

Figure 1. System boundaries for the modelled bio-energy systems producing the same amount of bio-energy (heat and electricity). The bio-energy chain based on residues from natural regeneration forestry (Sc1) is represented in the upper part (a), system based on energy-dedicated poplar (Sc2) and willow (Sc3) biomass is displayed in central part (b) whereas system based on traditional poplar cultivation residues (Sc4) is depicted in the lower part (c).

Figure 2. Environmental comparative profiles between the scenarios under study and the reference system. Acronyms: Sc1 – wood-based residues; Sc2 – VSRF poplar biomass; Sc3 – VSRF willow biomass; Sc4 – traditional poplar residues; ScR – reference system. Acronyms: CC - climate change, TA - terrestrial acidification, FE - freshwater eutrophication, ME - marine eutrophication, HT - human toxicity, POF - photochemical oxidant formation, PMF - particulate matter formation, FD - fossil depletion.

Figure 3. Distribution of characterization results per processes involved in each analysed scenario to impact categories; Acronyms: Sc1 – wood-based residues; Sc2 – VSRF poplar biomass; Sc3 – VSRF willow biomass; Sc4 – traditional poplar residues. Acronyms: CC - climate change, TA - terrestrial acidification, FE - freshwater eutrophication, ME - marine eutrophication, HT - human toxicity, POF - photochemical oxidant formation, PMF - particulate matter formation, FD - fossil depletion.

Figure 4. Comparative normalization indexes between the scenarios under study and the reference system. Acronyms: Sc1 – wood-based residues; Sc2 – VSRF poplar biomass; Sc3 – VSRF willow biomass; Sc4 – traditional poplar residues; ScR – reference system.

Figure 5. Comparative normalization indexes between the scenarios under study (Sc1-Sc2-Sc3-Sc4), the reference system (ScR) and alternative scenarios recovering 100% heat and recycling electricity to satisfy electric requirements (Sc1a-Sc2a-Sc3a-Sc4a).

Figure 6. Comparative normalization indexes between bio-energy production from wood-based residues from natural regeneration forestry considering different transport distances. Acronyms: Sc1 – 800km; ScA – 325km; ScB – 360km.

