The Many Dimensions of Behavior Change

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Plan – A keynote with 2 parts

1. How much will President Trump Change U.S. Energy and Environmental Policies?
2. Many Dimensions of Behavior Change

How much will President Trump Change U.S. Energy and Environmental Policies?

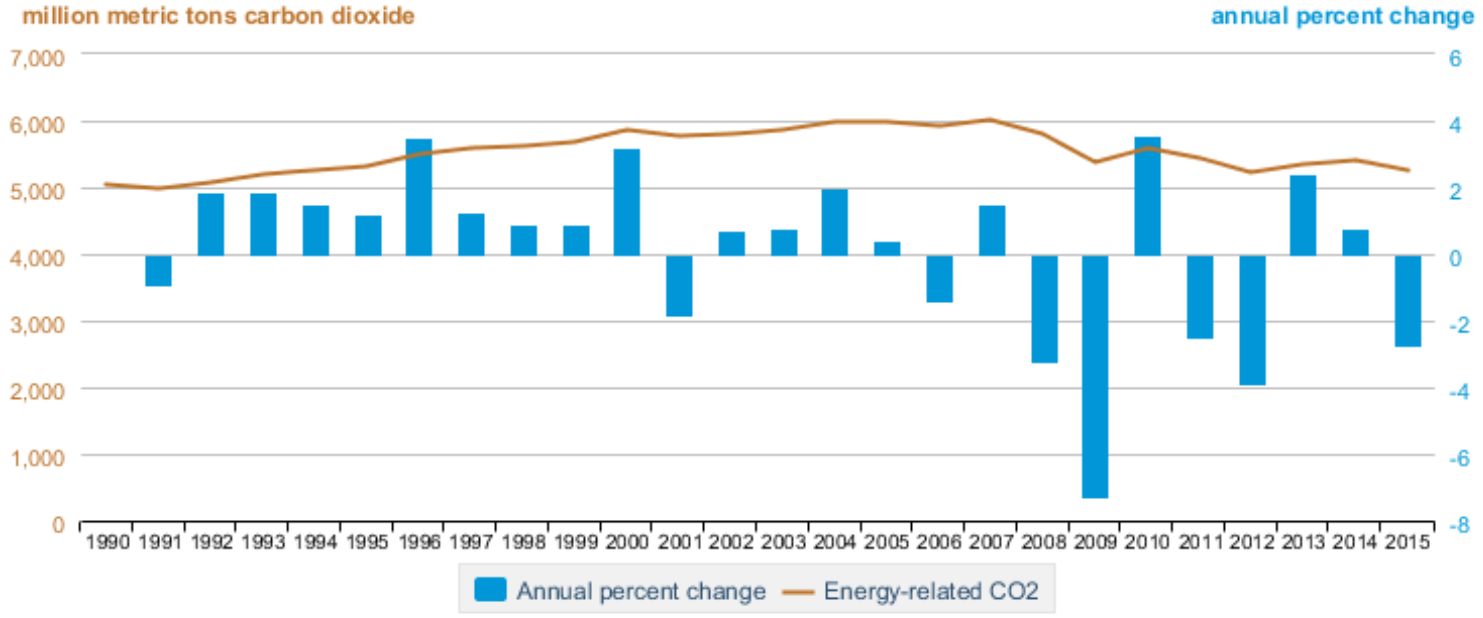
The US will:

- Leave the Paris Climate Agreement
- Change domestic policies:
  - Increase energy production (except renewables)
  - Ignore energy efficiency
  - Weaken environmental regulations

But CO_2 emissions will still fall ~2% in 2017 because:

