

SAND 2003-0723  
Unlimited Release  
Printed March 2003

# **INNOVATIVE DESIGN APPROACHES FOR LARGE WIND TURBINE BLADES**

WindPACT Blade System Design Studies

TPI Composites, Inc.  
373 Market Street  
Warren, RI

## **ABSTRACT**

The primary goal of the WindPACT Blade System Design Study (BSDS) was investigation and evaluation of design and manufacturing issues for wind turbine blades in the one to ten megawatt size range. The initial project task was to assess the fundamental physical and manufacturing issues that govern and constrain large blades and entails three basic elements: 1) a parametric scaling study to assess blade structure using current technology, 2) an economic study of the cost to manufacture, transport, and install large blades, and 3) identification of promising innovative design approaches that show potential for overcoming fundamental physical and manufacturing constraints.

This report discusses several innovative design approaches and their potential for blade cost reduction. During this effort we reviewed methods for optimizing the blade cross-section to improve structural and manufacturing characteristics. We also analyzed and compared a number of composite materials and evaluated their relative merits for use in large wind turbine blades in the range from 30 meters to 70 meters. The results have been summarized in dimensional and non-dimensional format to aid in interpretation. These results build upon earlier parametric and blade cost studies, which were used as a guide for the innovative design approaches explored here.