

Environmental Cost and Benefits Analysis of Different Electricity Option: A Case Study of Kuwait

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Abstract : In Kuwait, electricity is generated from two primary sources that are heavy fuel combustion and natural gas combustion. As Kuwait relies mainly on petroleum-based products for electricity generation, identifying and understanding the environmental trade-off of such operations should be carefully investigated. The life cycle assessment (LCA) tool is applied to identify the potential environmental impact of electricity generation under three scenarios by considering the material flow in various stages involved, such as raw-material extraction, transportation, operations, and waste disposal. The three scenarios investigated represent current and futuristic electricity grid mixes. The analysis targets six environmental impact categories: (1) global warming potential (GWP), (2) acidification potential (AP), (3) water depletion (WD), (4) acidification potential (AP), (4) eutrophication potential (EP), (5) human health particulate matter (HHPM), and (6) smog air (SA) per one kWh of electricity generated. Results indicate that one kWh of electricity generated would have a GWP (881-1030) g CO₂-eq, mainly from the fuel combustion process, water depletion (0.07-0.1) m³ of water, about 68% from cooling processes, AP (15.3-17.9) g SO₂-eq, EP (0.12-0.14) g N eq., HHPA (1.13- 1.33)g PM_{2.5} eq., and SA (64.8-75.8) g O₃ eq. The variation in results depend on the scenario investigated. It can be observed from the analysis that introducing solar photovoltaic and wind to the electricity grid mix improves the performance of scenarios 2 and 3 where 15% of the electricity comes from renewables correspond to a further decrease in LCA results.

Keywords : energy, functional uni, global warming potential, life cycle assessment, energy, functional unit

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