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ROAD MAINTENANCE: Damaging wind farms

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According to the U.S. Department of Energy, wind power has been the fastest-growing source of electrical energy for several years.

National wind power output increased by one-third between 2008 and 2009. In part, the growth is being driven by tax credits and increasing renewable energy requirements. For example, a Minnesota statute requires most power companies to produce 25% of its energy from renewable sources by 2025. While wind generation still accounts for only about 2% of all electric power in the U.S., it is certain that the nation's wind-generating capacity will continue to grow.

Jackson County, located in the southwestern corner of Minnesota, is a microcosm of the national trend. Tim Stahl, the Jackson County engineer, reports that there are 177 wind-generator towers in his county—but that within a few years, the county is likely to have about 500 towers.

Wind power's major advantage is well known: electric energy produced without fuel or emissions. Two significant byproducts are good-paying jobs during construction of wind-energy facilities and tax revenue. Stahl estimated that, by the end of 2011, wind-power developers will be paying about $1million per year in taxes to Jackson County and its townships.

A problem hidden in plain sight

Though some of wind power's down sides also have been well publicized, there is one negative

factor that has received little media attention: damage to rural roads during construction of wind-energy facilities. The common term “wind farm” is appropriate because most wind generators are in rural locations—for the simple reason that they need to be out in the open. That almost invariably means construction companies must traverse low-volume gravel- and asphalt-surfaced roads to reach the many construction sites that make up a wind farm. This presents several problems to the people responsible for maintaining those roads.

First, the large vehicle loads involved in wind-farm construction greatly exceed the designed capacities of most rural roads. For example, the gross weight of a truck carrying the turbine that will sit atop a typical 300-ft wind tower is 218,000 lb. The gross weights of trucks that carry tower sections vary from 134,000 lb to 232,000 lb. Another type of vehicle commonly used in wind-farm construction is the so-called rough-terrain crane. Each of these two-axle vehicles typically weighs 100,000 lb. A single pass by any of these loads can cause major damage to a gravel-surfaced road. In addition, many legal loads of concrete, rebar and gravel are hauled in to construct wind farms. To compound the matter, in northern climates, wind-power companies want to begin construction as early as possible in the spring—when roads are at their weakest.

Another problem is caused by the length of wind-generator blades. Blades currently being installed across the nation are up to 120 ft long, and 180-ft blades will be in use in some places in a few years. The vehicles that haul the blades require much wider turning radii than exist at typical rural crossroads. As a result, corners must be widened. In addition to issues such as compensation to land owners, obstruction of drainage ditches and destruction of crops, widening a corner can create problems that directly involve public-highway officials. For example, who will do the widening and what construction standards must be met? And, if a stop or yield sign must be moved, who is authorized to move the sign? Who will be required to reposition the sign if and when the corner is returned to its original shape? And perhaps most important, who will be liable if a sign was not moved back to its original position and this becomes a contributing factor in a crash?

Yet another issue is that, in some jurisdictions, there is a disconnect between the revenue paid by wind-energy developers to local governments and local road-maintenance budgets. Such a disconnect exists in Minnesota. Recent permits issued for wind farms by the Minnesota Public Utilities Commission (PUC) state that the permittee “shall identify all state, county or township roads [to be] used for the [wind farm] project and . . . shall make satisfactory arrangements . . . for maintenance and repair of roads that will be subject to extra wear and tear due to transportation of equipment and [tower] components.” However, currently, neither Minnesota PUC permits nor any Minnesota statute decrees that any portion of the taxes collected from wind-farm developers must be reserved specifically for road maintenance. Some county highway officials depend on their good relationships with elected officials to get a portion of the tax revenues applied to their highway maintenance budgets.

Finally, wind developers not only traverse county roads, but they also construct entrances from those roads and field drives to the towers. There are safety issues involved in deciding on the placement and number of these entrances. Also, the entrances interrupt drainage ditches, so

standards for culverts and their placement come into the picture. Furthermore, driving heavy loads over agricultural land often endangers drainage tile lines. Ultimately, all of these problems become issues of reimbursement and authority: How much should a wind-power developer (or any other enterprise that puts large amounts of stress on roads) pay for the use and abuse of roads and other infrastructure? And who should repair road damage—the developer or the agency?

Learning from experience

In nearly all cases, wind-energy developers and elected officials understand that it is advantageous to work closely with local highway officials. But some highway officials have learned that they must initiate the discussion on how roads are to be protected and that they need to change their policies. For example, Tim Stahl, county engineer for Jackson County, Minn., said that, prior to wind-farm construction, there was no charge for any type of permit in Jackson County. But a few years ago, he received a call in the middle of the night informing him that a large wind-farm construction crane had been moved on a county gravel road and had left depressions 6 in. deep.

“So we got smarter and started charging for moving permits,” said Stahl.

He has developed permit request forms, approval processes, fee schedules and procedures for entrances, utilities, radius extensions of corners and road crossings. Stahl reported that, in 2010, moving permits alone brought about $200,000 into his road-maintenance budget. He also said he assigns a staff member as a full-time inspector when moves of this type are in progress.

The right tools for the job

In 2009, Stahl, several other Minnesota county engineers and others formed a committee to discuss their experiences and share the lessons they’ve learned about dealing with wind-farm construction. The committee received funding from the Minnesota Local Road Research Board to synthesize information and develop tools that will help other agencies address road damage from wind-farm construction—or any other major traffic generators such as ethanol plants or power plants.

The product of this project is an interactive web-based tool (www.lrrb.org/trafcalc.aspx [6]) called Best Practices: Managing Interaction Between Local Authorities and Major Traffic Generators. The core of the tool is a detailed, step-by-step guide that suggests how engineers and other agency personnel can monitor and control roads throughout the wind-farm construction cycle.

For example, the tool helps an agency to develop its overall strategy for charging for road use and damage. The colored links at the right side of the screen take the user to permit application forms and road-repair agreements that have been used successfully in previous projects, research reports on the legalities of charging for road use and a road-damage calculation tool. Links on other pages of the tool take users to transcripts of interviews with public officials who have “been there” as well as to statutes, guidelines and articles.

Getting to the bottom line

One key component of the Best Practices tool is a spreadsheet that can be used to calculate the actual dollar amount to be assessed for a wind farm or any other project that puts major loads on asphalt-surfaced roads. To develop the spreadsheet, the committee worked with professor James Wilde of Minnesota State University, Mankato. Wilde said, “We made the tool easy to use, but also made sure it’s within the bounds of established pavement-design methods. It allows the user to estimate road damage costs by ‘designing’ a road two ways—with and without the large traffic generator. The difference in cost between the two designs is what’s attributable to the traffic generator and that’s the amount that should be reimbursed. From there we can estimate the cost per ESAL, or per installed turbine.”

In addition to Wilde, the committee worked with this writer and the LRRB’s research implementation consultant, Michael Marti of SRF Consulting Group Inc., to design and develop the web-based tool. According to Marti, “The challenge of this project was to capture the knowledge of many experts and communicate that knowledge to other practitioners in an engaging, practical way. As other agencies use the web-based tool, they are encouraged to submit additional information, experience and resources that may then be incorporated in future versions.” With this new tool readily accessible on the web, highway officials throughout the world will be able to respond to the challenge of unanticipated heavy road use and thereby maintain rural roads in better condition.

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