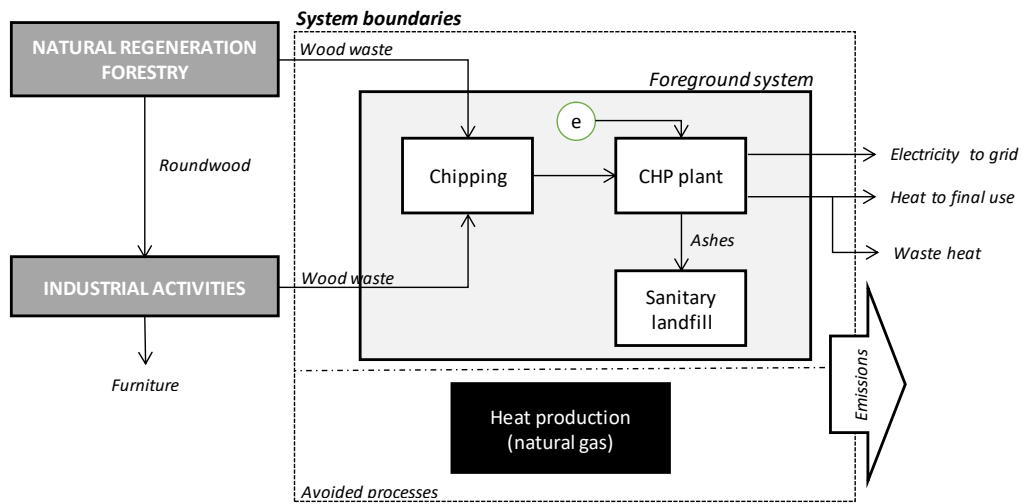


Figure 1a

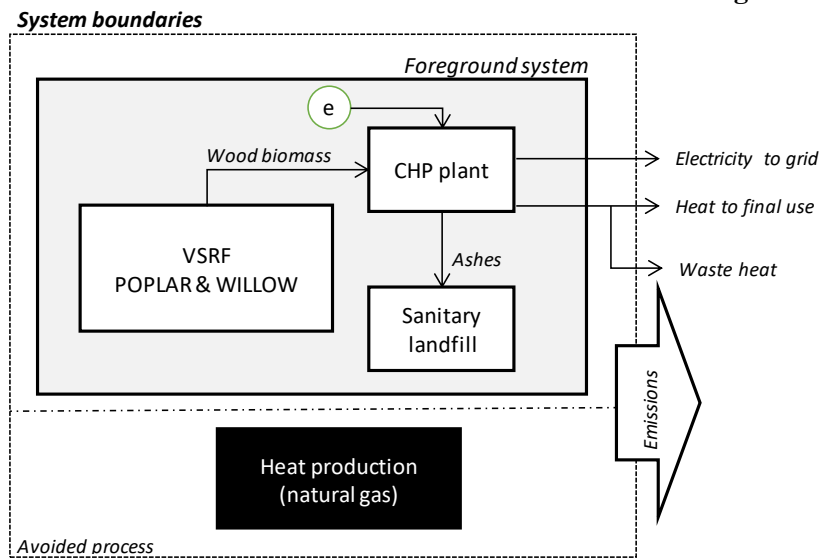


Figure 1b

