



U.S. Department of Energy
Energy Efficiency and Renewable Energy

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Wind Energy Program Technology Portfolio



Low Wind Speed Technology Phase II: Investigation of the Application of Medium-Voltage Variable-Speed Drive Technology to Improve the Cost of Energy from Low Wind Speed Turbines

Behnke, Erdman and Whitaker Engineering, Inc.

Project Description: As wind turbines grow in size, variable-speed operation becomes an absolute necessity to manage machine loads in turbulent wind conditions and to provide increased rotor efficiency in lower wind speed operations. Until now, wind turbines have been able to take advantage of readily available, low-cost low-voltage power converters and components. But economies of scale for low-voltage equipment begin to evaporate with the increased amperages of multimegawatt machines. It is clear that, at some point in the evolution of wind turbine technology, low-voltage components will be poorly suited for power distribution within the turbine. The new larger machines will depend more on full power handling through power electronics interface to control output frequency to the electrical grid. This study investigates the feasibility of applying medium-voltage variable-speed drive technology to low wind speed turbines with multi-megawatt ratings. The primary objective of this effort is to obtain a lower cost of energy from these machines by reducing the barriers to achieving lower capital cost and improved efficiency that simply paralleling additional low voltage components (generators, cabling, converters, switchgear, transformers) will allow. Areas of investigation include:

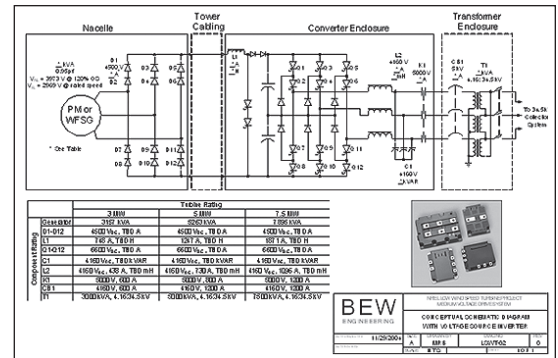
- Applications requirements—power and ride through capability
- Commercial availability of components
- Maintenance personnel requirements
- Power electronics topologies
- Existing intellectual property
- Special design and protection requirements.

Preliminary designs of power handling systems and operating costs for conceptual designs in the 3-, 5-, and 7.5-MW class will be developed. Based on this data, impact on turbine COE due to implementation of medium-voltage devices will be determined.

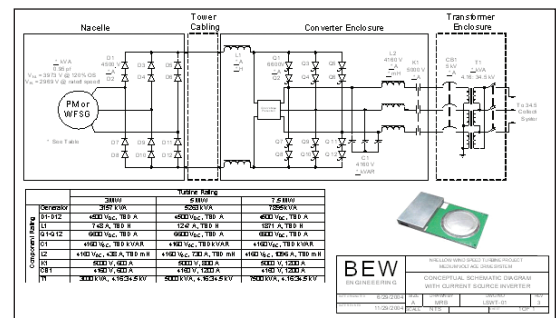
Total Project Budget: Conceptual Design Study
Total Project Budget: \$197,656
Industry Cost Share: \$0
DOE Cost Share: \$197,656
Planned Project Duration: July 2004–March 2005

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Current Status: Project Complete



Alternative power converter schematic.



Alternative power converter schematic.

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