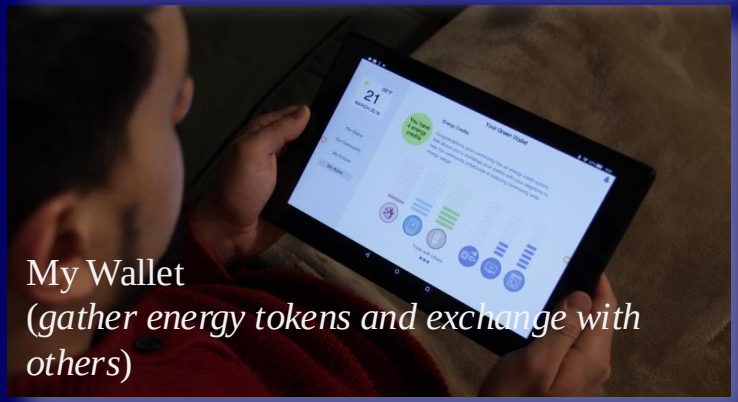
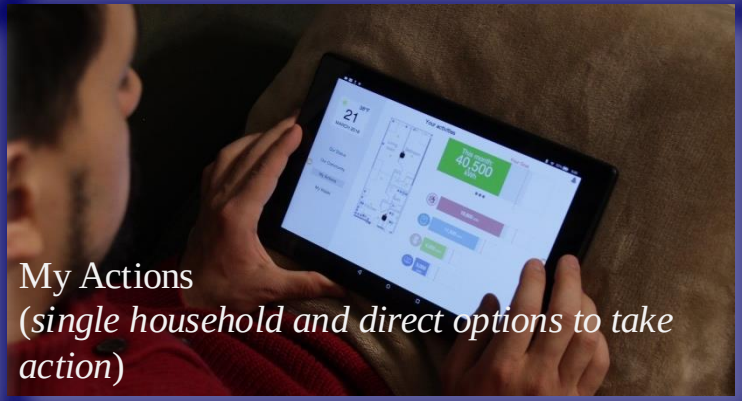
Energy-Saving Decisions: Turning Goals into Appliance-Specific Allocations

Our Status
(*community aggregate*)

Our Community
(*household break down and history*)



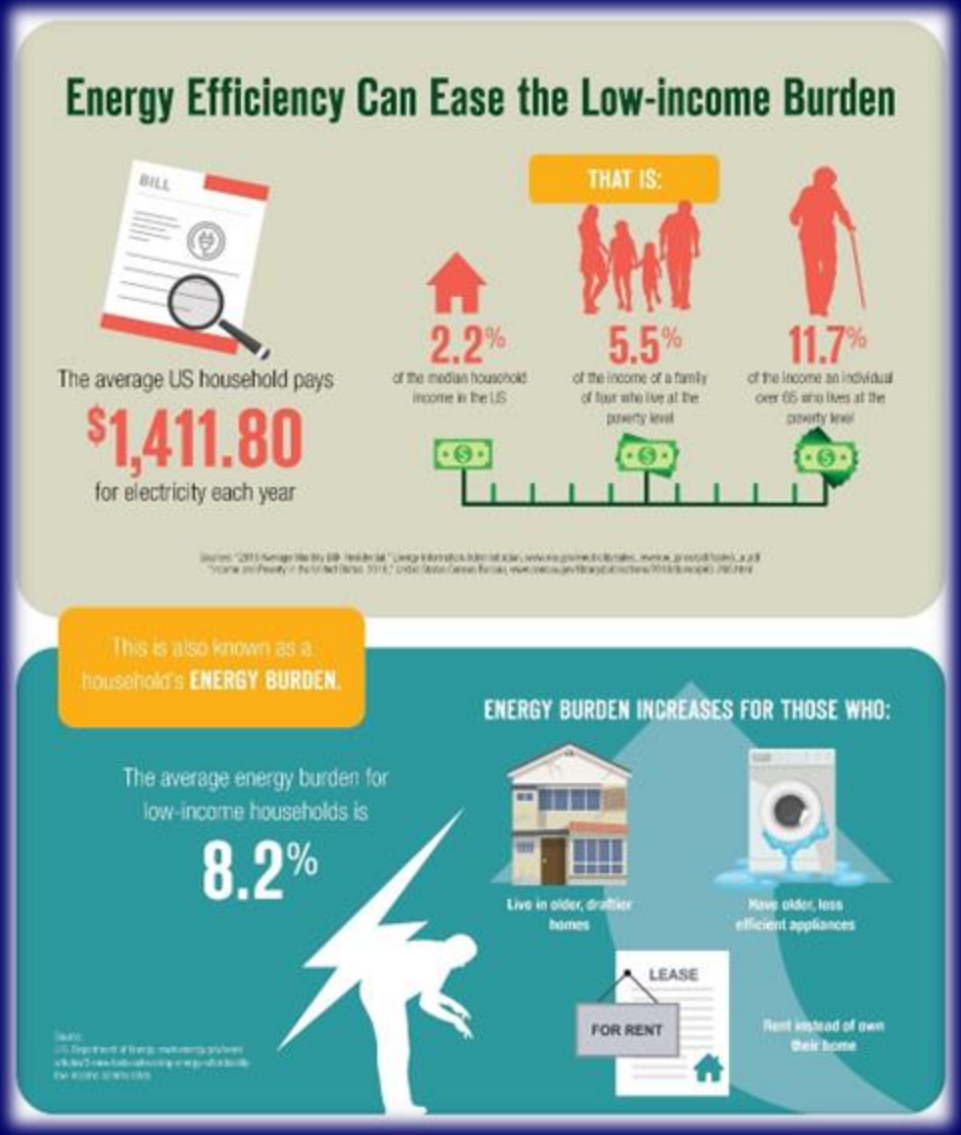
My Wallet
(*gather energy tokens and exchange with others*)



