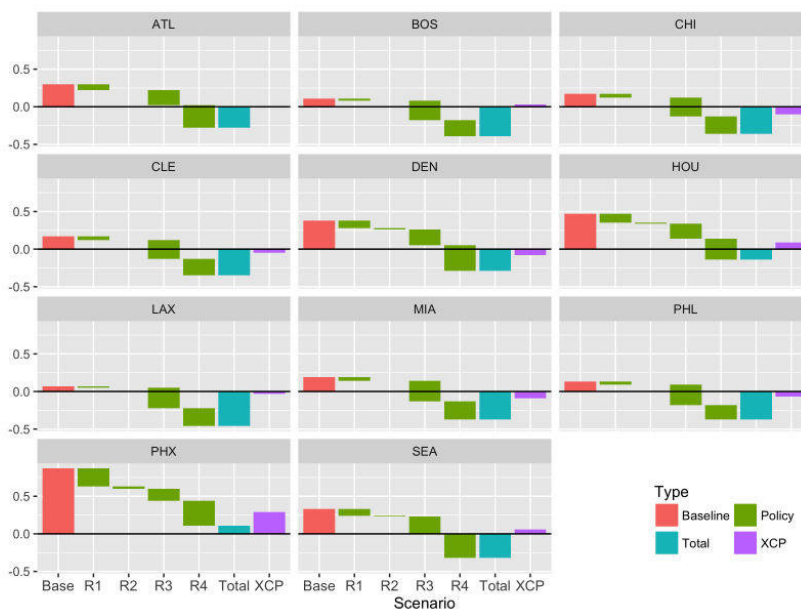# To drop CO2 emissions, look to local transportation and housing

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Penn and MIT researchers looked to the housing sector as one way localities could impact greenhouse gas emissions. These graphs showcase a sequential comparison of 2030 residential energy-conservation scenarios for 11 metro areas. Red represents the baseline. The other three colors signify different scenarios, with and without the Clean Power Plan. In the best-case option, CPP stays in place and cities adopt energy-conservation standards for new homes and retrofitting standards for existing home. Then emissions could potentially drop by 46 percent, on average. Credit: University of Pennsylvania

Worldwide, the United States is one of the biggest greenhouse gas

emitters. The Obama administration began efforts to drop those numbers by increasing vehicle fuel economy standards in 2011 and with its Clean Power Plan proposals in 2015.

But even if implemented as planned, which is uncertain given the current Administration's energy-policy agenda, that two-pronged approach would still fall short of the country's commitment to the Paris Climate Accord. Local efforts in residential housing and transportation, however, could help make up the difference, according to new findings from the University of Pennsylvania's John Landis and Erick Guerra, and David Hsu of the Massachusetts Institute of Technology.

"If you ask which end-use sectors are responsible for the most greenhouse gas emissions, the answer is housing and transportation," said Landis, the Crossways Professor of City & Regional Planning in Penn's School of Design. "These are two places where, if you wanted to take a regional approach to reducing greenhouse gases, you could. We wanted to see how far you could go."

Landis and colleagues looked at historical data from Atlanta, Boston, Chicago, Cleveland, Denver, Houston, Los Angeles, Miami, Philadelphia, Phoenix and Seattle. They then developed a series of spreadsheet models for each place based on multiple scenarios, some of which included Obama-era federal initiatives, others that did not. They published their findings in the *Journal of Planning Education and Research*.

To begin the analysis, they looked at the two sectors separately.

For housing, the researchers determined a baseline for each metropolitan area using U.S. Census data and statistics from the U.S. Energy Information Agency's Residential Energy Consumption Survey and then estimated the effect of adopting energy-conservation and retrofitting

standards with and without the Clean Power Plan. Minus CPP, the effort could reduce housing-sector emissions by 31 percent, on average, by the year 2030; with it, that number jumps to a 46-percent reduction.

"Nationally," Landis said, "that would help put us on track to exceed the Paris Accord."

On the transportation side, the researchers used GIS mapping of current population densities, plus per-capita vehicle miles traveled from the Texas A&M Transportation Institute. They determined that, absent changes in growth patterns or tightened fuel-economy standards, emissions would increase 26 percent by 2030, primarily due to projected population growth. Even if cities were built up compactly and driving less was aggressively promoted, emissions would still rise 10 percent. If these efforts were combined with a fuel-economy standard of 40 mpg, however, emissions would fall by an average of 31 percent by 2030.

"Most of the country is organized in such a way that it's really inconvenient to get around other than by private car," said Guerra, an assistant professor in Penn Design. "Marginal changes to the built environment in a lot of those places don't result in big changes in driving. For many parts of the country, reducing greenhouse gas emissions will really come down to cleaner vehicle technologies."

Much of the previous research in this vein has focused on hypothetical scenarios. For this work, the Penn team opted to use real numbers from real cities, looking at datasets not often analyzed together. They also paid close attention to how the Obama administration, which was in office when their work began, and the Trump administration move energy initiatives forward.

"If the current administration follows through on its promises to weaken previous climate-change policies," Landis said, "then the responsibility

for reducing greenhouse gas emissions will fall almost entirely to state and local governments, many of which are not prepared to pick up the slack."

To better identify which strategies work and why, the researchers would next like to study places that have already successfully reduced their emissions. "In the sense that there is a Phase B, we want to understand the driving forces behind the trends," Landis said. "How much of it is the economy? Policy? Maybe certain parts of the country buy new vehicles more frequently than others. Maybe it's turnover in housing stock."

They also said cities with fewer than 1 million people, which tend to be more rural and more car-dependent, could offer a different perspective, something not examined in the current findings. The bottom line, they concluded, is that because every place is different, efforts made in each will vary, but all have the potential to help.

"Our population is growing, our economy is growing, so it really takes a combination of multiple factors to actually reduce greenhouse gas emissions," Guerra said. "We might reduce them per capita, but the globe doesn't really care about per-capita emissions. It just cares about the total."