



# THE ENERGY REDUCTION MOTIVATIONAL INTERVIEW: PILOT RESEARCH

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# Study Context

**From: REDD: A Public Data Set for Energy Disaggregation Research**

J. Zico Kolter, Matthew J. Johnson

In Proceedings of the SustKDD Workshop on Data Mining Applications in Sustainability, 2011

**Website: <http://www.cs.cmu.edu/~zkolter/>**

**BECC poster session:**

**Protocol for Developing High Resolution Energy Disaggregation:  
Reference Energy Disaggregation Data Set (REDD)**

**Larsen Plano, J. Zico Kolter**

Tues., 6pm

The Tahoe Room

## Relevant REDD Context

- **Collect whole-home and appliance-level electricity use readings at a high sampling rate, for 50 homes.**
- **Inform homeowners about what was learned about their household energy consumption (energy debrief).**
- **Pilot test the *power of appliance specific* information to engage home owners in energy reduction.**
- **Use the opportunity to investigate the power of appliance specific information with the *most credible communication technique: interpersonal communication.***

# Rationale for the Energy Reduction Motivational Interview (ERMI)

- Increasing prevalence of home energy audits, feedback is variable.

- Feedback from current audits is often:

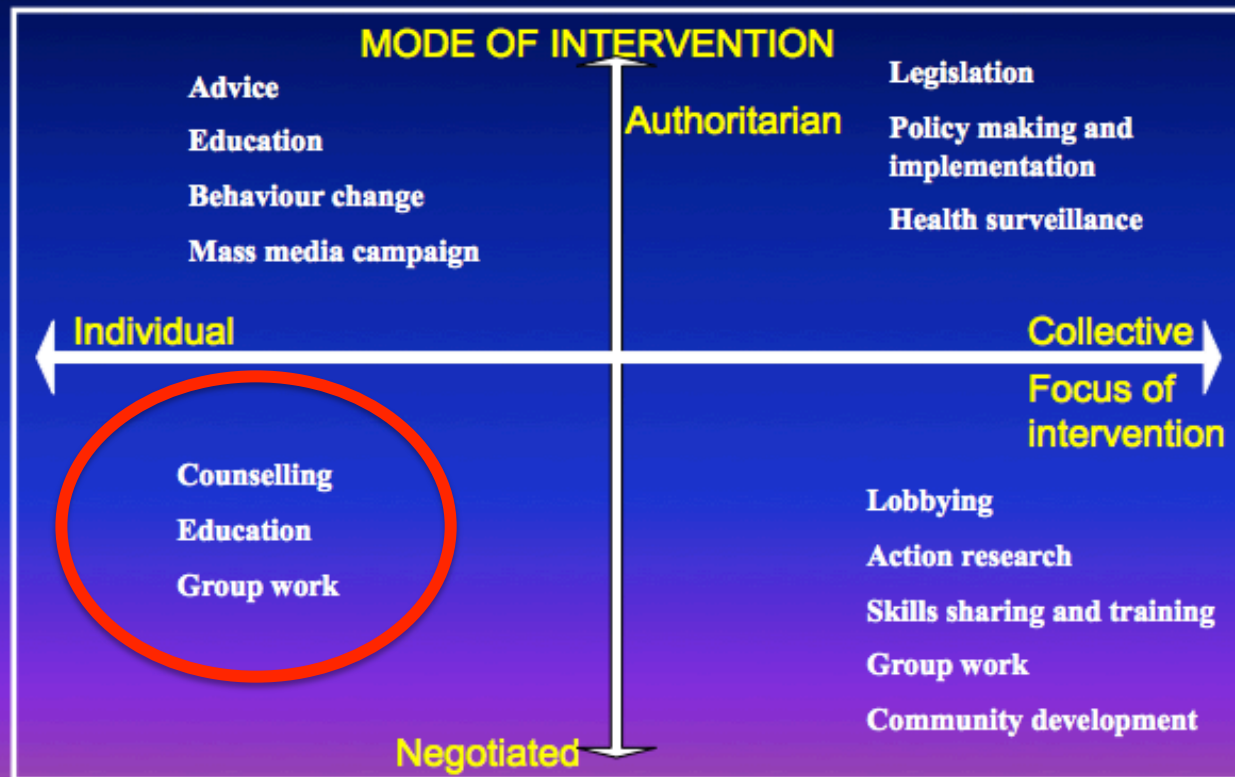
- Expert driven
- Directive
- Tailored to house but not to people
- Focused on more costly energy savings