- Coal → gas & renewables (but slower)
- Reduced electricity demand

U.S. CO_2 Emissions 1990 - 2015

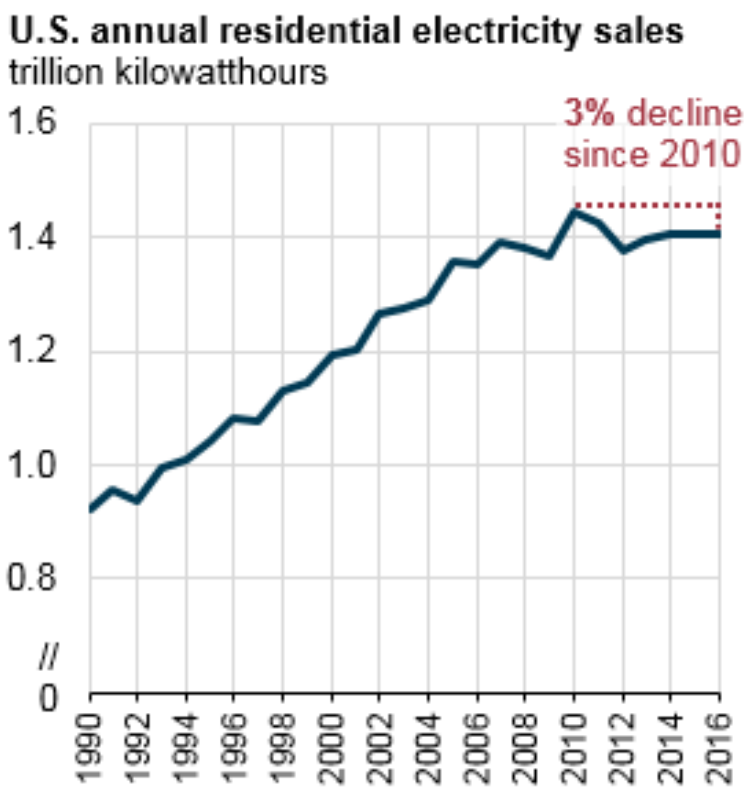


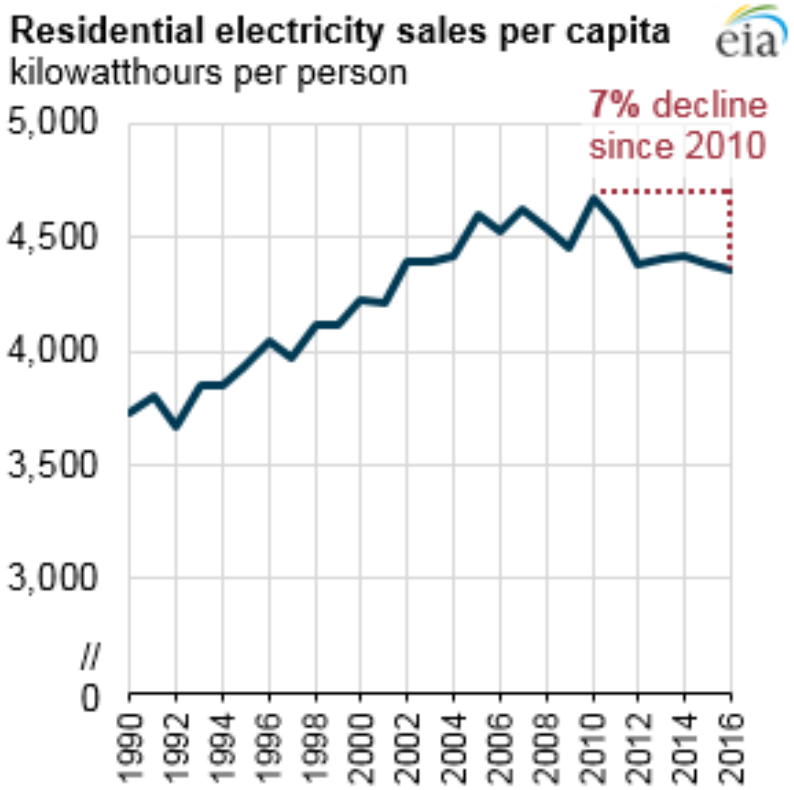
Source: U.S. Energy Information Administration, *October 2016 Monthly Energy Review*, Table 12.1 Carbon dioxide emissions from energy consumption by source.

Residential Electricity Use is Falling

Reductions in
- kWh sales
- kWh/person
- kWh/household

Savings caused by:
- Minimum efficiency regulations for appliances
- PV installations
- LEDs replace incandescent bulbs
- Warmer winters in south
- Behavior?





Why is it Difficult to Change America's GHG Trajectory?

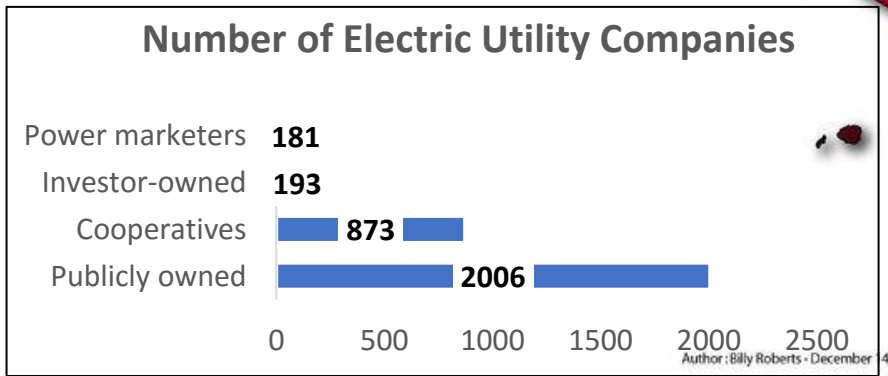
America's energy systems are highly de-centralized

Each state:

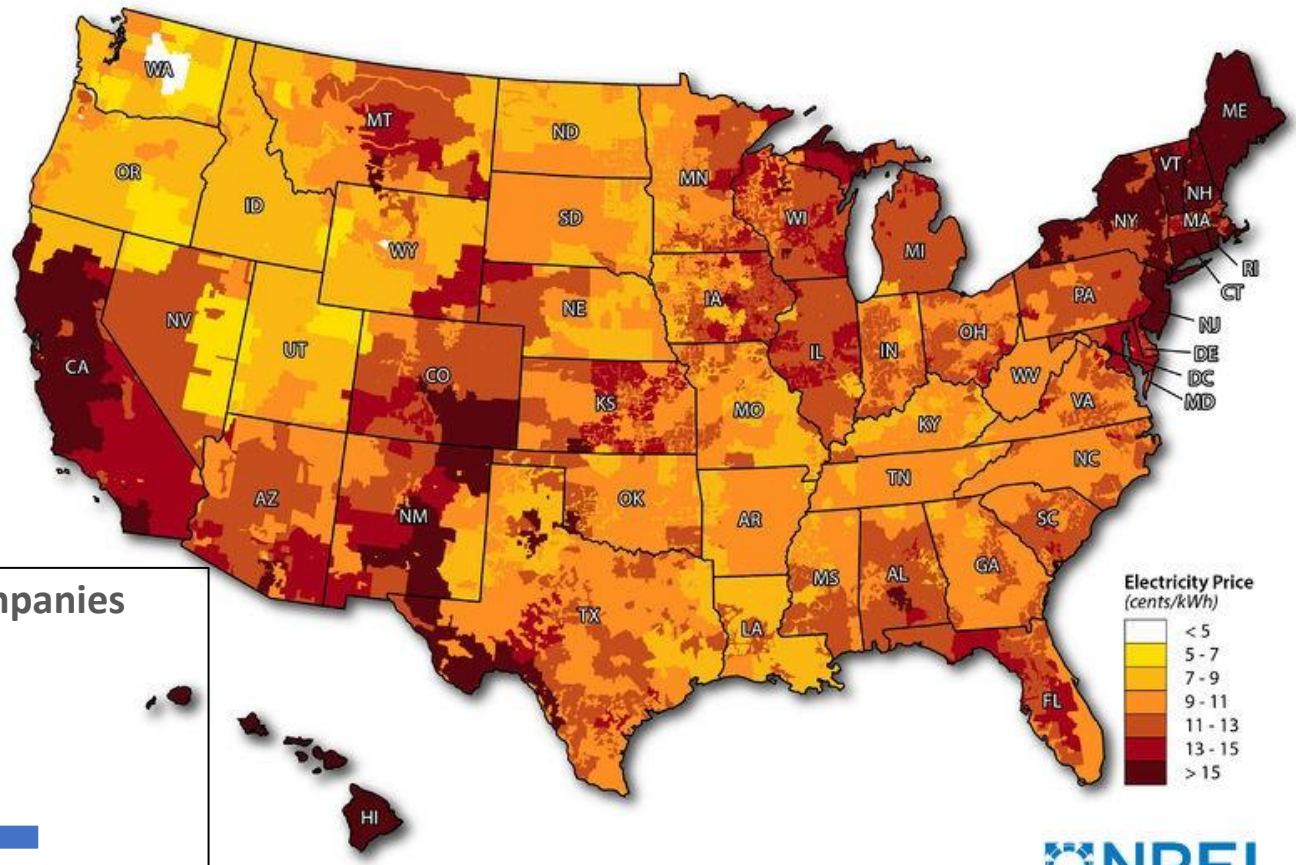
- regulates electricity prices
- sets taxes on electricity, natural gas, gasoline
- has its own rebates and subsidies for solar, EE, etc.
- makes special regulations for local air quality, transportation, etc.
- has different fuel mix, economy, climate
- supports its own energy and environmental research

