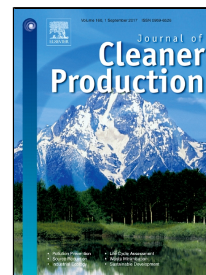


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Comparative Assessment of the Environmental Impacts of Nuclear, Wind and Hydro-Electric Power Plants in Ontario: A Life Cycle Assessment

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## Comparative Assessment of the Environmental Impacts of Nuclear, Wind and Hydro-Electric Power Plants in Ontario: A Life Cycle Assessment

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### Abstract

In this study, we analyze, assess and compare the environmental impacts of nuclear, wind and hydro power generation in the province of Ontario, Canada through a comprehensive life cycle assessment approach. The upstream, downstream as well as operation phases during the life cycle of these power generation methods are included. The output emissions inventoried in the study are carbon di oxide, methane, sulphur oxides, nitrogen oxides and total particulate matter. CML 2001 impact assessment methodology is utilized. Environmental impacts included are global warming potential, acidification potential, eutrophication potential, photochemical ozone creation potential and human toxicity potential. Hydro reservoir facilities with bio mass decay are found to have a life cycle GWP100 of 15.2 g CO<sub>2</sub>-eq/kWh, which is comparatively higher than wind (12.05 g CO<sub>2</sub>-eq/kWh) and nuclear power life cycles (3.402 g CO<sub>2</sub>-eq/kWh). However, hydropower is found to have substantially low impacts when other environmental impact categories, such as acidification potential, eutrophication potential, photochemical ozone creation potential and human toxicity potential are considered. This indicates only greenhouse gas emissions are not sufficient to describe the environmental performance of any product system. Wind power life cycle contributed most significantly to acidification, eutrophication, photochemical ozone creation and human toxicity potentials. This was attributed mainly to the construction phase of the life cycle. Hence, development of more environmentally benign wind turbine construction methods is suggested. For the nuclear power scenario, upstream and decommissioning phases are identified as major contributors to environmental impacts.

**Key words:** Environmental impact; Life Cycle assessment; Nuclear; Wind; Hydro; Ontario

### 1. Introduction

In this modern era, energy production forms an integral part of any economy. Incessantly increasing energy demands have caused detrimental effects on the environment. Increased usage

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