Comparative LCA of Conventional Materials and Wood for the Fabrication of Wind Turbine Blades

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Scope

- Wind energy is one of the most prominent forms of renewable energy available in the market to address global warming
- Life cycle analysis has become the ideal way of further understanding the cradle to grave economic, social and environmental impacts of a products life
- Wind turbine blades are currently being made out of wood and conventional materials such as fiberglass and carbon fiber

Figure 1. LCA Overview [1]

- The mechanical properties and environmental impacts of wood are being investigated in order to point out in which parts of the wind turbine blade they can be incorporated

Research Objective

- Conduct a LCA on wind turbine blade manufacturing materials to see which one poses a higher environmental threat

Methods

- LCA of wood and conventional materials is done through GaBi 6 software where data is acquired and interpreted for diverse environmental concerns such as acidification, global warming potential and eutrophication

Figure 2. LCA Methodology behind GaBi 6 Software [2]

Results

- For research purposes, it is assumed that both wood and fiberglass turbine blade manufacturing procedures were performed alike, but with different materials
- LCA for both cases with only one turbine blade

Figure 4. LCA Steps of Wood Turbine Blades [8,9,10,11,12]

- Obtain quantitative results that support the best material for reducing global warming impact
- Scale the LCA to producing results for the production of more than one blade
- Account for other possible scenarios for the end of life of the blade since for time purposes it was only assumed blade disposal was achieved through landfill usage
- Achieve a thorough LCA since for time purposes a lot of assumptions were made

Figure 5. Contribution of Environmental Impacts by Life Stages (Vestas 2.0 MW)

Future Work

- Obtain quantitative results that support the best material for reducing global warming impacts
- Scale the LCA to producing results for the production of more than one blade
- Account for other possible scenarios for the end of life of the blade since for time purposes it was only assumed blade disposal was achieved through landfill usage
- Achieve a thorough LCA since for time purposes a lot of assumptions were made

Figure 6. Global Warming Potential of Fiberglass Turbine Blade LCA

Figure 7. Components of a turbine blade [13]

References