There are ~3,000 electric utility companies in the US:

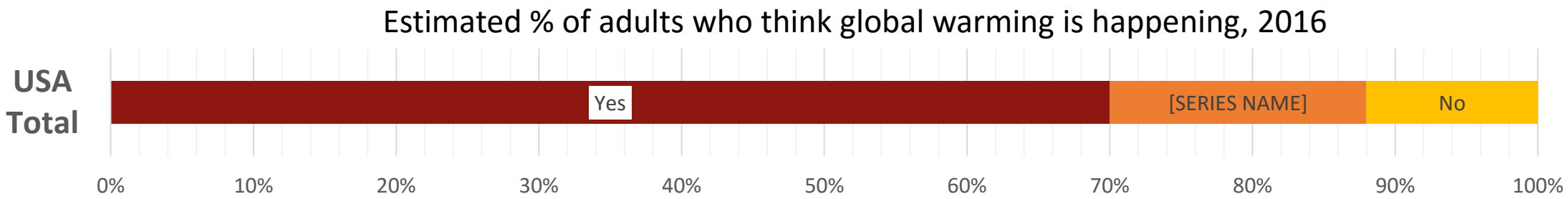
- Private
- Municipal
- Other



Average Residential Electricity Prices Vary Widely

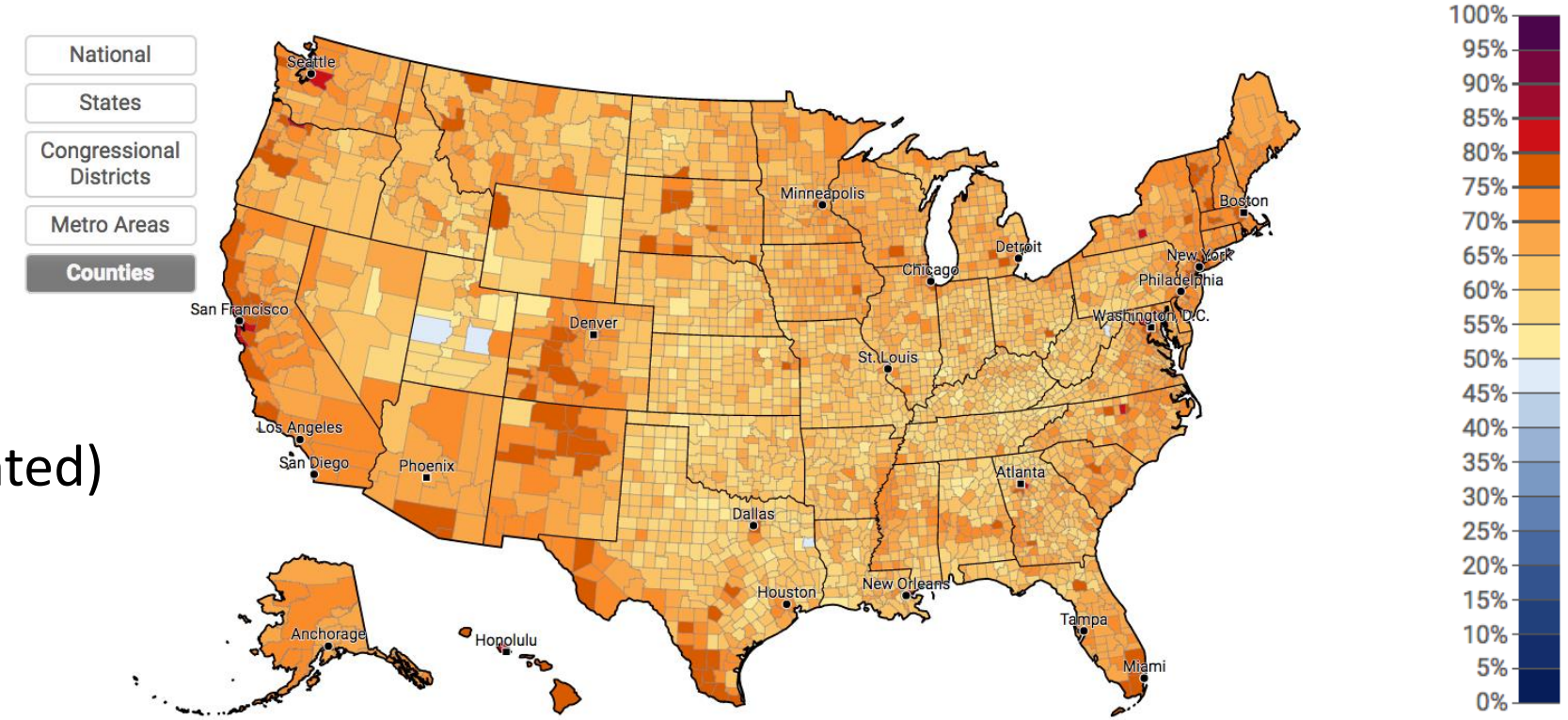


There is a Wide Range of Public Opinion Regarding Climate Change in the United States



USA total

By county
(not population weighted)



Source: Yale Program on Climate Communication, http://climatecommunication.yale.edu/visualizations-data/ycom-us-2016/

My prediction: States and cities will lead energy policies for the next 3 years

- Many states and cities have established their own GHG goals
- California (and other states)
  - 2030 GHG emissions reduction target of 40 percent below 1990 level
- Companies
  - Many of the largest companies will keep or make new environmental goals
    - Apple already uses 96% renewable electricity and pushing suppliers to be similarly green
