U.S. Department of Energy
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Wind Energy Program Technology Portfolio

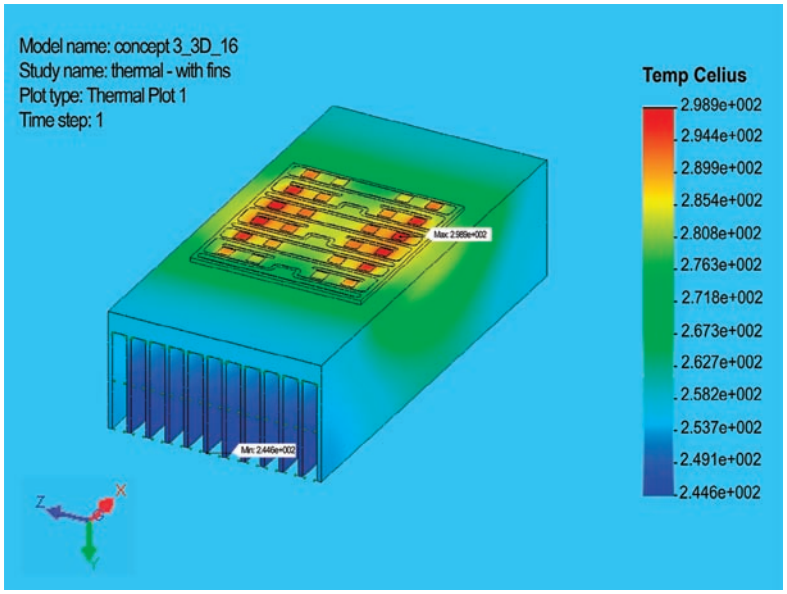
Low Wind Speed Technology Phase II: Breakthrough in Power Electronics from Silicon Carbide

Peregrine Power LLC

Project Description: All commonly used power semiconductors in power converters today are based on standard silicon technology. These have numerous limitations that power electronics designers work around. Newer designs in wind turbine drive trains will increasingly depend on such power converters to allow full power conversion and variable speed. Silicon carbide (SiC) has much better performance characteristics, including:

- Lower resistance and conduction losses
- Faster and cleaner turn-on and turn-off characteristics that result in much lower switching losses
- Much higher dielectric constant, which permits higher voltage applications
- Much higher thermal conductivity
- Much higher operating temperatures (662°F [350°C] or higher)
- Much greater ruggedness and reliability
- Positive feedback as to resistance, which automatically causes current to be shared well among parallel SiC dies to achieve higher currents.

This project will perform baseline characterization of SiC chips to determine their operating characteristics. Based on these data, some preliminary designs and cost estimates will be developed to determine SiC's potential impact on wind turbine power converter designs, efficiency, and operating costs.



Finite element modeling (FEM) of the thermal profile of a power module.

Project Type: Conceptual Design Study
Total Project Budget: $199,849
Industry Cost Share: $0
DOE Cost Share: $199,849
Planned Project Duration: May 2004–July 2005

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Current Status: Project Complete

DOE/GO-102006-2203
March 2006