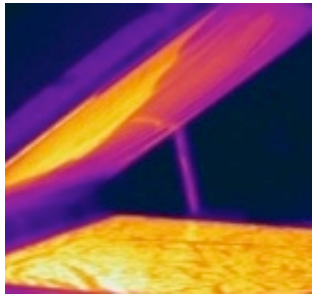
What Would You Do To Keep The Lights On In Your Community?



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Automatic control of household loads

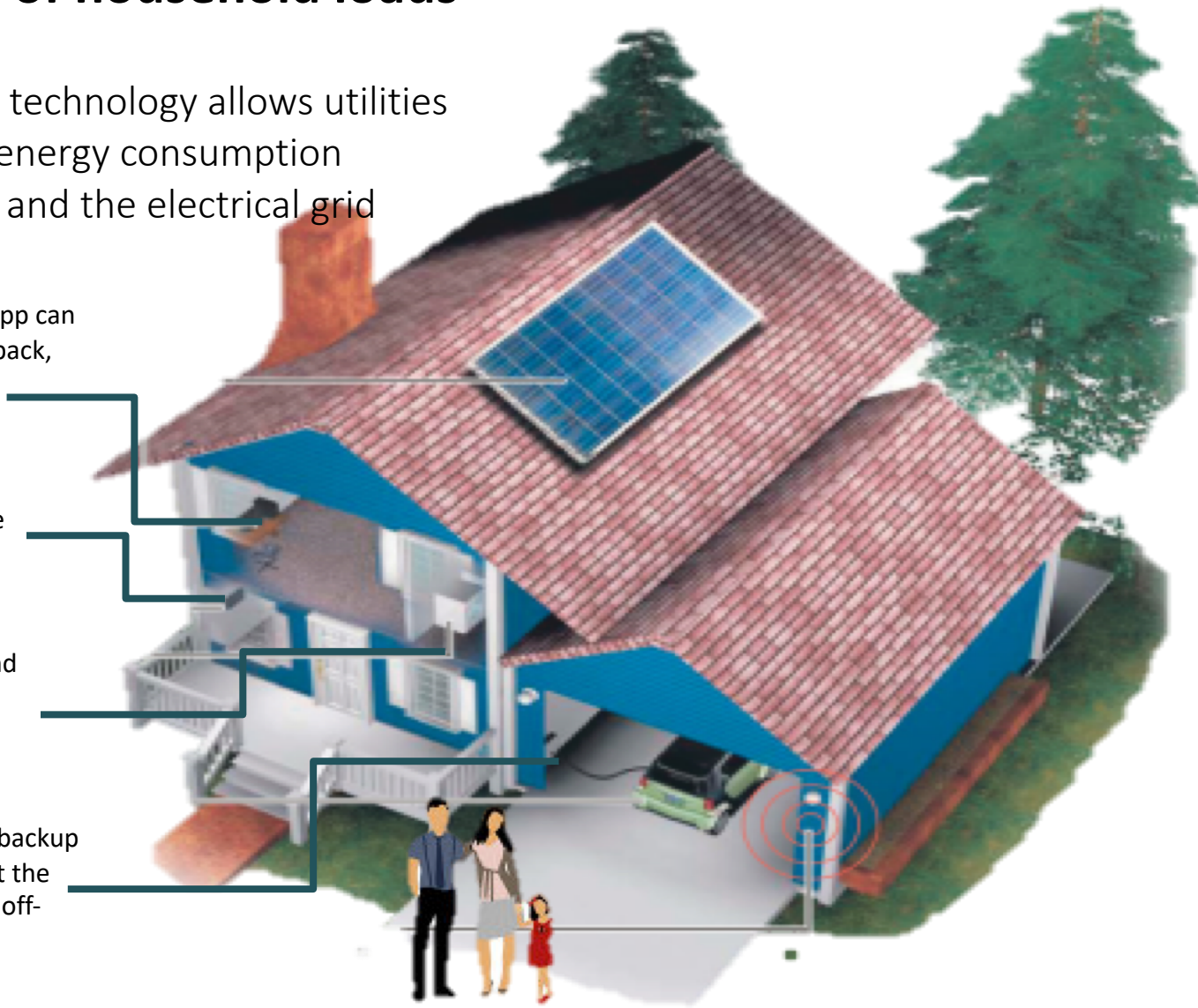
In an ideal world…
Two-way communication technology allows utilities and customers to adjust energy consumption according to preferences and the electrical grid constraints

Online / mobile feedback : Web or app can support real-time consumption feedback, and allow occupant control of home appliances.