    - Walmart will remove 1 Gigaton GHG from its supply chain by 2030 (= Germany's GHG)
- If you want to learn about new EE policies (sometimes involving behavior), you must visit cities like Sacramento, Seattle, New York, Austin, and Bentonville*. But Washington, D.C. will be less important for the next few years.

*Location of Walmart headquarters

Changes in Human Behavior Can Reduce Energy Consumption

Behavior change is important because:

- It can happen quickly
- It's diverse: millions of people or large supply chains
- A crisis or a deliberate policy can cause the change

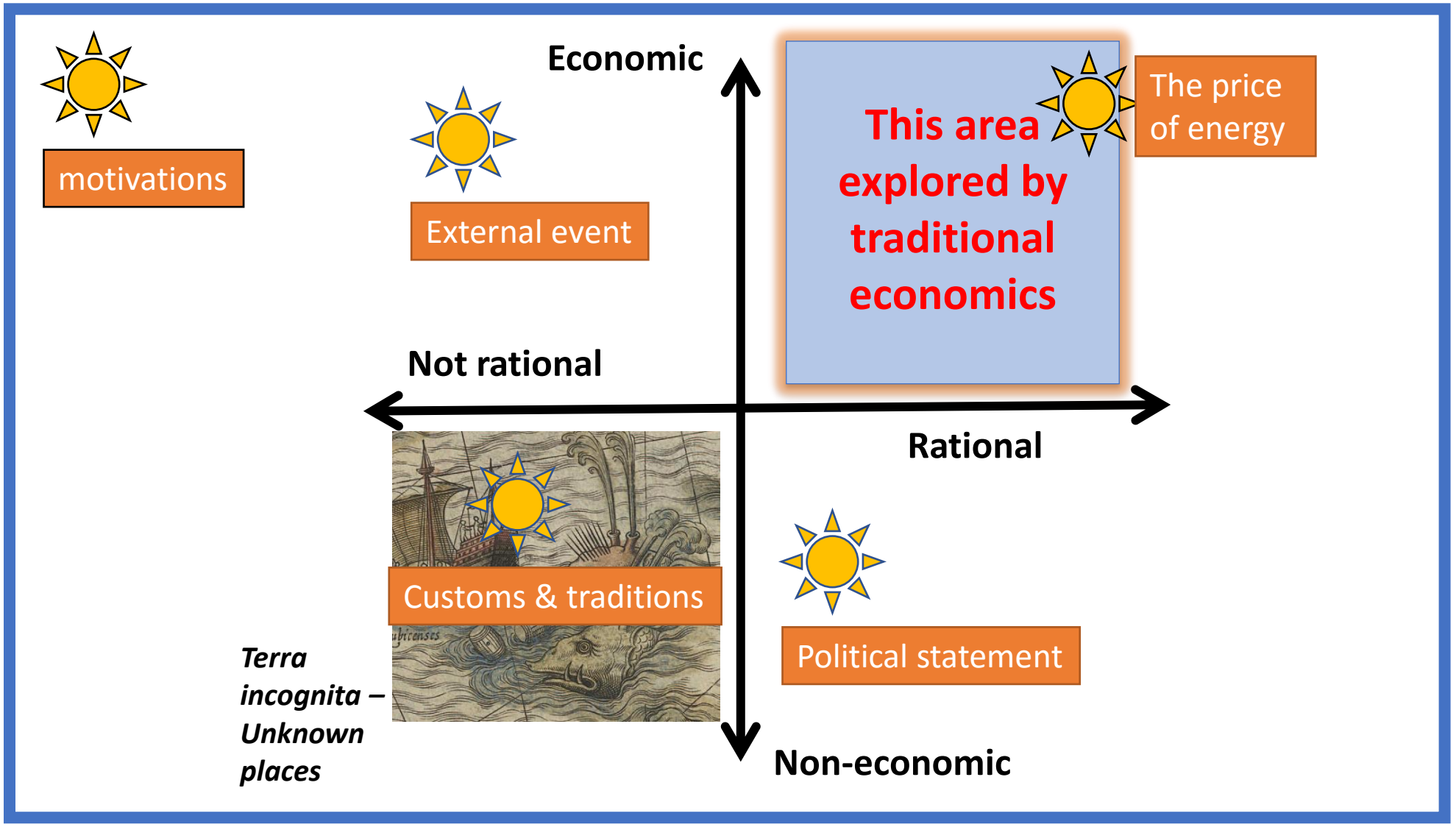
Time scales for changes in behavior:

- One hour
- One event or crisis
- Permanently

Small changes in behavior (even if temporary) encourage people to make larger or more permanent changes.