My Actions
(*single household and direct options to take action*)

Torsten Reimer, Hayden Barber, & Juan Pablo Loaiza-Ramírez
Communication and Cognition Lab - Brian Lamb School of Communication
Purdue University

Energy-Saving Decisions: Turning Goals into Appliance-Specific Allocations



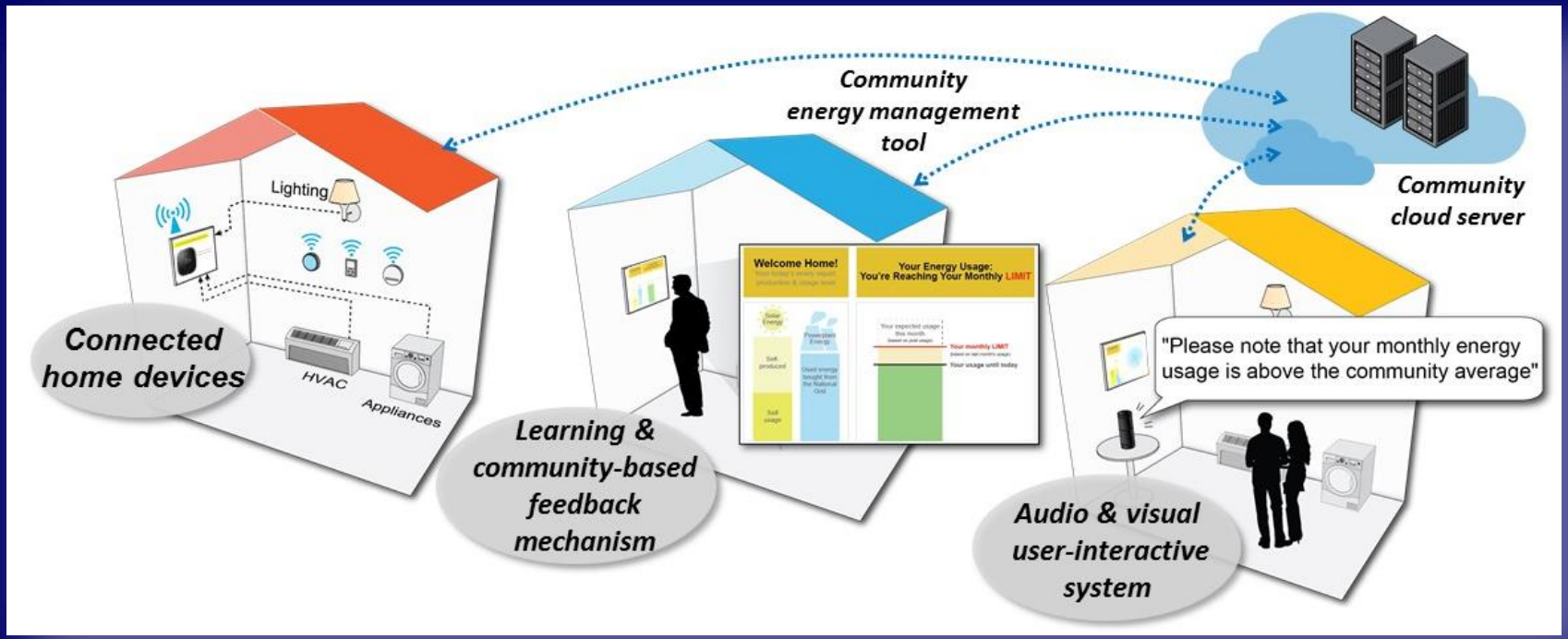
- Despite decades of weatherization and bill relief programs, low-income households still spend a larger portion of their income on energy compared to any other income group (8.2%)
- Every year, about 24 million low-income households in the US fail to pay their energy bills
- About 10 million suffering from utility service disconnection every year