Smart thermostats: can automatically adjust the temperature of the home based on utility signals or optimization algorithms.

IoT appliances: Laundry machines and and dryers can be adjusted automatically depending on utility / grid signals.

Electric plug-in vehicle: Can act as a backup generator for homes and supplement the grid during peak hours and charge in off-peak hours at lower cost.



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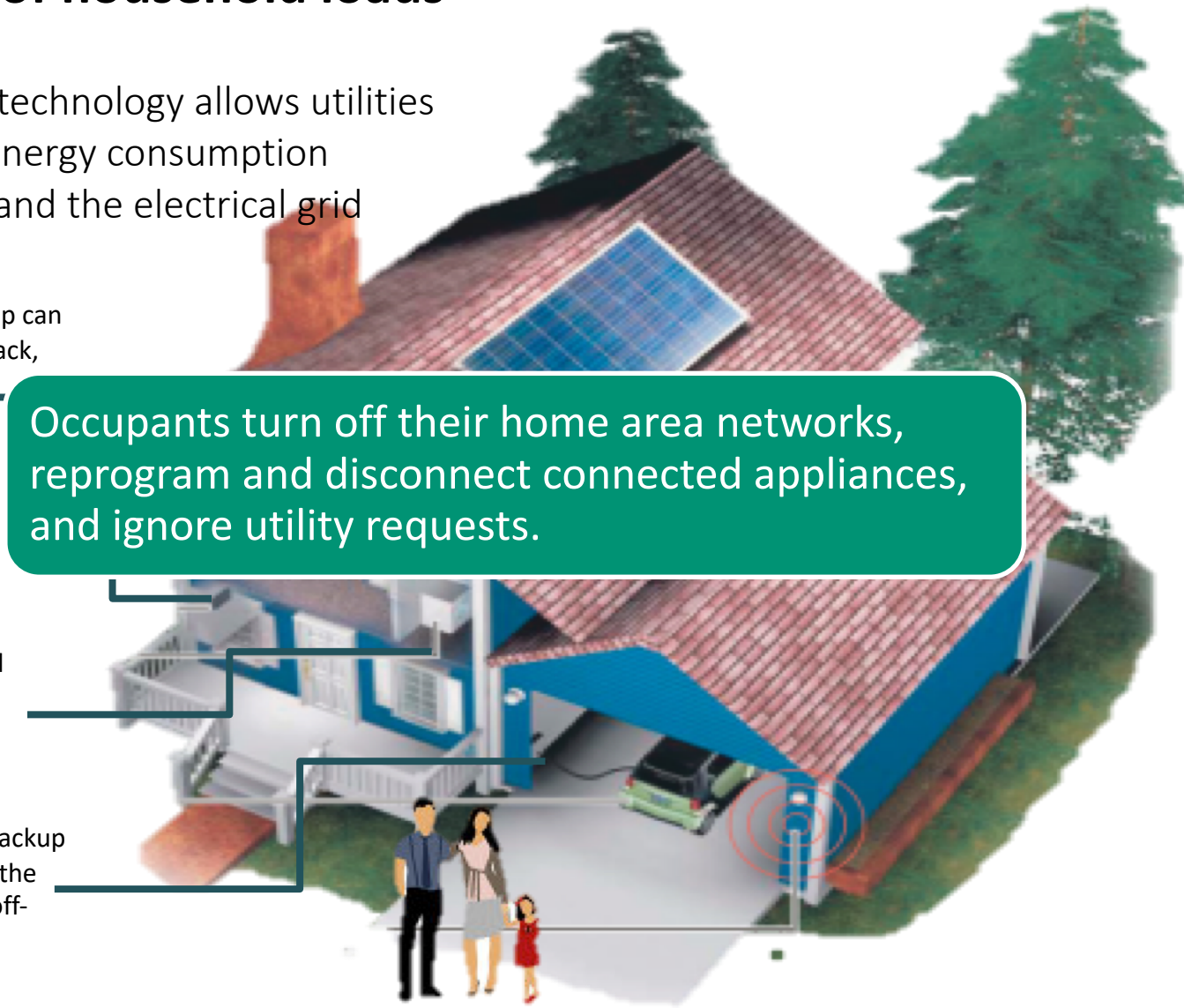