- Homeowner is often not engaged in *process* of energy reduction.
- We have a *special context* requiring more personal engagement: access to appliance-specific and plug-level data.

# Theory: Where does Motivational Interviewing Fit in Behavior Change Strategies ?

## MODEL OF HEALTH PROMOTION 2: HEALTH PROMOTION METHODS USING BEATTIE'S TYPOLOGY (BEATTIE – 1991)



<http://www.motivationalinterview.org>

# Motivational Interviewing

- **“... a collaborative, person-centered form of guiding to elicit and strengthen motivation for change.” Miller & Rollnick (2009)**
  - **ESSENTIAL CONCEPTS:**
    - Person-centered versus product centered, house centered
    - Members of the conversation while playing different roles are equal
    - Conversation is bidirectional
    - Listening and reflective listening are key
  - **KEY PRINCIPLES:**
    - Express empathy
    - Develop discrepancy between current and ideal actions.
    - Roll with resistance.
    - Support self-efficacy to change.
  - **INTERVIEWING/CONVERSATION TECHNIQUES**
    - Open-ended questions
    - Affirmations
    - Reflective listening
    - Summary statements

## ERMI Pilot Evaluation

- **Participants**
  - Homeowners in high resolution data collection project
  - IRB
  - Project up to 40 ERMI participants (13 to date)
- **Data**
  - Data collected in data doc during interview
  - Ask for access to PG&E data (13)
  - Install TED device for free (6)
  - Ask to sign up for an energy disaggregation feedback program and allow us access to data

## ERMI 5 Step Process

*Arrange Appointment:* 60 minutes, entire family welcome, walk through

**Step 1:** *Walk through:* Energy counselors and participants look at home to identify additional energy saving opportunities & clarify data

**Step 2:** *Review home energy data & five highest energy consumers using ERMI principles*

**Step 3:** ERMI, *Change talk*

**Step 4:** Summary chart and data report folder for participants

**Step 5:** Follow-up



## Set up ERMI Appointment

By time of interview all equipment has been removed

- Brief on content of feedback session
- Invite all members of household
- Inform about walk through
- Allow one hour
- Set date and time

## Step 1: ERMI, Walk Through

### Goals:

- **Clarify evaluated data**
  - **Identify new energy saving opportunities**
- 
- Walk through home with 2 Energy Counselors.
  - Look at home shell, outlets, windows, and appliances, noting:
    - Lighting, room by room
    - HVAC
    - Water heaters
    - Large appliances
    - Entertainment & computer areas
    - Unusual consumers & opportunities



