Value Characterization across the Life Cycle: A Model to Support Value Recovery from Used Wind Turbines

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Katherine was born in Cali, Colombia. She received her B.S. in Industrial Engineering and a specialization in Environmental Management from Icesi University. After a six-year career as an assistant professor at Icesi and developing research projects with small and medium size companies (SMEs), she decided it was time for a change. In 2008, she was awarded with the Fulbright-Regions Scholarship to pursue her PhD in the Ecological Sciences and Engineering program at Purdue. Integrating these two disciplines, her goal is to incorporate sustainable thinking in manufacturing activities from a life cycle perspective. She has studied the environmental impact of products and processes and currently, she is focused on the recovery of value from renewable energy technologies at end-of-use.

Abstract

Circular manufacturing calls for the value embedded in materials, products, and processes to be recovered and reintroduced into the manufacturing enterprise. The end-of-use (EOU) management of wind turbines has received little attention. The value proposition at EOU is not well understood.

To date, renewables represent 12% of the total U.S electricity generation capacity. Within renewable power sources, wind energy has the second largest share after hydro and provides 3.5% of the total U.S electricity demand. Their environmental benefits have been limited to green energy generation. With close to 46,000 units installed nationwide, planning in advance for the recovery of value at EOU is required to maximize environmental and economic benefits.

Three by-products can be obtained when recovering used WTs: remanufactured WTs, remanufactured subsystems, and recycled materials. Remanufacturing the entire WT offers the largest economic benefits. The installed cost of a remanufactured WT is around 58% of the cost of a new WT with a shorter lead time of six months. The cost of electricity could be reduced to $32/MWh, getting closer to industry goal of $30/MWh. Extending the life of the WT 15-20 years, represents reduced CO_2 emissions of between 32,002 and 66,330 tons and water consumption of 75.56 to 228 million liters when a WT is compared to conventional power systems using natural gas and coal respectively.