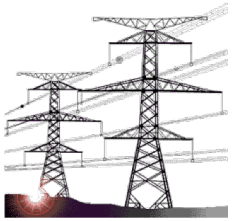

Typology of demand response

High

Barely noticeable

Load Response	Type of response	How?
Shedding or Balancing	Balancing power drawn to compensate grid short term fluctuations. e.g.: to compensate local intermittency due to renewable generation	e.g.: Shedding power from HVAC
Shifting	Moving loads away from peaks	e.g.: Pre-heating or cooling homes; Delaying activities: dishwashing, defrosting…
Shaping or Curtailment	Curtailment - shutting off appliances as a consequence of a signal from the grid	e.g.: Smart breakers; turning off household circuits

Frequency of events

Low

Impact in household activities

High impact

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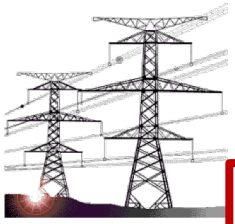
Based upon: Berst, J. (2010) , Smartgridnews.com, April 27



Typology of demand response

Barely noticeable

High

Frequency of events

Demand response could be designed to minimize the impact in the household activities, and thus to maximize the potential for actual, consistent / persistent response to reduce brownouts and increase local resiliency

Impact in household activities

Low

High impact

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Sociological perspective of everyday practices

- Electricity consumption is a consequence of household practices
- Habits have changed on a societal scale -> Not a matter of individual choice
  - Patterns of use are collective: each is the carrier and reproduces a practice
  - Collectively, people do what others do. Therefore practices are dynamic and influenced by norms and local infrastructure.

Know how

- How to use the stove top or microwave
- How to follow recipes
- How to store food

Meanings

- Cooking to feed the family. Family gathers for dinner vs. watching TV
- Food as fuel
- Ritual: gourmand

Tools

- Infrastructure: grocery shop
- Supermarkets
- Stove, oven, specific pans, microwave

Shove, 2009. Habits and their creatures. Lancas
Chappels and Shove, 2009. Debating the future of comfort: environmental sustainability, energy consumption and the indoor environment. **36** Building Research and Information

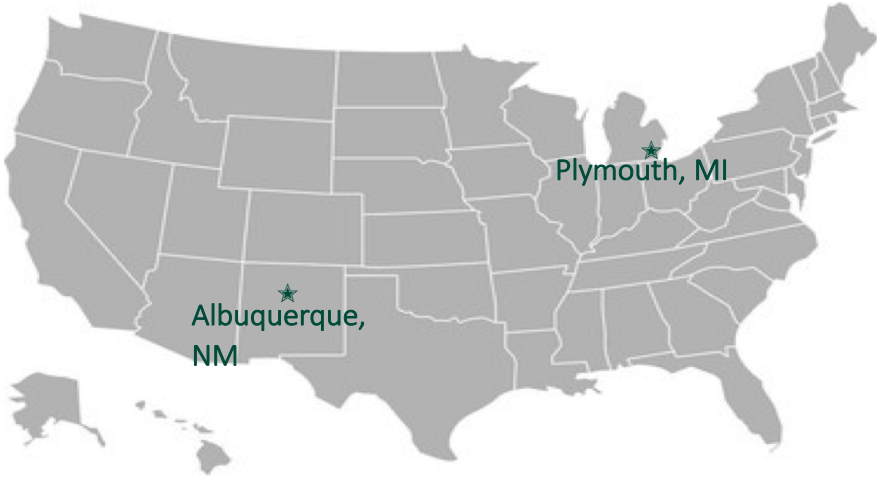
Politicians, engineers, and designers change the elements of everyday practices

- Example: development of the sewage infrastructure →Enabled new practices of hygiene

- Policy makers intervene changing the elements of the practice → Bike lanes change the meaning of commuting to work

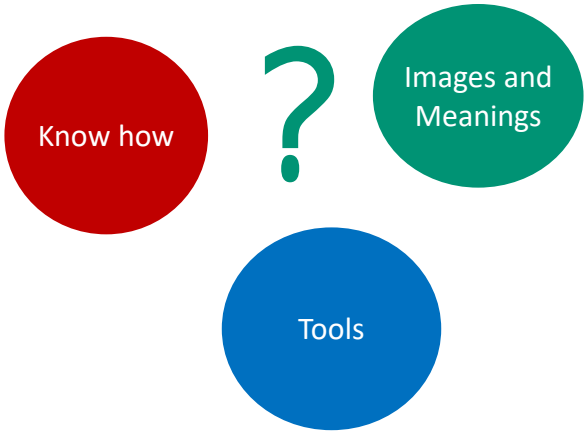
Field work to discuss everyday practices and their flexibility