Changing corporate behavior can have a huge impact on energy use (and deserves more research)

Categories of Behavior

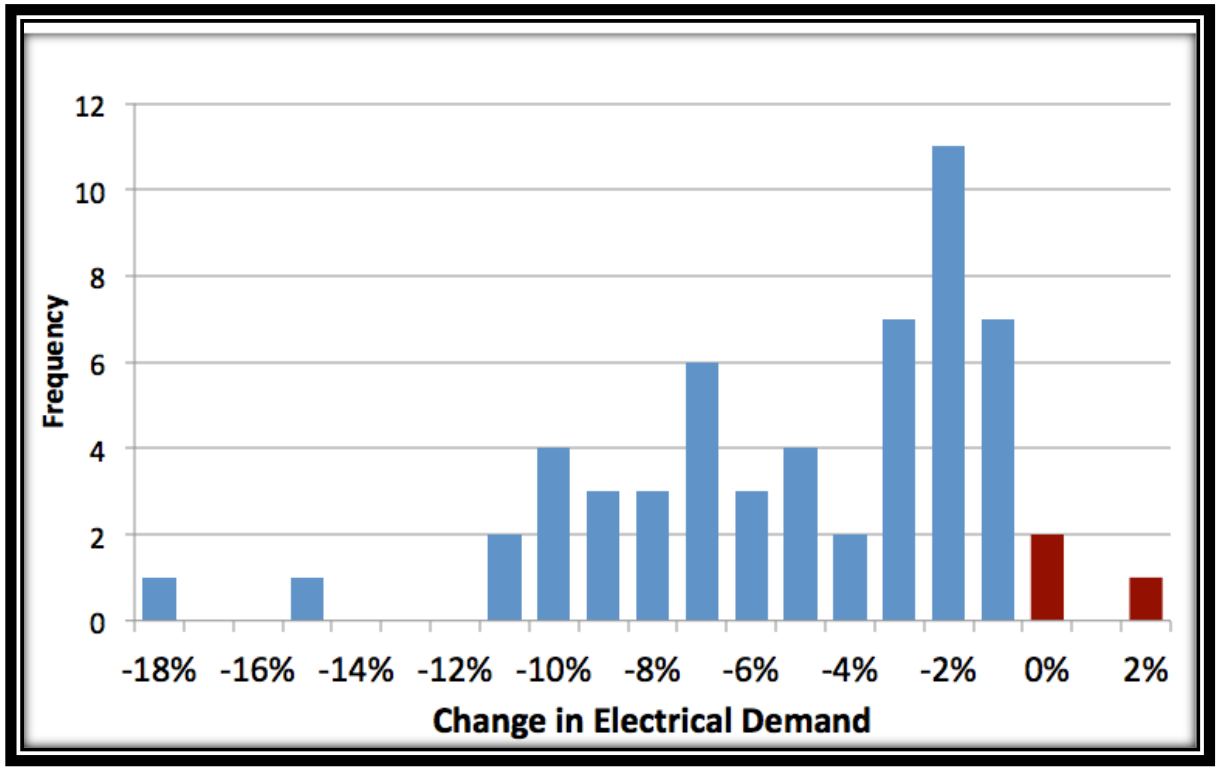


Inspired by: Akerlof, George A., and Robert J. Shiller. 2010. *Animal Spirits: How Human Psychology Drives the Economy, and Why It Matters for Global Capitalism*. Princeton University Press.

Political statement

EARTH HOUR: An Environmental Campaign Lowers Electricity Demand

- Many people tried saving energy for the first time
- Will next action be longer? More enduring?
- Behavior changes also included buying more efficient lights, etc.

