Measuring Energy Savings for Clean Power Plan Compliance

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Energy Efficiency in 111(d): Using Building Block #4 to Set and Meet Emissions Goals

RFF EPRI Webinar

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RESOURCES FOR THE FUTURE

Energy Efficiency (EE) in EPA's Clean Power Plan

- Basis of the 4th building block for determining state targets
  - Based on savings results/goals in leading states with EERS policies
- EE may play a role in state compliance plan
- Role depends on form of policy: rate or mass
  - With rate-based policy:
    - Evaluated energy savings (negawatthours) directly affect compliance

$$\text{tons CO2/MWh} = \frac{\text{generation emissons rate} \times \text{generation}}{\text{generation} + \text{negawatts}}$$

  - With mass-based policy, simply need to measure emissions from capped sources so measuring EE savings less important for assessing compliance

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EE Policies and Energy Savings

Do we have evidence that demonstrates a connection between specific EE policies and energy savings outcomes?

The answer is there is a lot of uncertainty.

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Issues with EE Evaluation, Measurement and Verification (EM&V)

- Most evaluation studies use engineering methods
  - Focus on verifying installations
  - Energy savings based on engineering calculations, models or look-up tables
  - Measurements of in situ performance and effects on consumption are rare

- Important questions to ask:
  - Is there a careful assessment of baseline consumption?
  - Does evaluation control for other confounding factors?
  - Would program participants have made investments anyway?
  - Is behavioral response assessed or assumed?
  - Does evaluation capture potential rebound? Spillovers? Measure interaction?

- Review of current practice suggests an energy efficiency evaluation gap.

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An Alternative Approach: Empirical Analysis of Energy Demand

- How do you know if an intervention saves energy?
  - Need a reliable assessment of the baseline
  - Consumption before the efficiency measure is not sufficient
  - Comparisons to non-participants can confound multiple effects

- Use experimental or statistical techniques
  - Where possible use randomized control trials or randomized encouragement
  - Quasi experimental methods (eligibility criteria, waiting lists) facilitate evaluation
  - Explain participation with IV methods or use matching to identify controls

- Estimate econometric equation to explain energy consumption
  - Use a panel of customer-level data on actual consumption
  - Nothing but net: method identifies policy induced savings

- Important questions to ask:
  - How do empirically estimated savings compare with engineering estimates?
  - Can we use these estimates to improve our understanding of EE potential and how to use policy to unlock it?

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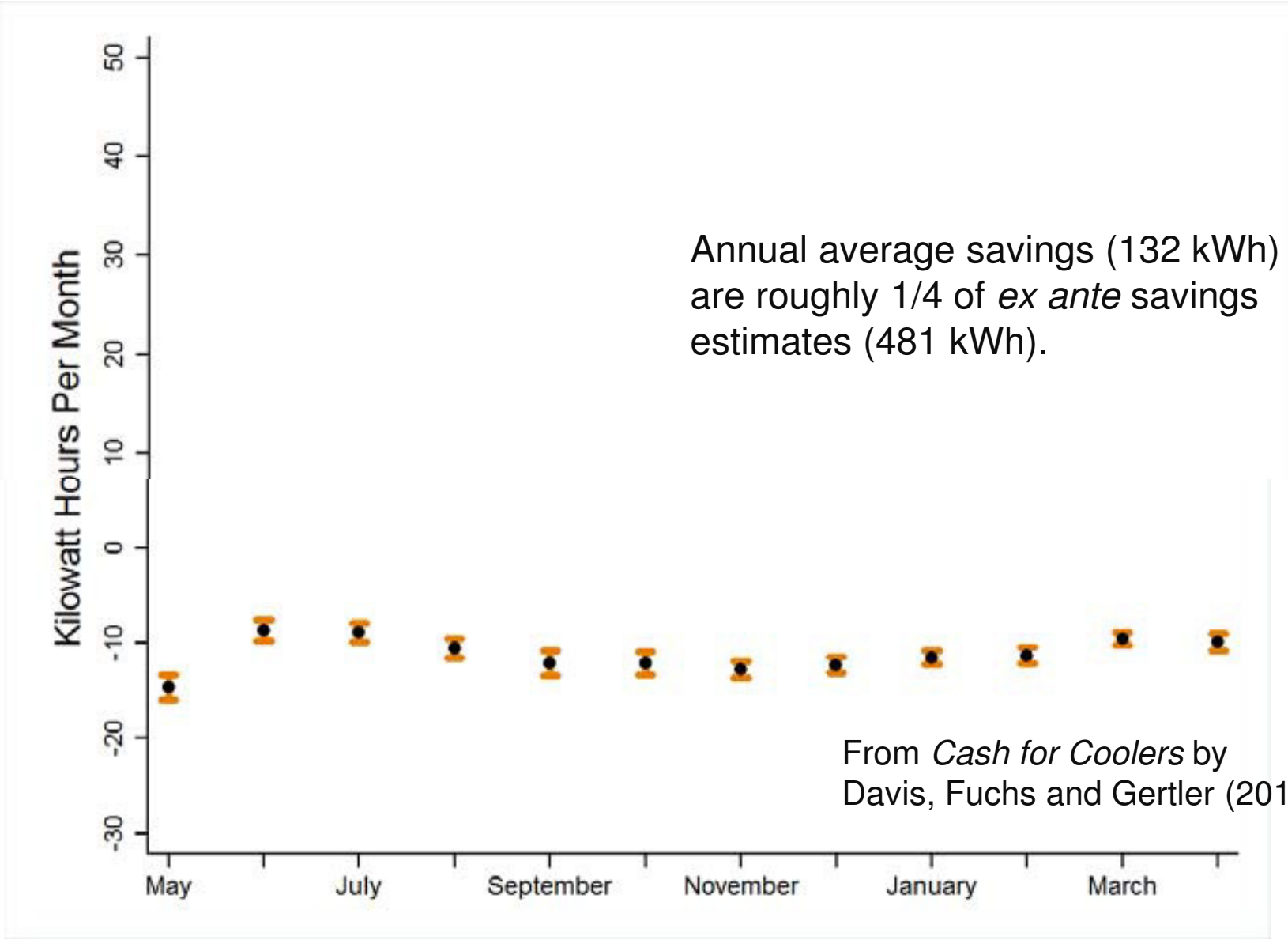
Impact of Mexican EE Refrigerator Subsidies on Energy Use



