Tubular Shell Wind Turbine Tower Constructed of UHPC for Taller Turbines

APPLICATION AREAS
Wind Energy

ABSTRACT
Wind energy is an area of increasing interest for power generation. Wind turbines, which generate electrical power, are mounted on towers; the specific energy yield increases with the height of the tower due to higher winds above ground level. However, as tower heights increase, so do transportation, construction and assembly costs; towers made of steel that are over 100 m in height—capable of producing multi-megawatts of electricity—require a diameter at the tower base of over 5 meters to support the towerhead weights of hundreds of tons, which prohibits their transportation by road. High wind turbine towers made of steel may also be vulnerable to buckling or other damage due loads from winds, snow, seismic activity, etc. To address the demands to balance wind turbine construction and transportation costs with efficiency and accessibility, ISU researchers have designed and tested construction of wind turbine towers using ultra-high performance concrete (UHPC). These towers may enable erection of wind turbines at heights of 100 meters, about 20 meters higher than today’s wind turbines. As a consequence, the steadier and less turbulent winds at that height could be harnessed to provide increased power production. These UHPC towers are assembled from hexagonal shaped segments that can be easily shipped over road and built on site.

BENEFITS
- Increased tower life through use of ultra-high performance and high-strength concrete
- Enables increased tower height
- Components are small enough to permit transportation by standard trucking
- Can be assembled on site
- Towers can be customized for any turbine size

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