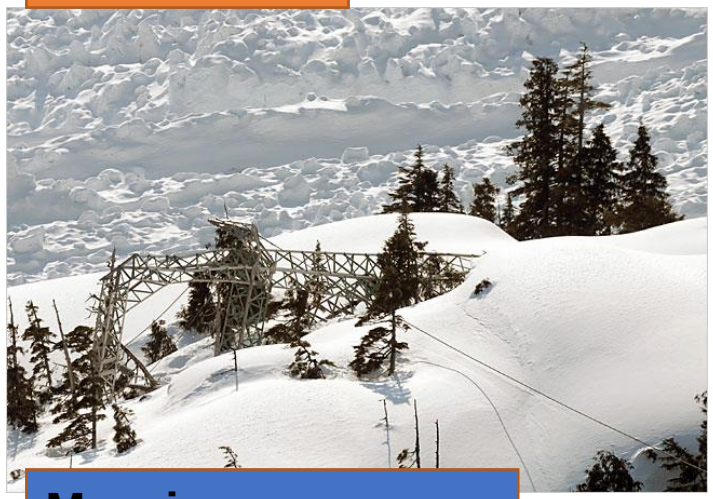


Observed Reduction in Electricity Use During Earth Hour

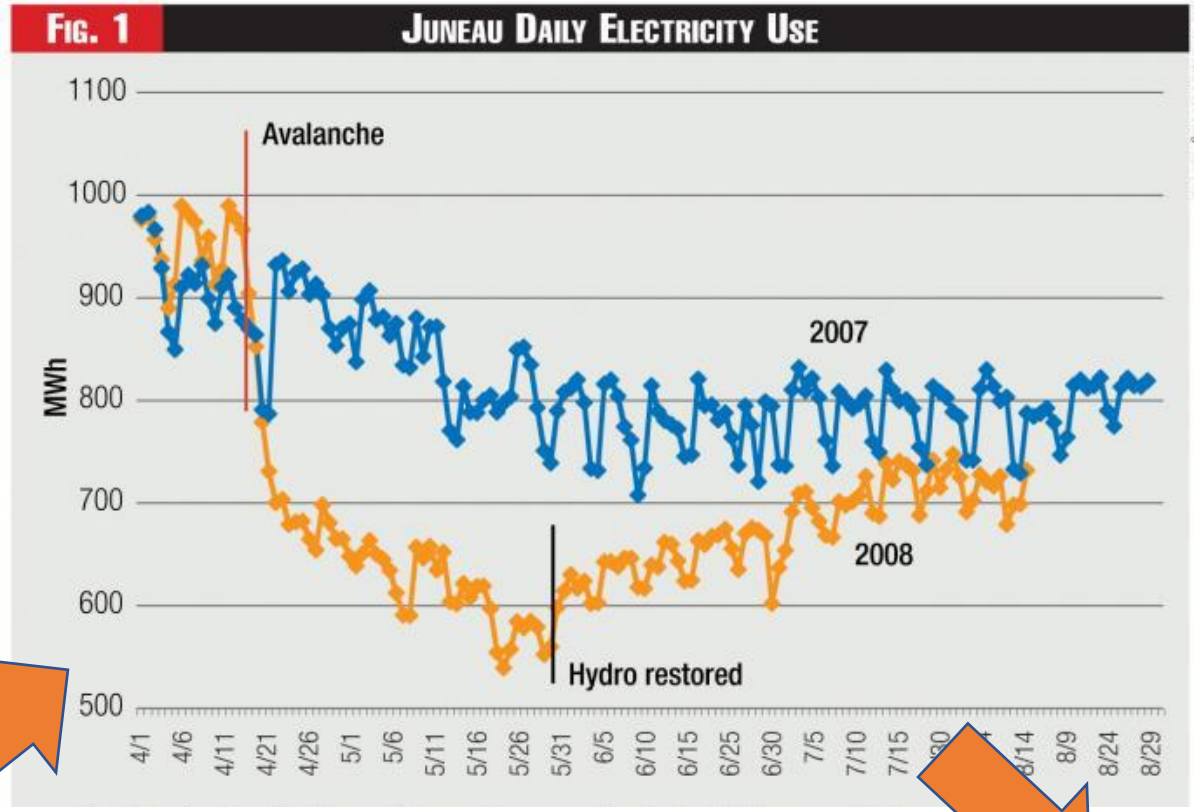
Olexsak, Sarah J., and Alan Meier. 2014. "The Electricity Impacts of Earth Hour: An International Comparative Analysis of Energy-Saving Behavior." *Energy Research & Social Science* 2 (June): 159–82.

Juneau, Alaska, Cut Electricity Use 40% in 6 Weeks

External event



Massive snow avalanche cuts all hydroelectric power to Juneau!



Sample conservation measures:

- Lower thermostats
- Reduce lighting
- Cut hot water use
- Install compact fluorescent bulbs
- Reduce standby power, unplug electronics, and use power strips
- Shorten business schedules
- Conserve cold water
- Switch off airport runway lights

JUNEAU UNPLUGGED
live more, use less

Juneau organized a conservation campaign in 5 days

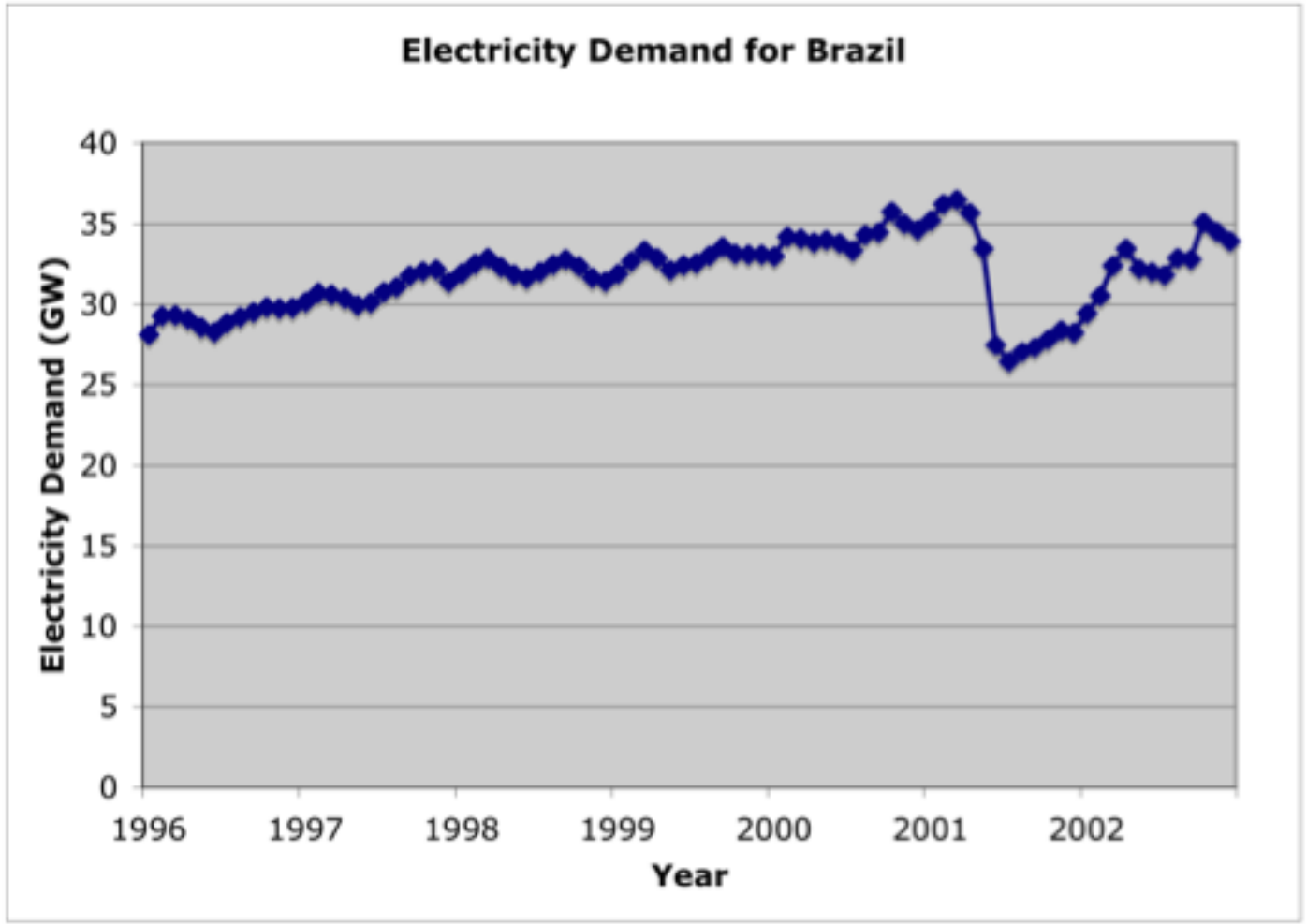
10% reduction continued after crisis ends