Reimer, Barber, & Loaiza-Ramírez (2023)

NSF Project Aims

SCC-IRG Track 1: Sociotechnical Systems to Enable Smart and Connected Energy-Aware Residential Communities

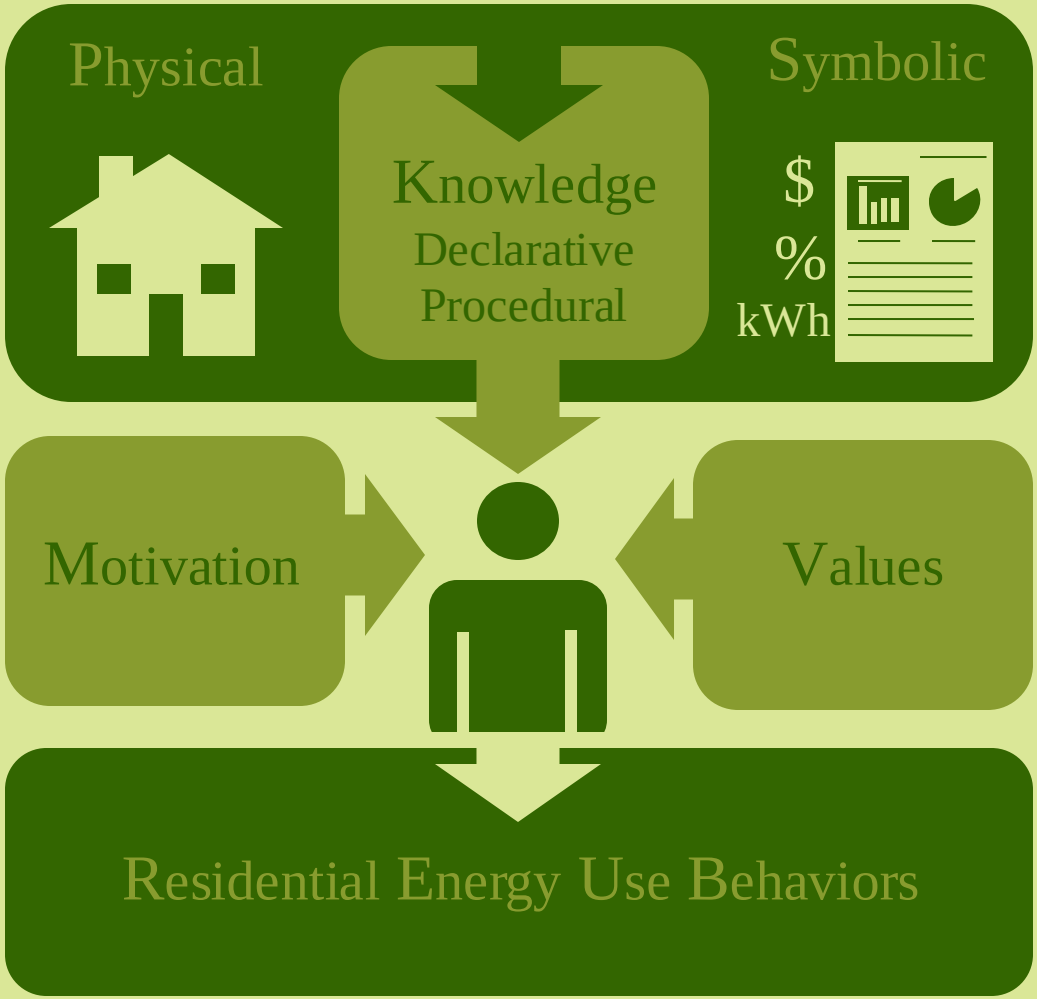
- Foster energy-aware communities that can be scaled across the U.S. based on data analytics and predictive modeling
- Develop user-interactive devices and feedback mechanisms that optimize and incentivize energy management (35% reduction in energy use and costs; see Kim et al., 2022)



