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# **Blade System Design Studies Volume I: Composite Technologies for Large Wind Turbine Blades**

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## **Abstract**

As part of the U.S. Department of Energy's Wind Partnerships for Advanced Component Technologies (WindPACT) program, Global Energy Concepts LLC (GEC) is performing a study concerning innovations in materials, processes and structural configurations for application to wind turbine blades in the multi-megawatt range. The project team for this work includes experts in all areas of wind turbine blade design, analysis, manufacture, and testing. Constraints to cost-effective scaling-up of the current commercial blade designs and manufacturing methods are identified, including self-gravity loads, transportation, and environmental considerations. A trade-off study is performed to evaluate the incremental changes in blade cost, weight, and stiffness for a wide range of composite materials, fabric types, and manufacturing processes. Fiberglass / carbon fiber hybrid blades are identified as having a promising combination of cost, weight, stiffness and fatigue resistance. Vacuum-assisted resin transfer molding, resin film infusion, and pre-impregnated materials are identified as having benefits in reduced volatile emissions, higher fiber content, and improved laminate quality relative to the baseline wet lay-up process. Alternative structural designs are identified, including jointed configurations to facilitate transportation. Based on the results to date, recommendations are made for further evaluation and testing under this study to verify the predicted material and structural performance.