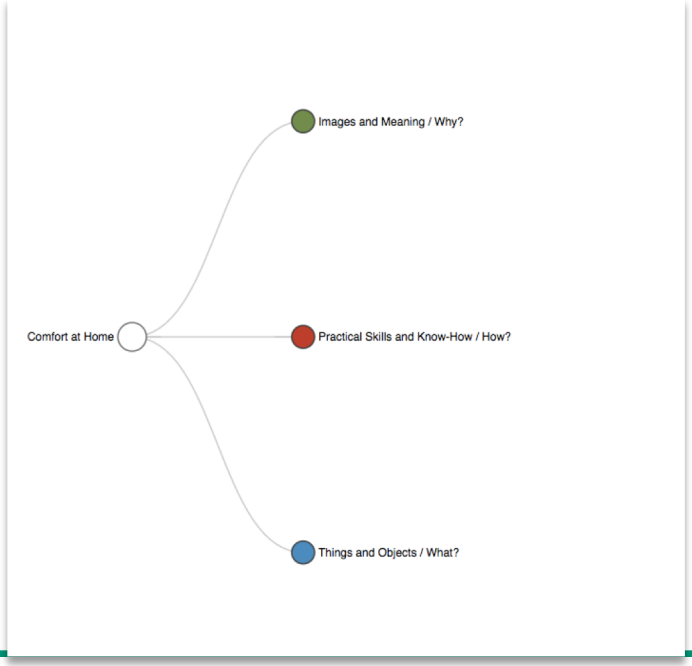
- 2 focus groups, 8 participants each, recruited from craigslist
  - FG Sections structured to build in each other.
- Probe into the willingness to adjust routines for
  - The benefit of the community or the individual
  - How does flexibility evolve according to the severity of the situation



Being comfortable at home

- Comfort is not universal: matter of culture and convention
  - People have reported being comfortable at temperatures ranging from 6ºC (42.8ºF) to 30ºC (86ºF)
- **Salience**: Participants do no consider the practice of maintaining thermal comfort in their home a daily "activity"
  - However they claim adjusting the temperature to keep comfortable

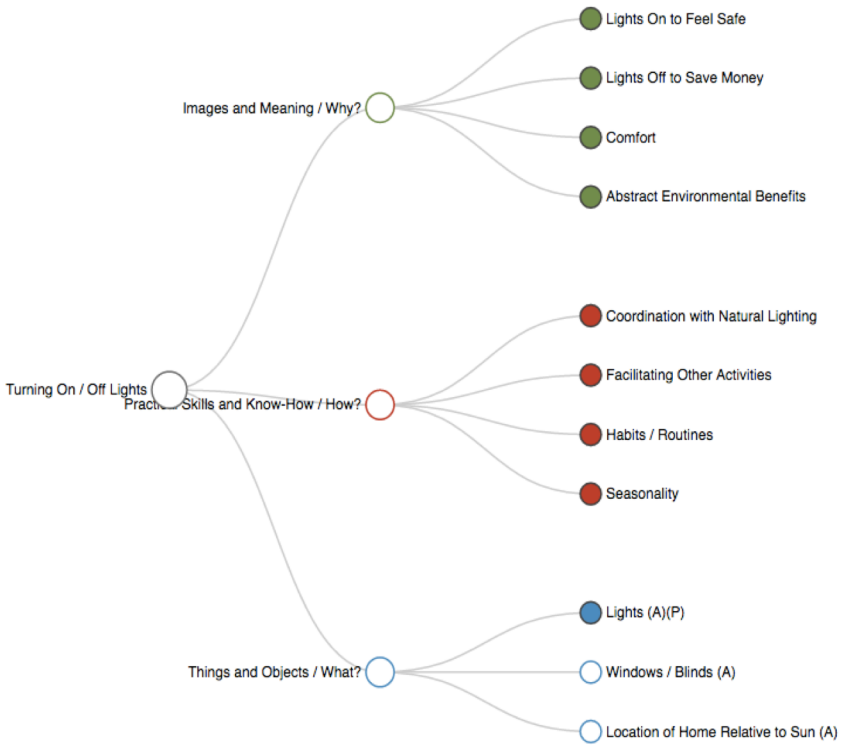




Turning the lights on

- **Salience:** Although light practices occur throughout the day, participants didn't seem to consider them an "activity" in the home but more of an enabler.