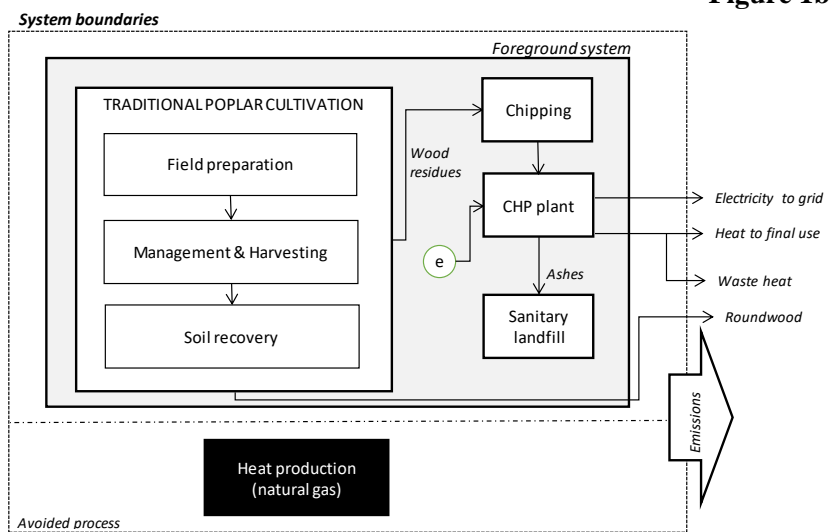


Figure 1c

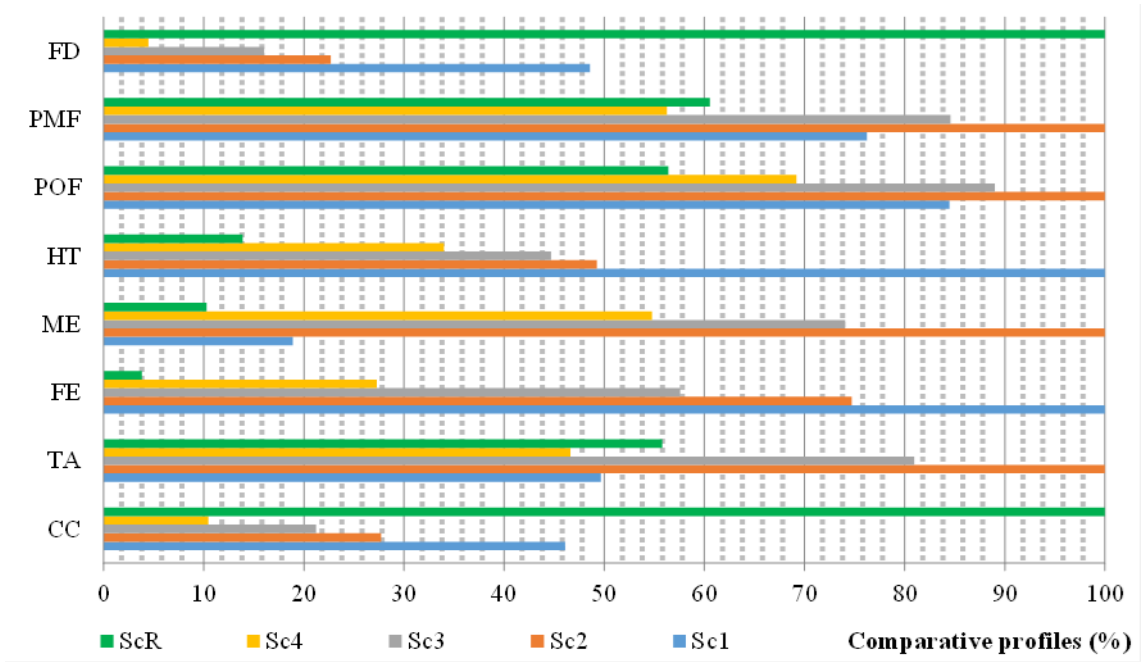


Figure 2

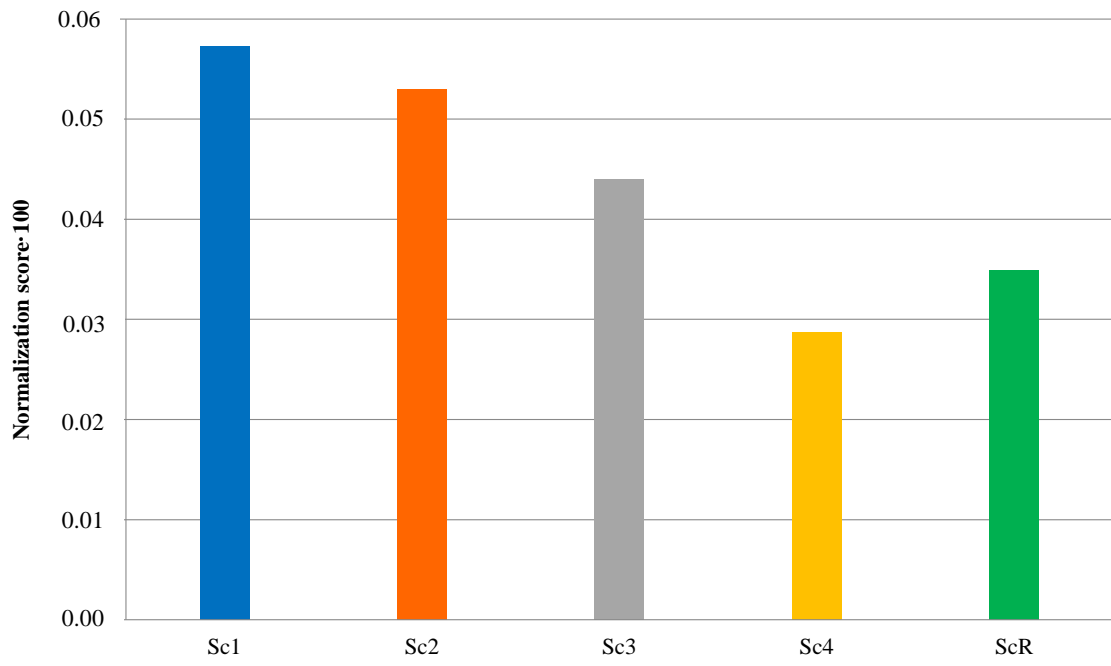


