Life Cycle Management in wind energy technologies and planning - a case from Siemens Wind Power

Bonou, Alexandra; Olsen, Stig Irving

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Life Cycle Management in wind energy technologies and planning – a case from Siemens Wind Power

Alexandra Bonou*[1] , Stig Irving Olsen[1]

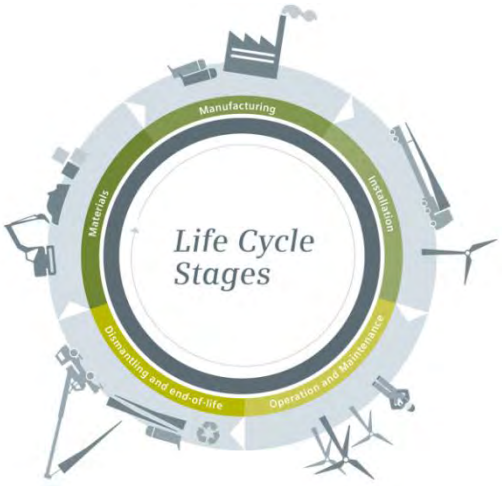
1: DTU Management

*abon@dtu.dk

We performed the LCA of 4 average wind power plants and assessed the environmental impacts related to the provision of kWh to the grid (FU). We assumed state of the art technology of 2015 and turbines of capacity 2.3, 3.2, 4.0 and 6.0 MW provided by Siemens Wind Power. We addressed two differ markets: onshore with 20 turbines and offshore with 80 turbines and two generator technologies (direct drive and geared). We accounted for the system from cradle to grave and we included all process required to provide the service. The energy payback time is less than 6 months for onshore and less than 11 for offshore plants. The CO2-eq emissions are correspondingly less than 6kgCO2-eq/MWh and 10kgCO2-eq/MWh. Climate change is a good proxy for environmental hotspot identification while human toxicity is identified as the most relevant impact category.

The results indicate that onshore wind energy environmentally performs better per functional unit compared to the offshore. This is mainly because offshore requires 3 times more material weight for the capital equipment and more resources for installation and maintenance and these needs do not counterbalance the benefits of higher energy output compared to the onshore market. In both markets the newer turbines with more advanced generator technology perform better. Also, in both markets more than 80% of the impacts are due to material stage and mainly due to the foundations (reinforced concrete for the onshore and steel monopiles for the offshore) the steel towers nacelles and blades.

The impacts need to be seen as a combination of impact intensity per material type and the amounts consumed. The materials of highest improvement potential per kg material are found in the blades. The negative impact of materials is to a great extend counterbalanced by the high recycling potentials at the end of life due to avoided production of primary materials and mainly steel. The system's performance is highly sensitive to wind speed, life time and recycling related assumptions related to technology and future management practices. These EOL assumptions are also the most uncertain part of the system.



A conceptual model of life cycle thinking used to determine how it applies to the daily work of internal cross-functions (Siemens AG, 2014)

Siemens AG, 2014. Environmental Performance- Assessing the environmental impact of Siemens wind turbines. Available at: http://www.energy.siemens.com/hq/en/renewable-energy/wind-power/epd.htm [Accessed June 1, 2015].