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EMERGING TECHNOLOGY AWARDS

A Machine the Size of the Eiffel Tower

INNOVATOR: GE Renewable Energy. Vincent Schellings, engineering and product development general manager for offshore wind.

INNOVATION: The largest ever wind turbine, capable of generating 12 MW of power.

IMPACT: Larger wind turbines for offshore facilities will produce more electricity for more hours of the year than smaller machines.

VINCENT SCHELLINGS

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CLEAN ENERGY

LARGEST Wind Turbine Ever

GE develops a giant machine for turning ocean breezes into power.

STORY BY JEFFREY WINTERS • ILLUSTRATION BY ZINA SAUNDERS

The windmill is a national symbol of the Netherlands, which has for centuries harnessed the fresh breezes coming off the North Sea to pump water and power small industries. It's fitting, then, that a Dutchman was tasked by GE Renewable Energy to manage the design and fabrication of the world's largest wind turbine.

Vincent Schellings, a mechanical engineer who is the engineering and product development general manager for the company's offshore wind business, said the scale of the Haliade-X model is a significant advance from earlier generations of offshore wind turbines. While those existing large turbines can generate 5 to 9 MW each, the Haliade-X is intended to produce 12 MW at full capacity.

The rationale for developing offshore wind turbines is straightforward: Unobstructed by hills and trees, the wind builds up over the ocean to produce stiff and steady breezes. But installing a wind turbine at sea is expensive, so companies want to put up fewer, taller towers supporting giant nacelles and long blades. Constructing fewer foundations for the towers will save money, Schellings said, adding, "A reduction in the number of installed wind turbines also yields an improvement in the cost to operate and maintain the wind farm."

Over the past decade, manufacturers have met that desire by designing larger and larger turbines. The challenge presented to Schellings was: What's the biggest possible wind turbine we can build? Schellings said his team looked at all sorts of factors—the maximum length of a blade, the height of a tower, how large the nacelle holding the generator could be without being too large for a crane to lift into place, and more.

The team settled on a machine with a 12 MW generating capacity, which

would feature three 107-meter-long blades mounted on a 150 m tower. The swept area of the rotor is equal to about seven football fields. Once those parameters were set, it turned out that the technology needed wasn't so much different from the 6 MW turbine GE already made.

"Our focus was less on component technology, but more on manufacturing technology," he said. "When building components of the size required for Haliade-X you find yourself in a situation where the typical manufacturing processes are either no longer feasible, or might not provide the required quality."

Schellings said that manufacturing even standard components at the physical scale needed for the much larger machine required close cooperation with suppliers. But even though they are his designs, the size of the components is breathtaking. "Based on the first components coming from the supplier's manufacturing lines I can tell you that every single piece of equipment is beyond imagination regarding its size," he said "I keep being amazed again every single day when people send me new pictures."

The first two units are being completed now, with one scheduled to be installed in the coming months.

GE expects each Haliade-X to generate about 67 GWh of electricity a year, or 63 percent of its capacity—a sign that it will be up and running more often than not. Such supersized wind turbines may never be as picturesque as the windmills that still dot the Dutch countryside, but they promise to be an integral part of the 21st century clean energy mix. ME

JEFFREY WINTERS is senior editor at *Mechanical Engineering* magazine.

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