



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

**BERGER/ABAM Engineers Inc.**

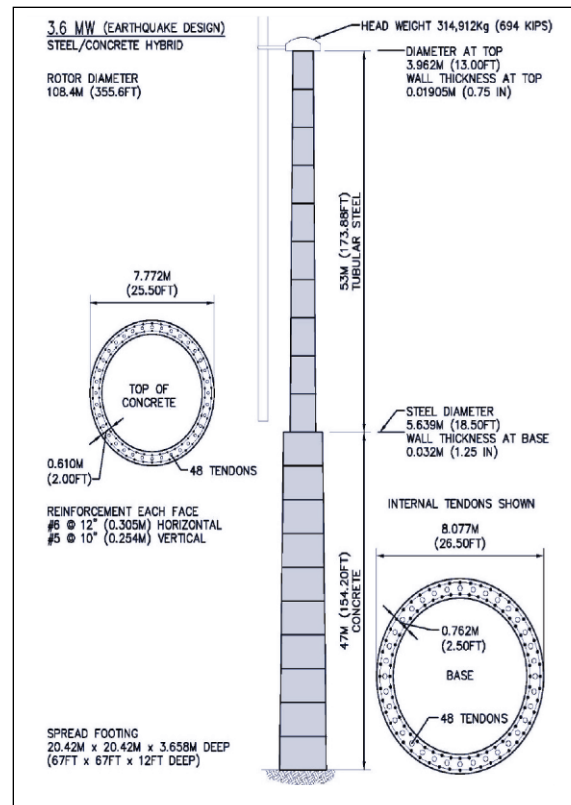
**Project Description:** This work addressed the economic feasibility of concrete and hybrid concrete/steel wind turbine towers. The wind turbine/tower sizes that formed a basis for comparing concepts are:

- 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](http://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](mailto: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](mailto:lanier@abam.com)

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