

Creating a low-carbon, non-nuclear economy: The case of Taiwan

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After the 2011 Fukushima nuclear disaster, energy experts and policymakers around the world began to reassess the future of nuclear power. Countries, including [Japan](#) [1] and Germany, have since scaled back or plan to shut down their nuclear power — sparking a global debate on how nations will replace nuclear.

Taiwan is just one country where this intense debate is unfolding. Yen-Heng Henry Chen, a Taiwan native and research scientist at MIT's Joint Program on the Science and Policy of Global Change, decided to look at how the nation's economy and emissions reduction strategies might be affected by future changes to Taiwanese nuclear energy policies.

"There has been little research on the interactions between non-nuclear and low-carbon policies," Chen says. "Taiwan has a small economy and limited natural resources, making it an interesting case study for other countries looking for ways to cut carbon emissions with or without nuclear power."

The Taiwanese government aims to cut its CO₂ emissions in half (from 2000 levels) by 2050. One way they had planned to do this was through nuclear power. Taiwan currently has three nuclear power plants, with plans to bring a fourth plant, the Longmen Nuclear Power Station, online in 2015. This tightly populated country has more than nine million residents within 50 miles of its three existing nuclear reactors. Because Taiwan is similar in topography and fault lines to Japan, the prospect of the new plant — and perhaps others to come — has raised public concerns about the safety of nuclear power.

"After the Fukushima accident, more than 60 percent of the Taiwanese population was against the construction of a new nuclear power plant according to a recent poll," Chen says. "I wanted to know what it would mean for the Taiwanese economy and the government's emissions reduction targets if they were to eliminate or reduce nuclear power."

Taiwan currently imports 99 percent of its energy, which includes oil, natural gas, coal and nuclear. Because the opportunities for alternative low-carbon energies such as solar, wind and hydro are limited, Chen conducted an economy-wide analysis that explored other ways to reduce carbon emissions: nuclear power, a carbon tax, and carbon capture and storage (CCS) technology.

When implementing a low-carbon and non-nuclear policy, without the availability of CCS (which is not yet cost-effective at a large scale), Chen finds that by 2050 GDP would drop by about 20 percent. If CCS were to become more cost-effective and could be added to the low-carbon strategy, GDP would drop by less than 10 percent.

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But the least expensive way to pursue a low-carbon policy, Chen finds, would be to expand nuclear capacity in addition to adopting CCS. If nuclear capacity was tripled (compared to current levels) and CCS option was feasible, by 2050 GDP loss would be reduced to around five percent.

Absent nuclear power and CCS, “Taiwan needs to convert its industrial structure into a much less energy intensive one if the country is serious about achieving a low-carbon environment,” Chen says. Taiwan’s industrial sector accounts for almost half of the country’s energy demands.

Costs could be lowered for industry and consumers if Taiwan were able to join an international emissions trading system — which Chen looks forward to exploring further in future research.

Until such an international trading system exists, “This case study can help policymakers better understand the costs of cutting CO2 emissions without nuclear energy,” Chen says, “as nuclear power becomes a less viable energy solution in Taiwan and around the world.”

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[1] <http://web.mit.edu/newsoffice/2013/fukushima-disaster-0311.html>