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Renewable energy and climate change go hand-in-hand these days. In this issue, a remarkable wind power project in Hull, Massachusetts provides a lesson in how to succeed by providing clean energy through innovative engineering.

Also, despite the power industry's image as being slow to change, Sean Casten, president and CEO of Recycled Energy Development, argues that tackling climate change can be done easier and faster than previously thought.

L. A. Burkhart
Editor

CLIMATE CHANGE

Making a Rapid Stop

By Sean Casten

The climate change debate has shifted to the United States Senate, where most discussions are based on an unstated assumption: Reform will be slow, requiring decades to make any serious reduction in greenhouse-gas pollution.

The legislation approved by the House of Representatives, in fact, envisions a time frame of more than a decade to achieve just a 17% reduction in our country's greenhouse-gas emissions — far below what climate scientists say is necessary. The fact that we have not yet enacted this legislation results directly from concerns that even this modest target is too ambitious.

Meanwhile, the surest way to be dismissed as a naïve idealist is to claim that faster change is possible. Claim that renewable energy can quickly displace coal (as Al Gore, T. Boone Pickens and others have done) and you will be dismissed immediately by energy industry insiders who assure you that the capital, commercial and long planning/construction horizons innate to their industry make such rates of change impossible. Those claims are hard to rebut. The industry historically has been pretty slow to change, and the investments really are massive.

Those claims, however, are completely false. Recent history is rife with examples of rapid change in the power sector. Intriguingly, those historic shifts — »

How should the power industry adapt its approach to capital markets in the economic downturn?

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RENEWABLE ENGINEERING

Hull's Unconventional Landmark

By Stephen Wright

In the mission to implement energy and environmental reform, communities across the country are often faced with the same question: How do you properly embrace an alternative energy strategy that will save a community hundreds of thousands of dollars, have minimal environmental impact, and serve as a source of goodwill for local residents?

For Hull, Mass., the answer is blowing in the wind.

Located on a peninsula just 10 miles from Boston, Hull has a history of harnessing wind power that dates back to the early 19th century, when residents used windmills to make salt from sea water. In the mid-1980s, the town constructed an 80-foot, 40-kilowatt wind turbine, which reduced Hull High School's electric bill by close to 30 percent before a windstorm destroyed it in 1997.

Today, the town features two wind turbines: a 165-foot-high, 660-kilowatt Vestas turbine known as Hull Wind 1, which has the distinction of being the first commercial-scale wind turbine to go online anywhere on the East Coast; and a second Vestas turbine, Hull Wind 2, with a capacity of 1.8-megawatts and a tower height of 195 feet.

However, what makes Hull's situation truly unique is the location of Hull Wind 2. Positioned near the Weir River Estuary and overlooking one of the main roads into Hull, the turbine sits atop the town's old landfill. Such a location is believed to be unprecedented in North America and naturally, presented site engineers with a set of truly extraordinary challenges.

Hull's turbine sits atop the town's old landfill and such a location is believed to be unprecedented in North America.

Unconventional Location

The success of Hull Wind 1, which was erected in December 2001 and has produced close to 12 million kilowatt hours since its creation, spurred the community to erect a second wind turbine. The proposed location was a tad unconventional—a 13-acre town landfill that began operating in the 1930s—and ultimately made this renewable energy project a landmark one. In the late 1980s, a 10-acre portion of the landfill was capped, leaving only a small, lined disposal cell that continues to operate to this day. It was on the closed portion of the landfill, located immediately adjacent to the operating cell, that the wind turbine ultimately was erected.

Post-closure uses of landfill sites traditionally have been directed toward solid-waste transfer stations or Department of Public Works (DPW)-related operations, where these activities generally are not performed on the landfill surface itself. In those instances where post-closure activities are conducted on the surface of the landfill, the use often is related to passive recreation such as ball fields, walking paths, *etc.*

Erecting a wind turbine on the plateau of the landfill was a post-closure project largely unheard of, and gave project engineers some unique challenges to overcome. (*See Hull construction photos 1-6.*)

First and foremost was ensuring the integrity of the existing landfill cap was maintained and that the capping system was fully integrated into the proposed turbine foundation. The landfill cap consists of topsoil, drainage sand, a 40-mil geomembrane barrier layer, and a 12-inch gas venting layer. The total depth of the capping system is three-feet, where the geomembrane layer is located 18 inches below grade. Beneath the landfill cap is approximately 60 feet of solid waste.