## Step 2: REDD Data review

### Data Review:

- Circuit level data
- Plug-level data

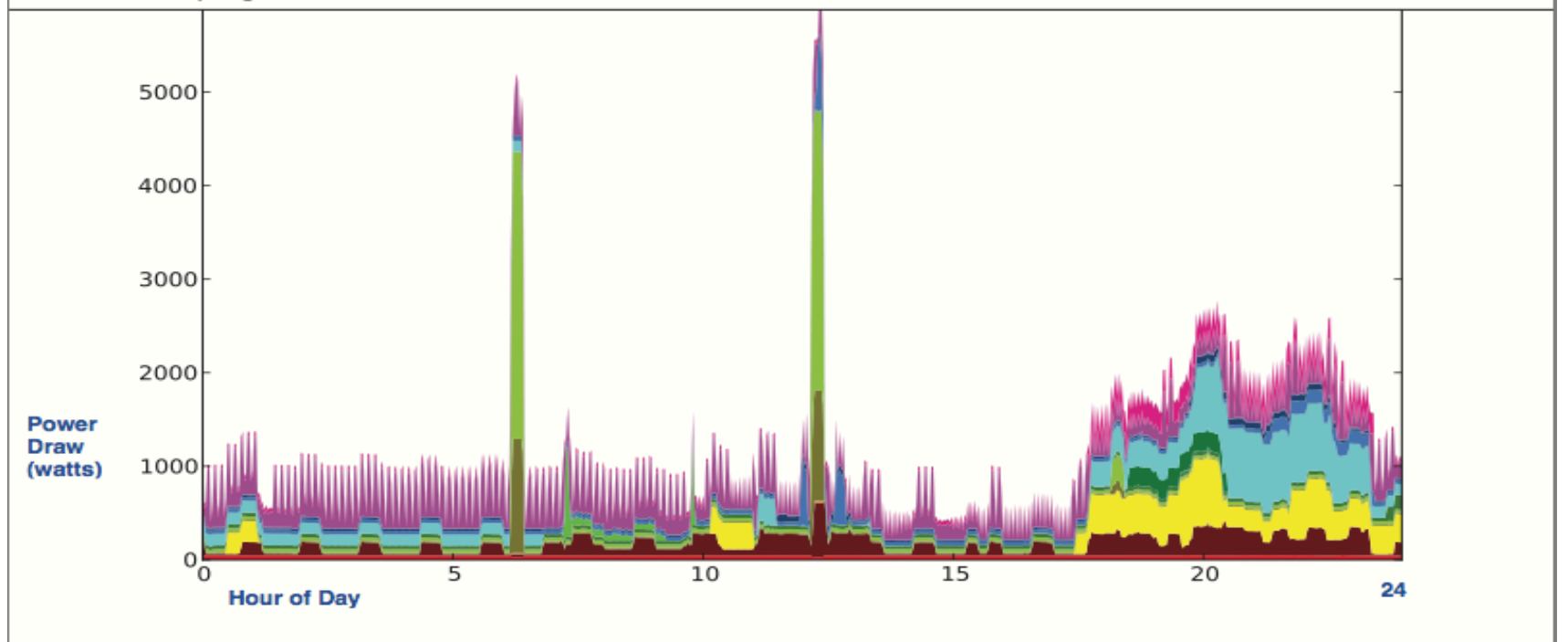


### Noting:

- Day of data collection (weekday, weekend, high)
- Axes and stacking of graph
- Components of pie chart
- Highest consumers