Annual average savings (132 kWh) are roughly 1/4 of *ex ante* savings estimates (481 kWh).

From *Cash for Coolers* by Davis, Fuchs and Gertler (2012)

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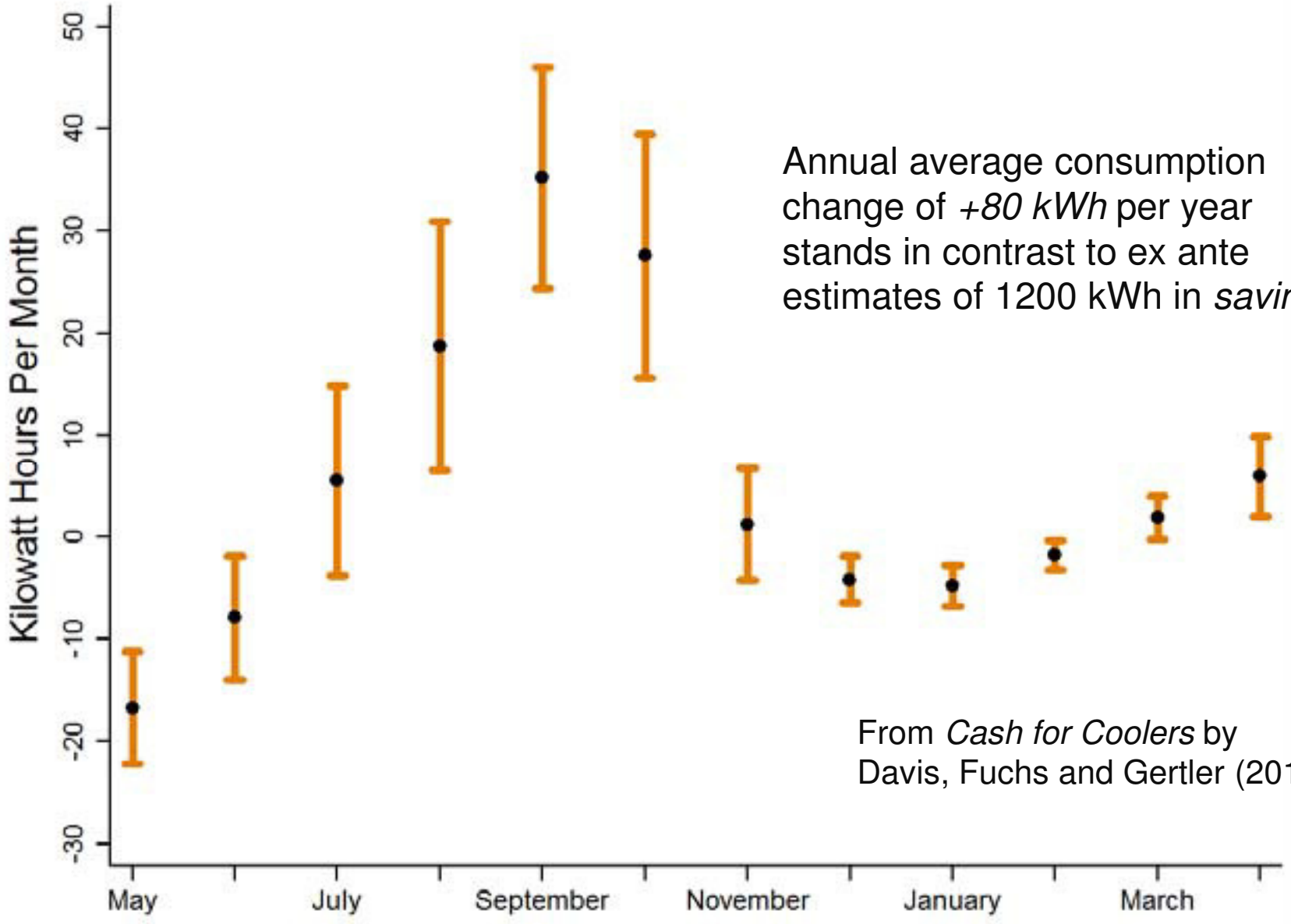
Impact of Mexican EE Air Conditioner Subsidies on Energy Use