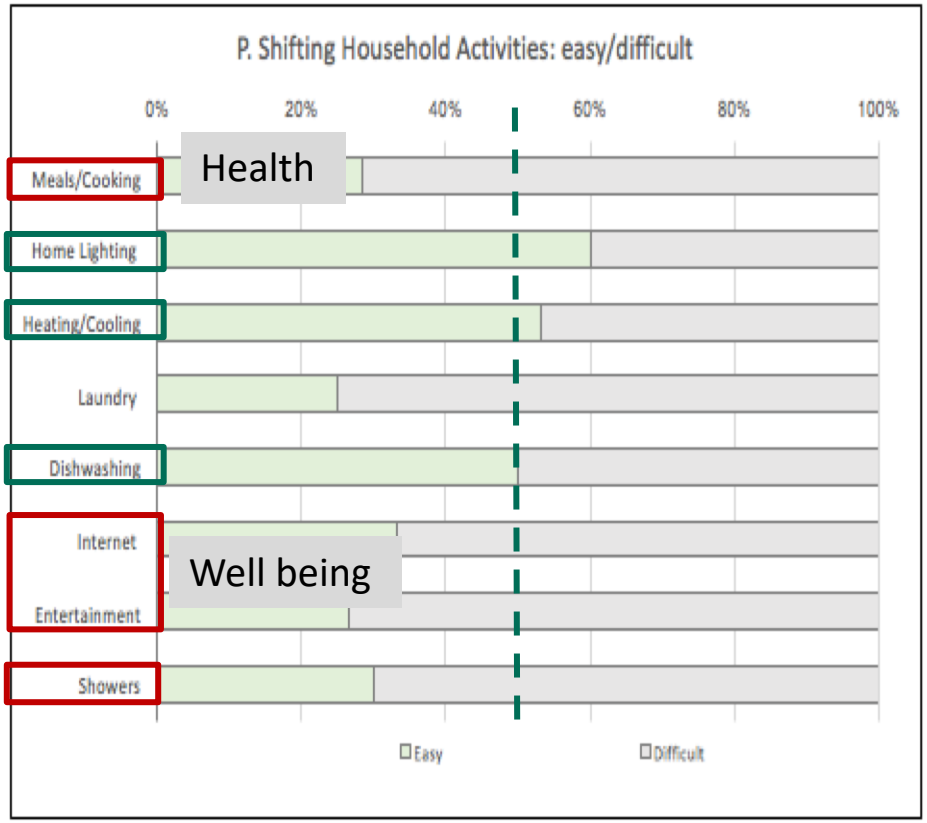
- **Images and Meanings:** Associated lighting with safety, comfort.
  - Habits are triggered by environmental cues: ex.: daylight savings time
- **Things:** Solar orientation of the home and natural light has an impact on the extent to which participants used lights in their home.
- **Ability to shift:** Unlikely to be a flexible practice