The turbine foundation consists of a 20-foot by 20-foot by 6-foot thick "pile cap" that sits atop 35 steel-driven, concrete infilled piles. The piles were driven through the waste mass to the underlying bedrock, where 20 of the 35 piles were cored and anchored 30 feet into the bedrock. Protecting the cap during construction meant implementing construction controls that would prevent excessive equipment loads, particularly those related to the 300-ton capacity crawler crane used to erect the turbine, from inducing stresses that would fatigue or tear the geomembrane cap. To address this issue, a cribbing system was created that distributed the weight of the construction equipment from a high of 60 pounds per square inch to a required ground bearing tolerance not exceeding 7.5 psi.

While protecting the cap during construction was critical to the successful execution of the project, restoring the cap and properly tying it into the turbine foundation system was essential in securing regulatory approval from the Massachusetts Department of Environmental Protection—an approval that was required if the project was to move forward. To this end, the pile cap subgrade and foundation sidewalls were installed with a 60-mil spray-on vapor barrier layer, creating an impermeable seal around the entire pile cap that not only restored the function of the former geomembrane that had been located in this area, but also provided a barrier to potential gas migration to the turbine tower. Completing the cap restoration work was the installation of a 40-mil geomembrane overlay within the full limit of work, where the overlay was constructed with a bellows system welded to the perimeter of the foundation. The bellows system provides tensile and shear stress relief for the geomembrane in the event the waste material in the vicinity of the turbine should settle.

Turbine Savings

Hull Wind 2 has been a massive success for the town of Hull, thanks to its revitalization of "dead" land, as well as its energy production. The first year after the wind turbine began operating (going online in May of 2006), it produced enough energy to power Hull's street lights. Also, the town was able to sell »

It's estimated the two wind turbines save the town $680,000 a year in energy costs.

approximately $150,000 in excess energy.

Today, connected to Hull's municipal power plant, the two wind turbines generate enough power for about 1,100 homes, along with the community's traffic and street lights (roughly 13 percent of Hull's power needs). It's estimated the wind turbines save the town $680,000 a year in energy costs.


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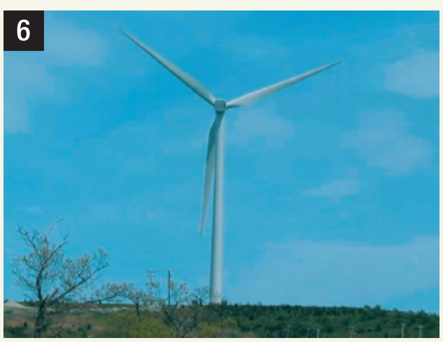
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Hull's efforts in promoting alternative energy also have earned the town some national acclaim. Last summer, representatives from the Environmental Protection Agency visited the wind turbines, calling Hull a glowing example of what communities across the country should be doing in providing more cost-effective, environmentally-friendly energy sources. Also, the U.S. Department of Energy presented the town with the 2006 Wind Power Pioneer Award. Hull's wind program was cited for leadership, demonstrated success, and innovation.

A Point of Pride

According to an Energy Department report entitled, "20% Wind Energy by 2030," American onshore wind plants are expected to generate an estimated 48 billion kilowatt-hours (kWh) of wind energy in 2008, or enough to power about 4.5 million homes. However, this number only represents more than one percent of the United States's total electricity supply.

The hope is Hull's unique efforts in siting its second wind turbine will create an example other municipalities can follow when considering renewable energy projects. Wind energy is clean, inexhaustible, and abundant; it's an energy source that could be incorporated in countless other communities with the proper resources, initiative, and creativity.

"It's a point of pride for the town of Hull," said Malcolm Brown, a retired philosophy professor who spearheaded the efforts to get the wind turbines erected. "I have a teacher friend who plays host to visiting schoolchildren and they always mention the turbines. It's no longer about connecting the town with the old carousel or Nantasket Beach. For them, Hull is the wind turbines. This is our new identity." ■

Stephen Wright is Principal Engineer and Environmental Group Manager for S E A Consultants Inc., a 160-person engineering and architectural firm headquartered in Cambridge, Mass. S E A Consultants served as principal engineers for the Hull Wind 2. Wright has 20 years of solid waste engineering and planning experience, and has worked on a wide range of projects, including waste-handling facilities, landfill assessments, closures, and post-closure site uses.

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