

# Waste Not

## *Curtailment of renewables means lost energy*

By Leigh Cooper

**I**n the world of electricity, generators must provide the exact amount of energy, second by second, that users demand. But some conventional power plants, fueled by coal or nuclear, cannot be turned on and off like a light switch. So when demand drops very low, instead of reducing nuclear or coal production, which can't easily drop below a certain base load, the power grid reduces production of renewable energy—below the amount these sources potentially could provide.



Such reductions, called curtailment, allow energy production to equal energy demand, but also permit potential energy to drift away in the wind. Xi Wang, a CIRES graduate student with the Center for Science and Technology Policy Research, and her colleagues at the National Renewable Energy Laboratory, recently reported on curtailment practices worldwide.

They found that countries interested in bolstering the renewables industry are attempting to mitigate curtailment, because high curtailment levels discourage investors: No

one wants to produce energy they can't sell.

Mitigation strategies vary from changes in energy markets to government incentives. "In many areas, for example, renewable energy generators now can offer bids into a wholesale electricity market," Wang says. "If their bid is accepted, their energy is dispatched. When renewables can bid into the market like other generation sources, they know they're competing based on market demands." In other regions, especially Europe, energy providers compensate renewable-energy producers for curtailed energy.

Curtailment takes another form too: Construction of transmission lines is expensive and can lag behind construction of wind and solar farms, so at times, not all the energy from a wind or solar farm can be transported to cities. So, completing transmission projects would also help maximize renewables' potential. "We hope other regions encountering increasing curtailment can better plan by incorporating some of these successful mitigation strategies," Wang says.



# Getting the Carbon Out of US Energy

By Katy Human

**P**roponents of renewable energy often bemoan the "fact" that wind and solar energy can't reliably provide power for every person in the United States, all the time. But CIRES researcher Christopher Clack, NOAA's Sandy MacDonald, director of the Earth System Research Laboratory, and their colleagues aren't convinced. For one thing, few of the researchers analyzing wind and solar potential have a background in meteorology, even though it's weather that primarily drives that potential.

So the NOAA and CIRES team created a mathematical model that incorporates all aspects of the U.S. energy system. The researchers started with the location of current coal, gas, and nuclear plants and the costs of installing new transmission lines. They included the hourly ups and downs of power demand everywhere in the continental United States and the prices people pay for their power, now and projected into the future. And they included hour-by-hour weather information, so they knew when and where wind turbines might spin and solar panels produce energy. Importantly, they included a national system of wind and photovoltaic solar power plants, with details such as location and size to be determined by the model runs.

"In essence, we created a national energy simulator," says Clack. "We can use it to answer critical questions about renewable energy: its affordability, reliability, and the possibility of renewables meeting our growing energy needs."

Clack, MacDonald, and their colleagues can, for example, insist that the model never allow an area to go without power; ask it to optimize renewables' role in the power supply system; or have it minimize future costs. They can ask it to "solve" the challenge of creating a transmission system that allows for widescale use of renewables. The computerized system is so sophisticated, it takes a week to run simulations. Preliminary results are promising, with more to come in 2014...



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