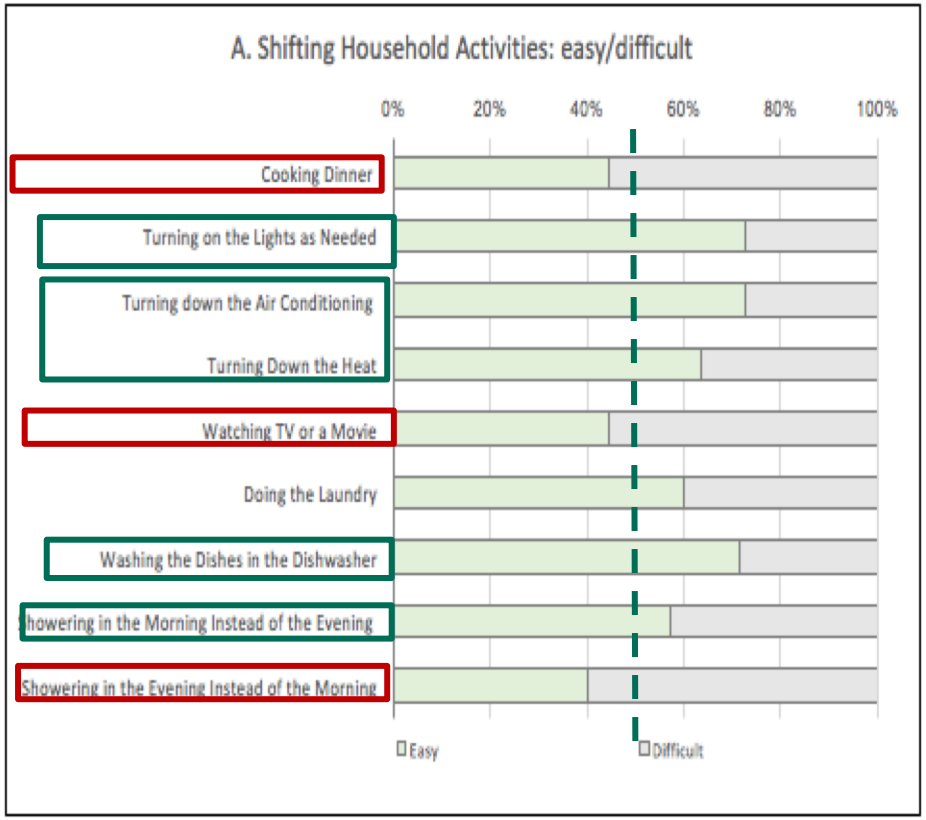


What comes to mind when thinking about adjusting routines?

Preparing meals	**Preference:** "I eat when I am hungry" "I like cooking later evening and not earlier unless completely necessary" **Diet/Health:** (hypoglycemia, diabetes) **Time/flexibility:** "plan dinner after work" ; "can't shift meals"
Dishwashing	**Need:** "only use when full" **Hygiene:** "I don't want dishes to stand too long" **Preference:** "I don't like the noise so I run at night"
Showering	**Appearance:** "Hair would look better" **Need:** "Must do as needed" … several times a day **Time/Flexibility: "**could not shift this, especially on a work day" **Routine**: "Start of day"; "I do it in the morning in preparation for dressing"
Doing the laundry	**Inconvenience:** "Might not have certain garments available to wear" **Convenience:** "My machines are noisy, so I don't like to run when we are in the family room/kitchen" **Routine**: "For people with more fixed schedules might not be possible to change"

How hard is it to shift key energy intensive routines





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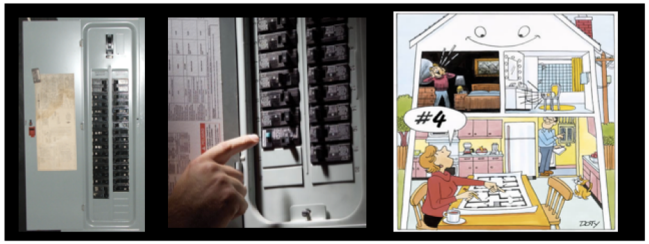
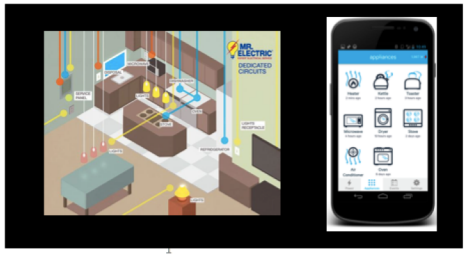
Scenario: to keep the lights on in your community

Circuit board



Automatic control



SLIDE 1

Empowerment, organization, controlling costs

SLIDE 3

Scenario: what comes to mind when you think about participating in ADR to keep the lights on in your community

On a peak day

During an Emergency

Utility notifies customers

Non essential circuits **are turned off** to prevent widespread power outages in the community

Scenario: what comes to mind when you think about participating in ADR to keep the lights on in your community

Question	Peak Day	Emergency
What would make it easy?	Functionality (App Benefits); Peace of Mind; Saving Money	Helping Others; Warning; Last resort ("if there's no other way"; "nothing would be easy"
What would make it difficult?	Functionality (Tech Issues) Privacy; Choice/Autonomy	Functionality; Routines; Lack of Warning
What are the advantages?	Functionality; Save Money; Save Energy	Help others; General benefits ("prepare for an outage" "brown out better than blackout")
Who would approve?	Only one participant openly; approved; Business would approve	Government; 5 participants said they/their families would approve – everyone would

Summary of findings

1. **Heating and cooling**, **turning off lights as needed**, and **dishwashing** would be easy home activities to shift.

   Showering in the evenings, **entertainment (TV)**, **cooking meals** would prove difficult to shift.

2. Households are more likely to shift activities that can be **automatically moved** (such as air conditioning, washing machines or laundry)

   Especially if they do not interfere with other routine-based behaviors like cooking or showering

3. Participants in these FGs seemed willing to take actions to alter their household activities beyond what they would normally do when considering the welfare of their communities.

4. Since practices at home depend on cultural dynamics, and are constantly evolving, it is possible to design and introduce elements to adjust practices for clearly defined purposes for example **"to keep the lights on in the community".**

Thank you!

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