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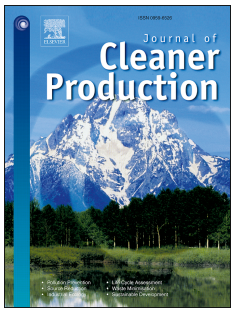

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Michael R.W. Walmsley, Timothy G. Walmsley, Martin J. Atkins

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Linking Greenhouse Gas Emissions Footprint and Energy Return on Investment in Electricity Generation Planning

Michael R.W. Walmsley[a], Timothy G. Walmsley [b], Martin J. Atkins[a]

[a] Energy Research Centre, School of Engineering,
University of Waikato, Hamilton, New Zealand
[b] Sustainable Process Integration Laboratory – SPIL, NETME Centre,
Faculty of Mechanical Engineering, Brno University of Technology,
Brno, Czech Republic

Abstract

This paper aims to relate total greenhouse gas emissions footprint with Energy Return on Energy Invested for Coal, Natural Gas, Hydro, Geothermal, Wind and Solar PV electricity generation methods. Emissions from construction, decommissioning, operations and maintenance, and fuel, are all included in the analysis. Often the generation equipment is imported so much of the emissions associated with construction are "virtual" emissions (i.e. imported). These virtual emissions contribute to a peak emissions as renewable generation is installed at the start to ultimately lead to a lower emissions factor for a countries' electricity system over time. The peak occurs due to the short-term emissions resulting from construction and a long-term emissions reduction due to the low/zero carbon renewable generation installed. The electricity sector in New Zealand is used as a case study for projected new generation through to 2050 for four scenarios (a) Global Low Carbon, (b) Mixed Renewables, (c) High Grid and (d) High Solar. The study demonstrates that as total greenhouse gas footprints are included an emissions peak occurs due to new construction, mainly because of renewable generation, especially solar and high energy emissions factors in countries manufacturing generation equipment.

Keywords

Energy planning, energy ratio analysis, Energy Return on Investment, Primary Energy Factor, Life Cycle Analysis, renewable energy.