Brazil cut its electricity demand 20% in 3 months

External event

Drought empties Brazil's reservoirs

President declares national emergency and requires conservation



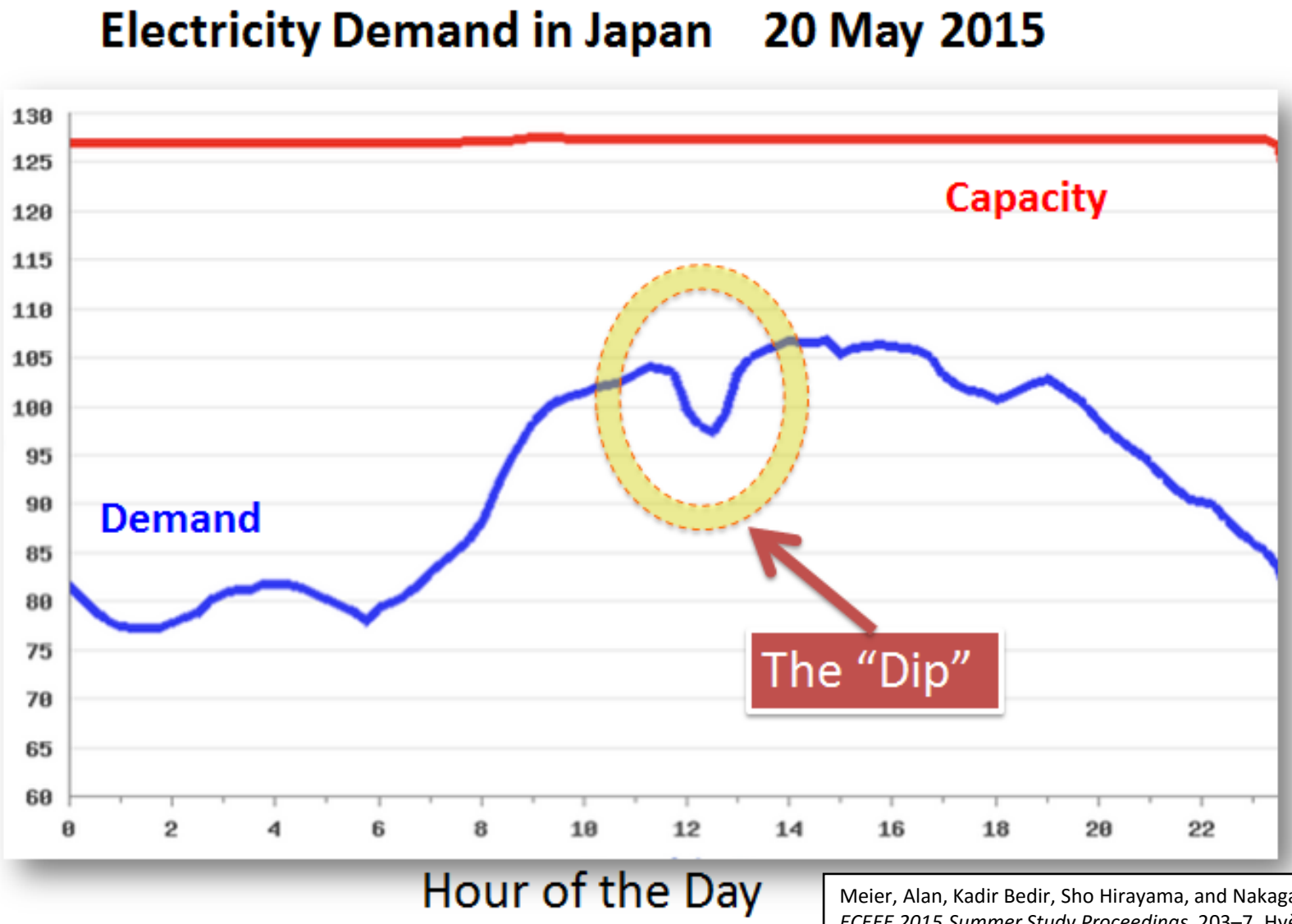
No black-outs

Economy survived

2008 demand still below 2001

The Electricity Impacts of Coordinated Behavior Can be Huge

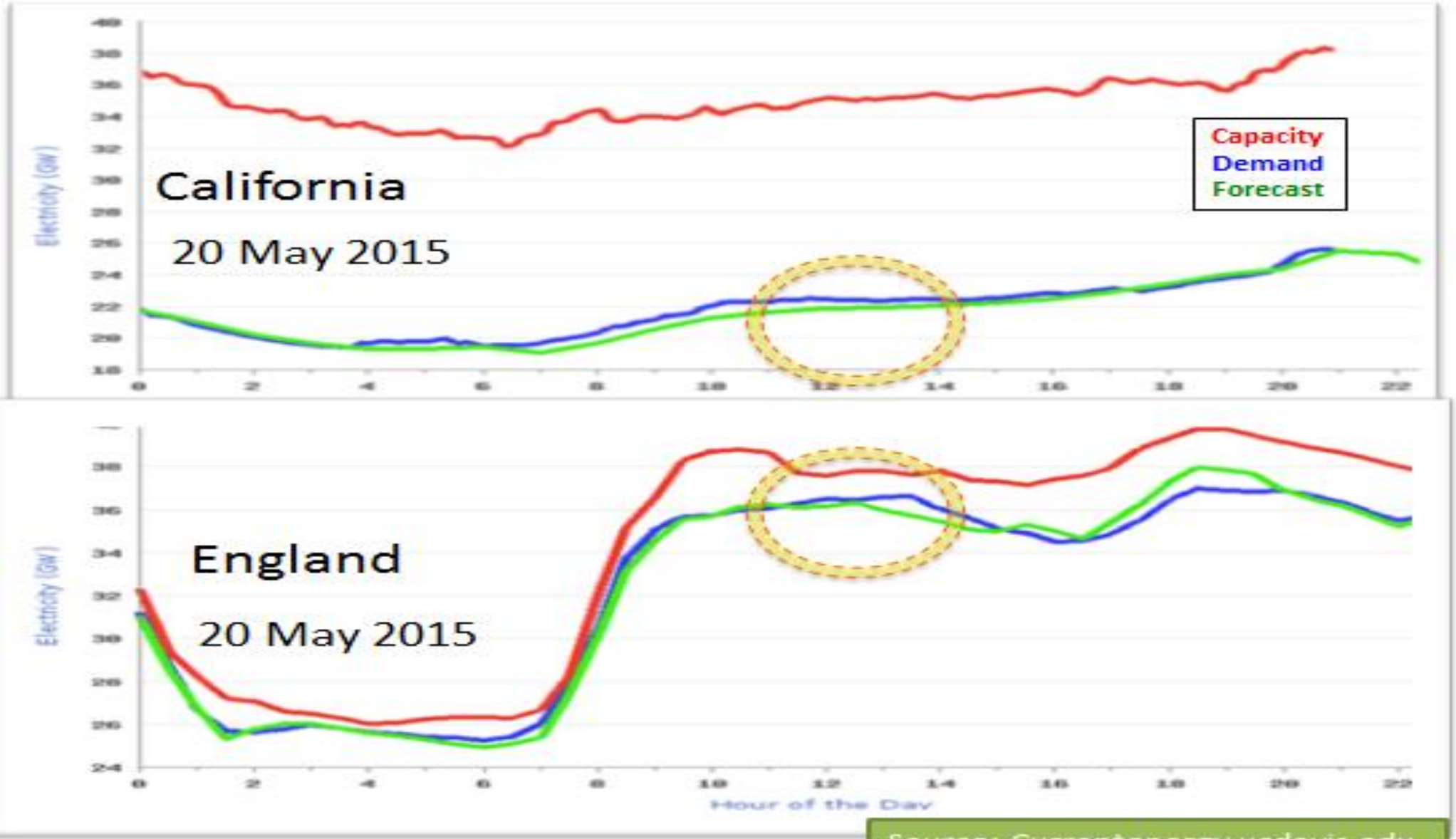
Electricity Demand and Capacity (GW)



Customs & traditions

Meier, Alan, Kadir Bedir, Sho Hirayama, and Nakagami. 2015. "Japan's 6 GW Lunch Break." In *ECEEE 2015 Summer Study Proceedings*, 203–7. Hyères, France: European Council for an Energy Efficient Economy.

No Lunch Dips in California or England



Customs & traditions

Source: Currentenergy.ucdavis.edu

Persistence of Behavior Changes: From 1 hour → 50 years

- Japanese lunch-time behavior has persisted for over 50 years
  - Can this behavior be exported?
- Will CoolBiz be another persistent behavior?
  - What are the supply chains for CoolBiz?
  - Can America import this behavior?

Customs & traditions

Humor is an important tool for promoting behavior change

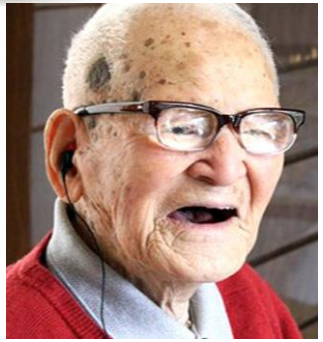
Motivations for NOT Changing Behavior

New or complicated user interfaces are an obstacle to saving energy

"It's easy to save energy"

Fear of the unknown

"I can't see which button saves energy … so I won't touch it."



Conclusions

- Carbon emissions in the US will continue to decline but look to the states, cities, and firms for innovations in energy efficiency and climate change
- The motivations for changes in behavior are diverse.
  - Most of the research has focused on the ”rational, economic” quadrant
  - We need to examine behavior of firms and their relationships with each other (supply chains)
- Don’t just study behavior, take action and then evaluate impact of interventions, new arrangements, and even humor