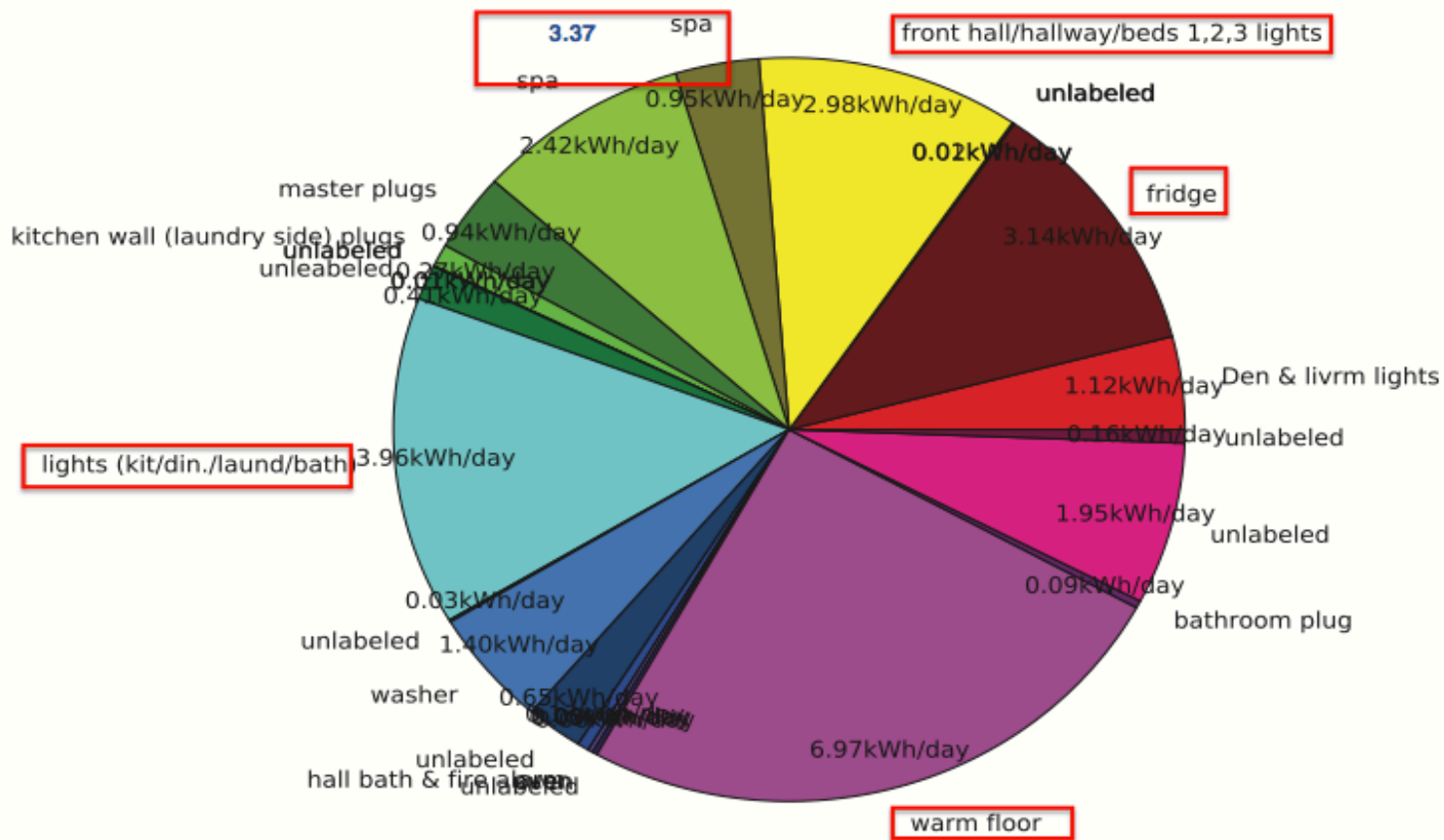
# Step 2: Data review (circuit level graph)

