	□
E.4 Ease of profits repatriation	□	□	□	□	□
E.5 Subsidization level	□	□	□	□	□
E.6 Other, please specify: ---------- ---------- ----------					

SECTION F –CONSTRUCTION PHASE RISKS

Please indicate the risk level associated with the following areas in your institution (1=Very low, 2=Low, 3=Moderate, 4=High, 5=Very High)	1	2	3	4	5
F.1 Construction permitting	□	□	□	□	□
F.2 Availability of local skilled workforce	□	□	□	□	□
F.3 Availability of experienced local manufacturers	□	□	□	□	□
F.4 Logistics	□	□	□	□	□
F.5 Security	□	□	□	□	□
F.6 Other, please specify: ---------- ---------- ---------- ----------					

SECTION G –OPERATIONAL RISKS

Please indicate the risk level associated with the following areas in your institution (1=Very low, 2=Low, 3=Moderate, 4=High, 5=Very High)	1	2	3	4	5
G.1 Operations & maintenance weight due to local conditions	□	□	□	□	□
G.2 Availability of spare parts	□	□	□	□	□
G.3 Availability of local skilled workforce	□	□	□	□	□
G.4 Availability of experienced local manufacturers	□	□	□	□	□
G.5 Logistics	□	□	□	□	□
G.6 Security	□	□	□	□	□
G.7 Other, please specify: ---------- ---------- ---------- ----------					

SECTION H –RELATED TO THE FINANCIAL STRUCTURE RISKS

Please indicate the risk level associated with the following areas in your institution (1=Very low, 2=Low, 3=Moderate, 4=High, 5=Very High)	1	2	3	4	5
H.1 Availability of long-term financing	□	□	□	□	□
H.2 Availability of short-term credit	□	□	□	□	□
H.3 Interest rate risk	□	□	□	□	□
H.4 Exchange rate risks	□	□	□	□	□
H.5 Currency convertibility	□	□	□	□	□
H.6 Inflation rate risk	□	□	□	□	□
H.7 Flow of Capital in/out	□	□	□	□	□
H.8 Risks related to lack of renewable energy project financial skills	□	□	□	□	□
H.9 Risks related to financial policy bias	□	□	□	□	□
H.10 Tax regime and tax incentives	□	□	□	□	□
H.11 Dedicated state renewable energy fund	□	□	□	□	□
H.12 Other, please specify: ---------- ---------- ---------- ----------					

SECTION I –ENVIRONMENTAL AND SOCIAL RISKS

Please indicate the risk level associated with the following areas in your institution (1=Very low, 2=Low, 3=Moderate, 4=High, 5=Very High)	**1**	**2**	**3**	**4**	**5**
I.1 Clarity of environmental impact assessment procedures	□	□	□	□	□
I.2 Lack of awareness of renewable Energy projects	□	□	□	□	□
I.3 Social resistance related to special interest groups	□	□	□	□	□
I.4 Social Resistance related to "Not in my back yard" concerns	□	□	□	□	□
I.5 Other, please specify: ---------- ---------- ---------- ----------					

SECTION J – SUGGESTIONS

Could you suggest policies to be taken by the government to avoid one or more types of risks associated with investment in renewable projects?

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