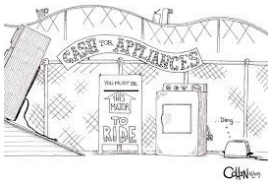
Annual average consumption change of *+80 kWh* per year stands in contrast to ex ante estimates of 1200 kWh in *savings*.

From *Cash for Coolers* by Davis, Fuchs and Gertler (2012)

Some EE Programs Defy Engineering Assessment

- Behavioral programs that use nudges
  - Opower experiments (RCTs) comparing my energy use to neighbors have been shown to reduce energy consumption by roughly 2% (Allcott 2012)

- Information programs
  - Responses to Energy Star program are very heterogeneous across consumers (Houde 2014)
  - Experiments can inform better information provision through appliance labeling (Newell and Siikamaki 2014)
  - Program interactions can also be assessed with statistical techniques and data: "Cash 4 Appliances" subsidies for Energy Star appliances produced little energy savings (Houde and Aldy 2014)



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Best Practices for Rigorous Program Evaluation

- Best practice approaches have been assessed in EPA's SEEAction Report: *Evaluation, Measurement and Verification of Residential Behavior-Based Energy Efficiency Programs: Issues and Recommendations*.

SEE Action
STATE & LOCAL ENERGY EFFICIENCY ACTION NETWORK

- ***All*** programs (not just behavioral programs) elicit behavioral responses; evaluations need to account for this.

- Scientifically rigorous approaches to program evaluation call for:
  - Randomized control trials or quasi experimental designs
  - A neutral arbiter
  - Making data available for replication

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Best Practices for Rigorous Program Evaluation

- Used to evaluate new drugs, poverty alleviation, education and health care policies.
- Few examples of such studies in energy efficiency program evaluation realm.
- Insights could help calibrate and operationalize efficiency supply curves.

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Filling the Energy Efficiency Evaluation Gap

- Two ingredients to fill the gap
  - Design efficiency programs for good evaluation
  - Provide researchers/evaluators with access to customer level data for participants and controls before and after program intervention

- Development of state plans for Clean Power Plan compliance creates an opportunity
  - Compliance starts in 2020 so time for experimentation
  - Can build a knowledge base to:
    - enable better forecasting of future energy savings
    - help to target future efficiency policies and program $

More EE policy experimentation + Rigorous EE policy evaluation =

Better understanding and more effective policy

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Questions?

- Thank you for your attention.

- For more information and perspectives see:
  - RFF's blog, Common Resources: www.common-resources.org
  - RFF's Expert Forum on the Clean Power Plan: www.rff.org/CPPforum
  - RFF research: www.rff.org/cleanairact and www.rff.org/eeinfo
  - Or contact me: Palmer@rff.org

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