

A surprise: China's energy consumption will stabilize

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(PhysOrg.com) -- As China's economy continues to soar, its energy use and greenhouse gas emissions will keep on soaring as well --or so goes the conventional wisdom. A new analysis by researchers at Lawrence Berkeley National Laboratory (Berkeley Lab) now is challenging that notion, one widely held in both the United States and China.

Well before mid-century, according to a new study by Berkeley Lab's China Energy Group, that nation's [energy use](#) will level off, even as its

population edges past 1.4 billion. "I think this is very good news," says Mark Levine, co-author of the report, "China's Energy and [Carbon Emissions Outlook to 2050](#)" and director of the group. "There's been a perception that China's rising prosperity means runaway growth in [energy consumption](#). Our study shows this won't be the case."

Along with China's rise as a world economic power have come a rapid climb in energy use and a related boost in man-made [carbon dioxide emissions](#). In fact, China overtook the United States in 2007 as the world's leading emitter of [greenhouse gases](#).

Yet according to this new forecast, the steeply rising curve of energy demand in China will begin to moderate between 2030 and 2035 and flatten thereafter. There will come a time—within the next two decades—when the number of people in China acquiring cars, larger homes, and other accouterments of industrialized societies will peak. It's a phenomenon known as saturation. "Once nearly every household owns a refrigerator, a washing machine, air conditioners and other appliances, and once housing area per capita has stabilized, per household electricity growth will slow," Levine explains.

Similarly, China will reach saturation in road and rail construction before the 2030-2035 time frame, resulting in very large decreases in iron and steel demand. Additionally, other energy-intensive industries will see demand for their products flatten.

The Berkeley Lab report also anticipates the widespread use of electric cars, a significant drop in reliance on coal for electricity generation, and a big expansion in the use of nuclear power—all helping to drive down China's CO₂ emissions. Although China has temporarily suspended approvals of new nuclear power plant construction in the wake of the disaster at Japan's Fukushima Daiichi Nuclear Power Station, the long-range forecast remains unchanged.

Key to the new findings is a deeper look at patterns of [energy demand](#) in China: a "bottom-up" modeling system that develops projections of energy use in far greater detail than standard methods and which is much more time- and labor-intensive to undertake. Work on the project has been ongoing for the last four years. "Other studies don't have this kind of detail," says Levine. "There's no model outside of China that even comes close to having this kind of information, such as our data on housing stock and appliances."

Not only does the report examine demand for appliances such as refrigerators and fans, it also makes predictions about adoption of improvements in the energy efficiency of such equipment – just as Americans are now buying more efficient washing machines, cars with better gas-mileage, and less power-hungry light bulbs.

Berkeley Lab researchers Nan Zhou, David Fridley, Michael McNeil, Nina Zheng, and Jing Ke co-authored the report with Levine. Their study is a "scenario analysis" that forecasts two possible energy futures for [China](#), one an "accelerated improvement scenario" that assumes success for a very aggressive effort to improve energy efficiency, the other a more conservative "continued improvement scenario" that meets less ambitious targets. Yet both of these scenarios, at a different pace, show similar moderation effects and a flattening of energy consumption well before 2050.

Under the more aggressive scenario, energy consumption begins to flatten in 2025, just 14 years from now. The more conservative scenario sees energy consumption rates beginning to taper in 2030. By the mid-century mark, energy consumption under the "accelerated improvement scenario" will be 20 percent below that of the other.

Scenario analysis is also used in more conventional forecasts, but these are typically based on macroeconomic variables such as gross domestic

product and population growth. Such scenarios are developed "without reference to saturation, efficiency, or usage of energy-using devices, e.g., air conditioners," says the Berkeley Lab report. "For energy analysts and policymakers, this is a serious omission, in some cases calling into question the very meaning of the scenarios."

The new Berkeley Lab forecast also uses the two scenarios to examine CO₂ emissions anticipated through 2050. Under the more aggressive scenario, China's emissions of the greenhouse gas are predicted to peak in 2027 at 9.7 billion metric tons. From then on, they will fall significantly, to about 7 billion metric tons by 2050. Under the more conservative scenario, CO₂ emissions will reach a plateau of 12 billion metric tons by 2033, and then trail down to 11 billion metric tons at mid-century.

Several assumptions about China's efforts to "decarbonize" its energy production and consumption are built into the optimistic forecasts for reductions in the growth of [greenhouse gas emissions](#). They include:

- A dramatic reduction in coal's share of energy production, to as low as 30 percent by 2050, compared to 74 percent in 2005
- An expansion of nuclear power from 8 gigawatts in 2005 to 86 gigawatts by 2020, followed by a rise to as much as 550 gigawatts in 2050
- A switch to electric cars. The assumption is that urban private car ownership will reach 356 million vehicles by 2050. Under the "continued improvement scenario," 30 percent of these will be electric; under the "accelerated improvement scenario," 70 percent will be electric.

More information: [Full text](#) of the report: "China's Energy and Carbon Emissions Outlook to 2050"

Provided by Lawrence Berkeley National Laboratory

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