Typical weekend day, Sunday, 09/02/12



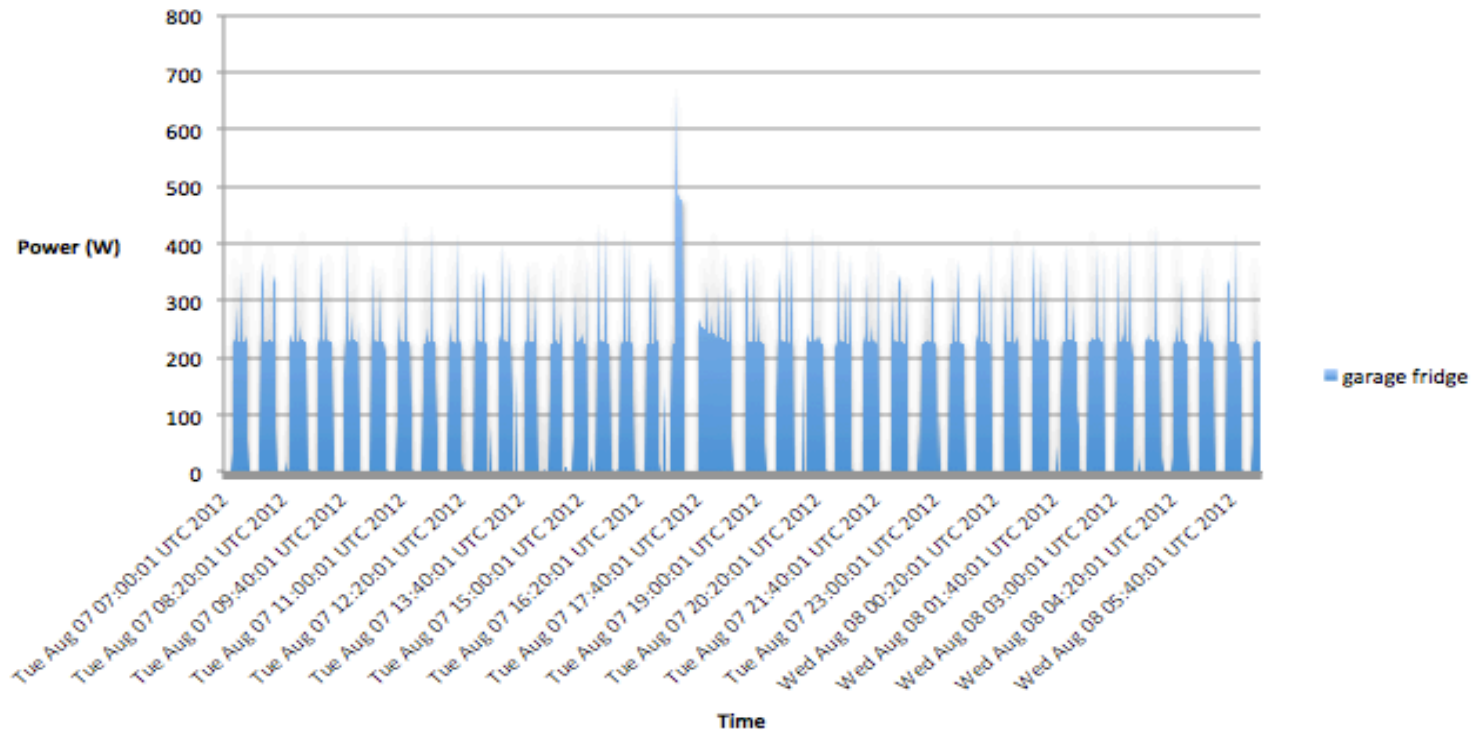
# Step 2: Data review (circuit level pie chart)

Daily Average (27.72kWh/day)  
 Typical weekend day, Sunday 9/02/12



## Step 2: Data review (plug-level data)

**Garage fridge, 3.46 kWh/day**  
**Tuesday, August 7**



# Step 2: Data review, ERMI

- ERMI often begins during data review.
- Counselors use ERMI key principles and techniques if so.
- Interviewer 1: Counselor      Interviewer 2: data doc

House Id: 34/35	Ted installed: no	Start time: 4pm walk-through 4:10pm ERMI
Square footage: 3200	PG&E:	End time: 5:10pm
Researchers Interviewer 1: Sarah Interviewer 2: Lauren Observer(s): June		Participant(s) (eg mother, father, etc):
<b>TOP ENERGY CONSUMERS:</b> fridge spa warm floor lights - front hall / hallway / beds 1, 2, & 3 lights - kitchen / dining / laundry / bath		
<b>New opportunities recognized in walk through:</b> - pull - jackets before heat - doghouse - full loads on dishwasher & laundry		<b>MI techniques used:</b>

## Step 3: ERMI

**Begin ERMI with open-ended question:**

**“Does anything surprise you in the data  
we’ve reviewed?”**



Further probes:

“Are there any opportunities you can see for saving energy?”