Energy-Saving Decisions: Turning Goals into Appliance-Specific Allocations

Physical Domain and Symbolic Representation

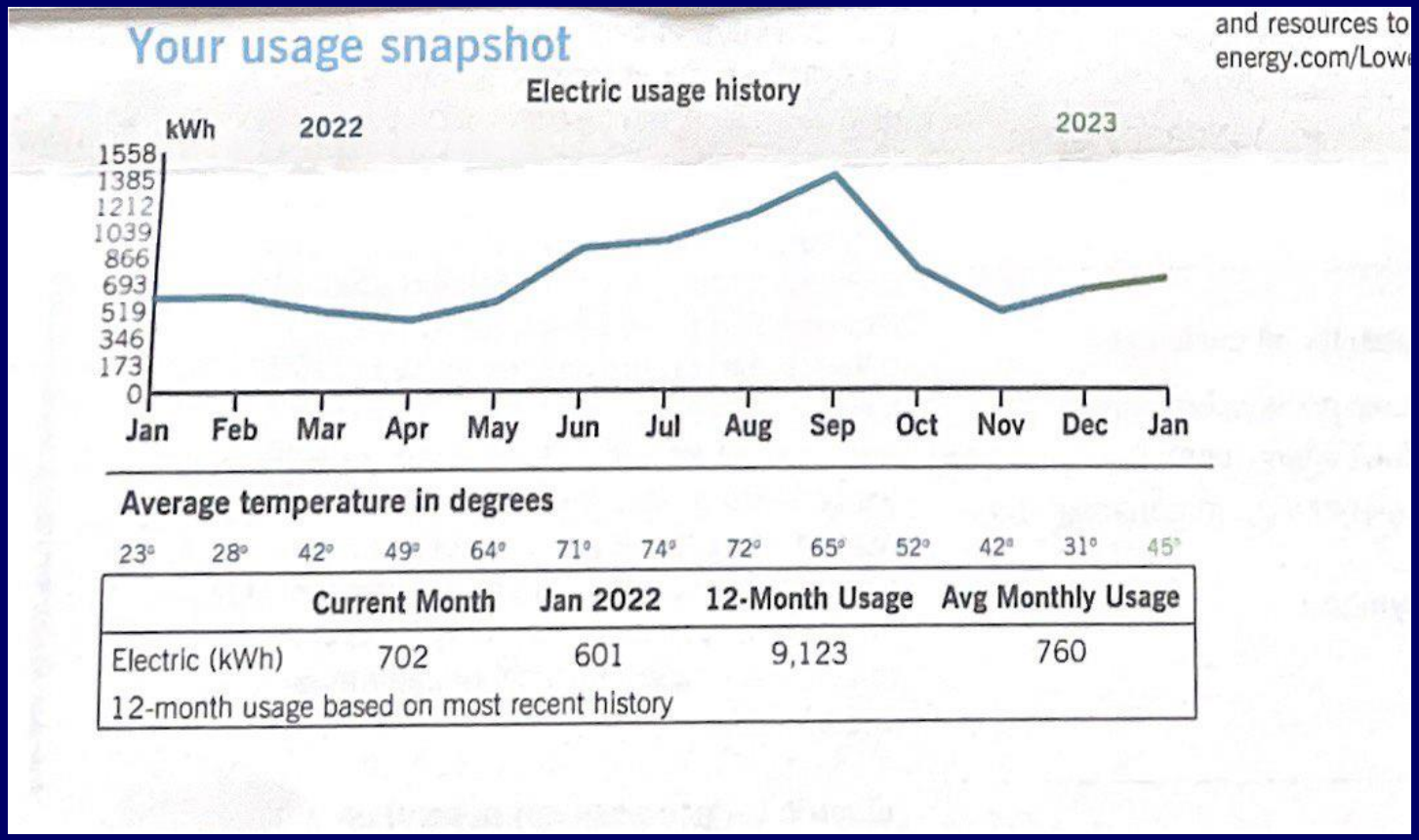
- Physical
  - Energy use options
  - Lighting options
- Representation
  - Percentage of consumption
  - Dollar cost
  - Energy units