Figure 4

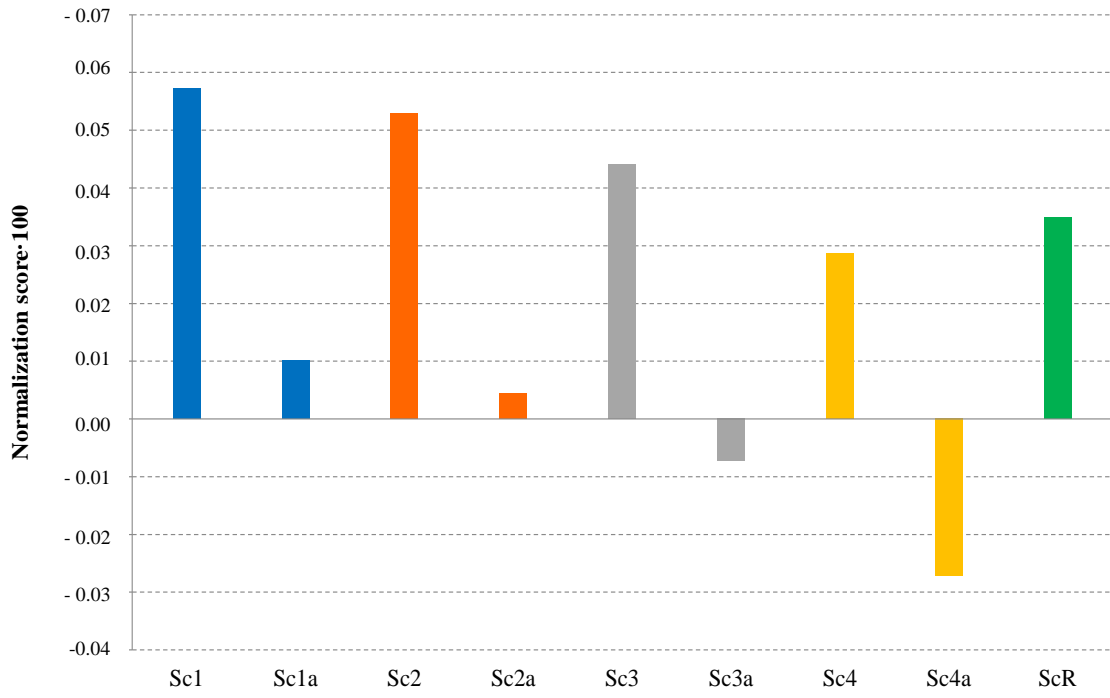


Figure 5

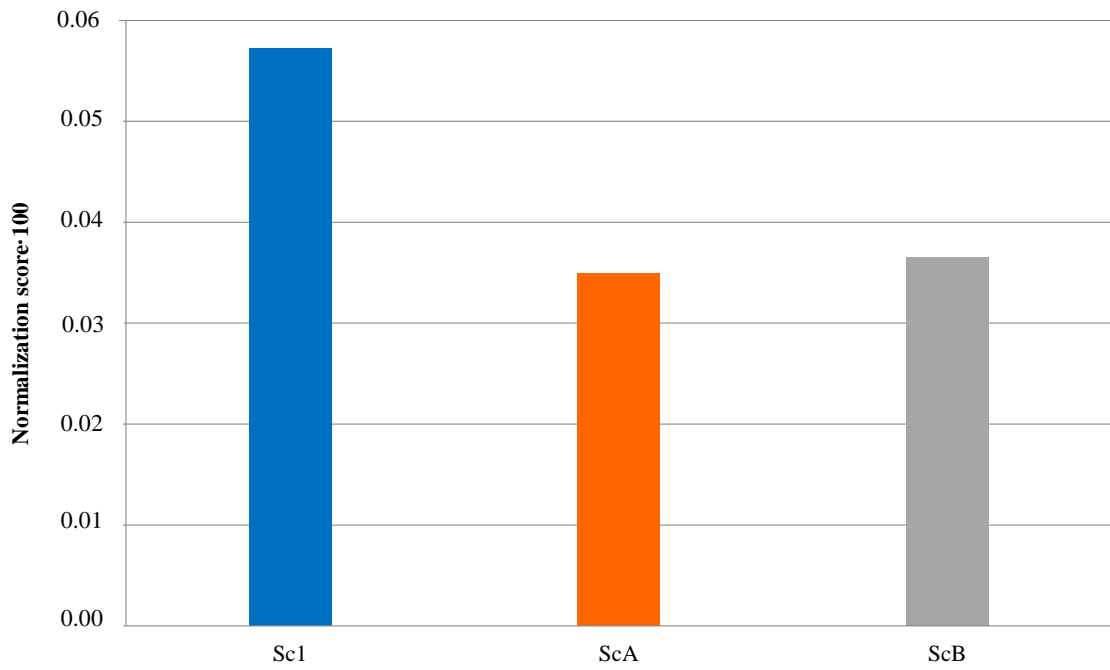


Figure 6