“What types of changes might be possible for you and your family?”



## Step 2: Data review, ERMI

# DOES APPLIANCE-SPECIFIC FEEDBACK HAVE AN IMPACT?

“I had no idea my \_\_\_\_\_ was using THAT much!”

“There's NO reason for the \_\_\_\_\_ to be on then!”



## Savings Potential

Armel, K. C., Gupta, A., Shrimali, G., Albert, A. (revisions requested from Energy Policy). Is Disaggregation The Holy Grail of Energy Efficiency? The Case of Electricity.

## Step 3: ERMI, Preparation for change talk

**Encourage participant to initiate preparative change talk** for the identified opportunities for energy reduction using open ended questions.

**DARN:** Desire, Ability, Reason, & Need

- Desire “I want to..”
- Ability “I can..”
- Reason “It’s important to..”
- Need “I should..”

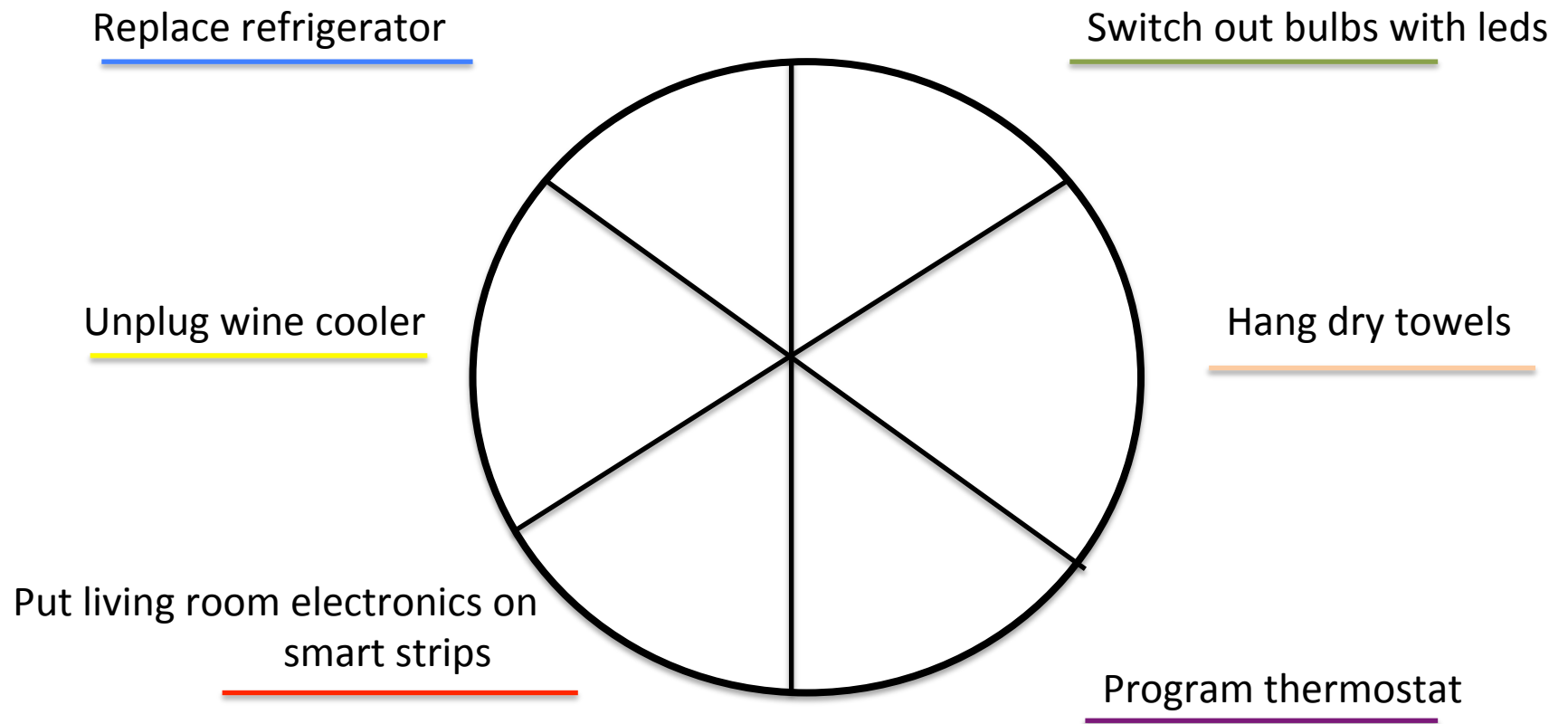


# Step 3: ERMI Change talk

Opportunity	Challenge	Solution	D A R N	C A T
<p><b>1.</b> Warm floor "And below mission" "it's so good" Water floor</p>	<p>cold water floor</p>		<p>D A R N</p>	<p>C A T</p>
<p><b>2.</b> and make "lots of visitors"</p>		<p>Could "unplug" "and have lots of visitors"</p>	<p>D A R N Definitely not do that.</p>	<p>C A T</p>
<p><b>3.</b> Lighting In, ed CFLs cost less than (Germans) it's could be not under</p>		<p>more info</p>	<p>D A R N</p>	<p>C A T</p>

# Step 4: ERMI Summary

## Energy saving opportunities



## House 28 Follow Up

1. **Floor heater:** it is typically around 0.1 kWh/day, which seems to be a standby energy consumption. On days when it appears to be used, it varies from 0.3 to 0.5 kWh/day.
  2. **Lighting** - there may not be good replacement bulbs for the track lighting, depending on the type of lamp. For the other fixtures that use a standard screw base and are not dimming, there are lots of good options:
    - a. For a good incandescent replacement look for a light temperature between 2k and 4k and color rendering index (CRI) of 80 or above. This [site](#) describes light temperature and CRI.
