

ALTERNATIVE COMPOSITE MATERIALS FOR MEGAWATT-SCALE

WIND TURBINE BLADES:

DESIGN CONSIDERATIONS AND RECOMMENDED TESTING

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ABSTRACT

As part of the U.S. Department of Energy's Wind Partnerships for Advanced Component Technologies program, Global Energy Concepts LLC (GEC) is performing a study concerning blades for wind turbines in the multi-megawatt range. Earlier in this project constraints were identified to cost-effective scaling-up of the current commercial blade designs and manufacturing methods, and candidate innovations in composite materials, manufacturing processes and structural configurations were assessed. In the present work, preliminary structural designs are developed for hybrid carbon fiber / fiberglass blades at system ratings of 3.0 and 5.0 megawatts. Structural performance is evaluated for various arrangements of the carbon blade spar. Critical performance aspects of the carbon material and blade structure are discussed. To address the technical uncertainties identified, recommendations are made for new testing of composite coupons and blade sub-structure.