

# Cap-and-trade trumps taxes for clean tech adoption

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A cap-and-trade system is more likely than a carbon tax system to trigger the adoption of clean energy technologies, according to a study by professor Yihsu Chen at the University of California, Merced.

The study — coauthored by Chung-Li Tseng of the University of New South Wales in Australia and published this month in the *Energy Journal*, a quarterly journal of the International Association for Energy Economics — also found that the volatile pricing of a cap-and-trade system could lead to earlier adoption of clean technology by firms looking to hedge against carbon cost risks.

The study used economic models based on a framework of real options to determine the optimal timing for a coal-burning firm to introduce clean technologies using the two most commonly considered policies — cap-and-trade, in which carbon emissions are capped and low-emission firms can sell excess permits to high-emission firms; and carbon taxes, which employ a fixed monetary penalty for per-unit carbon emissions.

"To our knowledge, there has been no formal study based on real options that compares the investment timing of these two instruments," Chen said. "In our view, cap-and-trade offers 'carrots' while taxes offer 'sticks.' Cap-and-trade induces firms to explore profit opportunities, while taxes simply impose penalties to turn clean technology into a less costly option."

For the study, the researchers considered a scenario of a relatively small

firm that owns a coal-fired power plant and is obliged to supply power to its customers. They compared cap-and-trade and [carbon tax](#) models in determining when the firm would choose to add a natural gas power plant, a relatively [clean energy](#) resource, in order to meet its energy demands while maximizing its long-term profits.

The study found that when considering the relationship of the related costs and risks, the cap-and-trade model triggered the adoption of clean energy technology at a lower overall [carbon](#) price than a tax policy did. Further, the study found that the volatility of unfixed permit prices — often a criticism of cap-and-trade policies — was the key difference that led the firm to add a natural gas plant earlier than it would have under a more predictable tax system.

Chen's study is yet another example of UC Merced faculty conducting research into some of society's most challenging problems.

"In this time of global climate change, policy choices are critical in steering polluting industries toward more timely [adoption](#) of clean technologies," Chen said. "Based on our study, mechanisms designed to reduce cap-and-trade permit prices or suppress price volatility — which have been implemented in existing cap-and-trade programs like the Regional Greenhouse Gas Initiative — are likely to delay [clean technology](#) investments."

Provided by UC Merced

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