U.S. Department of Energy
Energy Efficiency and Renewable Energy
Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

Wind Energy Program Technology Portfolio

Low Wind Speed Technology Phase I: Evaluation of Design and Construction Approaches for Economical Hybrid Steel/Concrete Wind Turbine Towers

BERGER/ABAM Engineers Inc.

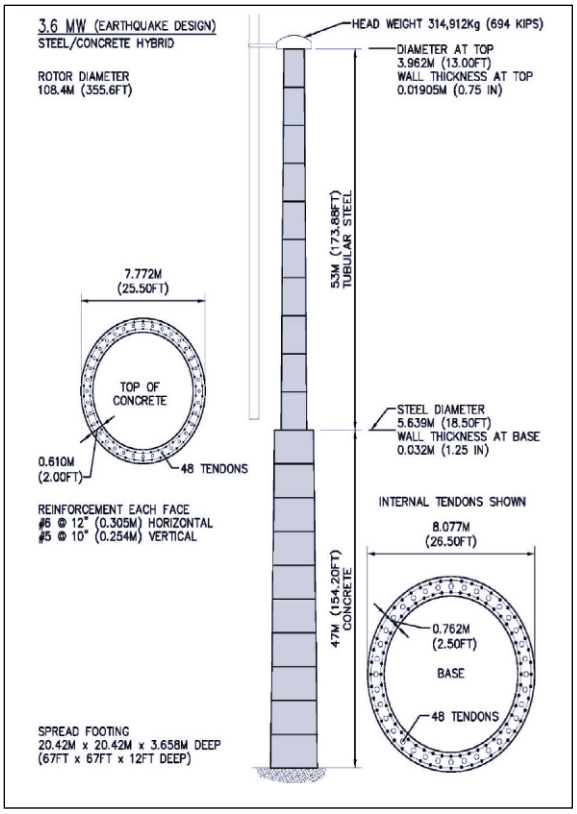
Project Description: This work addressed the economic feasibility of concrete and hybrid concrete/steel wind turbine towers. The wind turbine/tower sizes that formed a basis for comparing concepts are:

- 1.5-MW turbine on a 100-m tower
- 3.6-MW turbine on a 100-m tower
- 5.0-MW turbine on a 100-m tower.

The design concepts included hybrid steel/concrete towers with 47–49-m concrete base tower sections and 51–53-m steel top tower sections and all-concrete towers 100m tall.

The study considered several construction approaches and developed prices for the concepts. A segmental precast concrete approach was developed in some detail for the 1.5-MW tower and was scaled for the 3.6- and 5.0-MW turbines. Additionally, researchers considered slip- and jump-forming construction methods to evaluate cast-in-place (CIP) concrete construction.

A method for reducing the height of the heavy lifts for installing the turbine and rotors atop the tower was developed in some detail. The results indicate that the costs for the 1.5-MW/100-m tower—the hybrid steel/concrete, the CIP concrete, and the tubular steel towers—are all within 33% of each other. The CIP concrete approach modifies conventional industrial chimney construction and is estimated to be the lowest cost solution. The cost savings associated with nacelle semi self-erection at 50m versus 100m do not provide a strong cost advantage over the hybrid steel/concrete. For the 3.6-MW/100-m tower, the CIP concrete concept is 68% of the estimated cost of the tubular steel concept. For the 5.0-MW/100-m tower, the CIP concrete concept is 63% of the estimated cost of the tubular steel tower concept.



Schematic for a hybrid steel/concrete wind turbine tower.

Project Type: Conceptual Design Study
Project Budget: $209,947
Industry Cost Share: $0
DOE Cost Share: $209,947
Planned Project Duration: June 2002–July 2004

Current Status:
Project Complete—Final Report, *LWST Phase I Project Conceptual Design Study: Evaluation of Design and Construction Approaches for Economical Hybrid Steel/Concrete Wind Turbine Towers*
www.nrel.gov/docs/fy05osti/36777.pdf

Contacts:

NREL/Sandia:
David Simms, NREL
1617 Cole Blvd.
Golden, Colorado 80401
303-384-6942
david_simms@nrel.gov

Berger/Abam:
Michael W. LaNier, BERGER/ABAM Engineers Inc.
33301 Ninth Ave. S, Suite 300
Federal Way, Washington 98003-2600
206-431-2300
lanier@abam.com

DOE/GO-102006-2202
March 2006