



Energy and Climate: Vision for the Future

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In a talk that suggested a contrast between China's "amazingly detailed and extremely ambitious plans" for carbon reductions and similarly ambitious but relatively unformed plans in the United States, Michael McElroy, Gilbert Butler Professor of Environmental Studies at the Harvard School of Engineering and Applied Sciences, presented some of his recent research related to the potential for carbon emissions reductions in the two countries.

China has seen rapid growth in wind power, nuclear power, solar, and hydro power, McElroy observed, noting that so far it has done well in meeting its carbon reduction commitments. However, he observed that China is facing some new challenges. Investment in coal power production continues, although the utilization of additional plants, on average, has declined. With coal prices poised to increase in conjunction with declining coal stocks, McElroy noted, these reductions in plant utilization may continue. Wind capacity is strong—China now has more installed wind capacity than the U.S.—however, overall, China produces less electricity from wind than is produced in the United States. One reason for this, McElroy explained, is that these wind plants are competing with power from combined heat and power coal plants, which are running primarily to provide heat and hot water, and so can't be simply supplanted by wind electricity.



A concerning new finding from researchers in McElroy's group is that the wind resource in China seems to have declined over the past few decades in ways that seem to be related to global warming, disrupting the monsoonal circulation—suggesting a potential negative feedback loop in which global warming itself diminishes the potential of low-carbon energy production in China.

Turning to the situation in the United States, McElroy noted that U.S. emissions reduction commitments are also ambitious, given that meeting them requires the extension of a trend of reductions tied to a constellation of recession and high gas prices that is no longer in effect. Successfully meeting these targets in the future, McElroy suggested, is likely to require significant growth in electric transportation. As a result, the United States will need to not only drastically reduce carbon emissions in the electricity sector; the country will need to do this while at the same time increasing the total amount of electricity produced.

In theory, McElroy said, there are enough renewable energy resources available in the United States to more than meet expanded electricity demand with carbon-free energy. McElroy presented data from his research group's analysis of the wind potential in the United States, which found that the U.S. is "wind rich," especially in the middle parts of the country, where some states have the potential to produce hundreds of times their annual electricity consumption from wind, even in an analysis that excludes urban and forested areas. McElroy acknowledged, however, that challenges exist in accommodating the variability of wind and solar resources and in connecting the electricity production from wind and solar resources to demand across the United States.

The path to utilizing the potential wind and solar resource, then, is not clear, although McElroy suggested that it might include major new transmission projects and expanded production tax credits for wind energy. Ongoing research with the Midcontinent Independent System Operator, McElroy said, is examining the potential impact of different policy scenarios, including a \$100 per ton carbon tax and a variable wind production tax credit.

McElroy spoke as part of the Kennedy School's Energy Policy Seminar Series, which is sponsored by the Consortium for Energy Policy Research of the Mossavar-Rahmani Center on Business and Government.