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Title: What-If Modeling to See Energy Futures Under Climate Change: The Case of Air Conditioning

Abstract: Where do energy policy makers' visions of a climate-changed future come from, and how do they get translate to planning? Historically, energy efficiency-centered planning has modeled energy futures based on penetrations of specific technologies and efficiencies along with exogenous demographic changes. In the era of climate change, envisioning energy futures must handle a wider range of influences and consequences. At a minimum, there are: major weather changes, anticipated shifts away from fossil fuels transforming the nature of the power grid, longer time scales, and high awareness of topics such as system feedbacks, resilience, equity, unintended consequences, and other people-centered concepts that don't suit being tackled in averages. Being able to practically think this way requires suitable modeling tools and metrics. Research studies can do some of this work, but time frames are long and results can be distant and static. Well-designed nimble tools can step in to create new quantitative and structural frameworks that make it feasible for planners to tangibly apply their knowledge and imagination. Such tools can also create a ready way to use new data streams -- such as AMI data -- as they emerge, versus leaving useful data underutilized. Considering these hypotheses, we developed a fully working prototype What-If "Sandbox" model using research funds from the California Energy Commission. The tool uses an agent-based structure and focuses on residential air conditioning (AC) the most uncertain and most critical end use in California's hotter mid-term future. AC is already the biggest electricity use in some locales, has major effects on grid adequacy, and is critical to everyday comfort and health. Because AC is integral to overall housing design, cooling-related transitions are highly sensitive to policy influences. One pathway could lock cooling into inflexible if efficient modes of compressor-based air conditioning; another could foster a more flexible and diverse array of cooling methods. The presentation has three components. First, it reviews this research rationale and demonstrates the tool, showing how its structure and output can assist planning. Second, it ties this modeling to the enterprise of envisioning energy in decades ahead, drawing in historical examples to illustrate the role of the unplanned and the nonlinear. Third, we engage the audience to discuss how such analytical activities could help research, planning, and civil society communities test and craft sociotechnical transitions in a way that takes fuller advantage of the creativity and data available than is currently possible.