    - b. [At this website](#), you can shop and filter by color temperature, output, color rendering index (CRI), and other parameters. [This bulb](#) seems to fit the bill in terms of temperature and CRI while having a lower mercury content than most CFLs. Incandescent replacement [LEDs](#) are available for \$15 to \$30 dollars.
  3. **Kitchen plug-strip-** The plug-strip chart is correct. It is your toaster that shows up in green on the plug-strip data charts for the power strip plugged into your kitchen appliances. We unplugged your microwave because the load was tripping the plug-strip.
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## Insights to date

1. During ERMI open ended process, homeowners generate challenges/barriers/obstacles AND solutions.
2. Homeowners identify personal habits that deepen their understanding of energy consumption, e.g. refrigerator open during salad making.
3. Affirmations useful to reinforce owner generated solutions.  
“Your understanding of how to help your family save energy by reducing dryer loads with hang drying, and your enthusiasm about doing so is wonderful.”
4. Interesting solution types: conduct experiments, discuss with spouse, prioritizing, investigating, seeking more information.

# Data Collection

## Quantitative Analysis– Lessons

~~DARN~~

**RNDA**

Reason	1
Need	2
Desire	3
Ability	4

**CAT**

Commitment	1
Activation	2
Taking steps	3

	Energy Saving Opportunity	R N D A	C A T
1	Put second fridge on timer	2	2
2	Unplug Instahot	2	3
3	Close refrigerator during salad making	4	1
4	Switch to more efficient lighting in kitchen	4	1
5	Put hot water pump on timer	4	3

# ERMI, What's Next?

- In the middle of an iterative process to define the ERMI process.
- Completed #13 of ~40.
- We've edited the protocol about every second ERMI, and are still refining.
- Continuing qualitative and quantitative data analysis.
- Looking for other opportunities & venues for the ERMI.





**THANK YOU!**

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