Reimer, Barber, & Loaiza-Ramírez (2023)

Energy-Saving Decisions: Turning Goals into Appliance-Specific Allocations

Energy Bill



Your usage snapshot

and resources to
energy.com/Lowe

Electric usage history

Average temperature in degrees

23° 28° 42° 49° 64° 71° 74° 72° 65° 52° 42° 31° 45°

	Current Month	Jan 2022	12-Month Usage	Avg Monthly Usage
Electric (kWh)	702	601	9,123	760

12-month usage based on most recent history

Energy-Saving Decisions: Turning Goals into Appliance-Specific Allocations

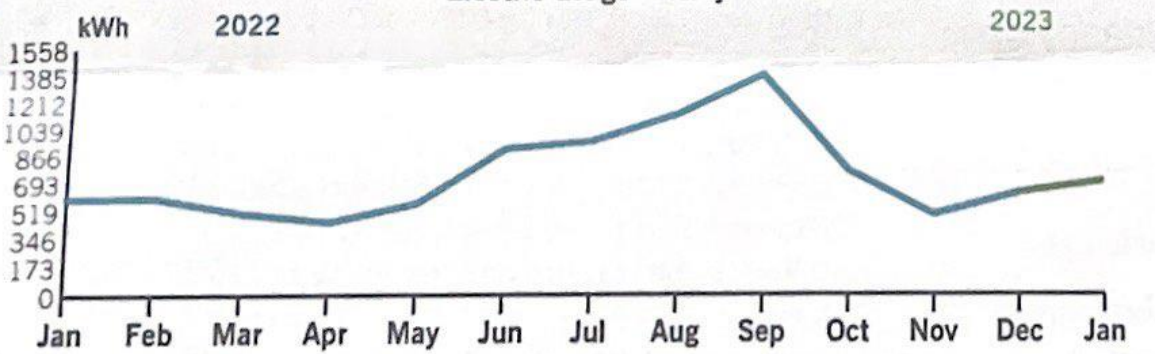
How to save energy?

Reduce TV time? Reduce heating? Reduce cooling?

and resources to
energy.com/Lowe

Your usage snapshot

Electric usage history



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12-month usage based on most recent history

Reimer, Barber, & Loaiza-Ramírez (2023)

Energy-Saving Decisions: Turning Goals into Appliance-Specific Allocations

Canfield, Bruine de Bruin, & Wong-Parodi (2017)

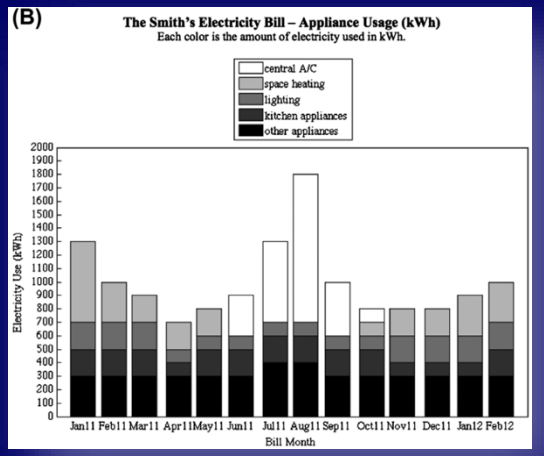
Tables are an easier format to understand than…

(A)

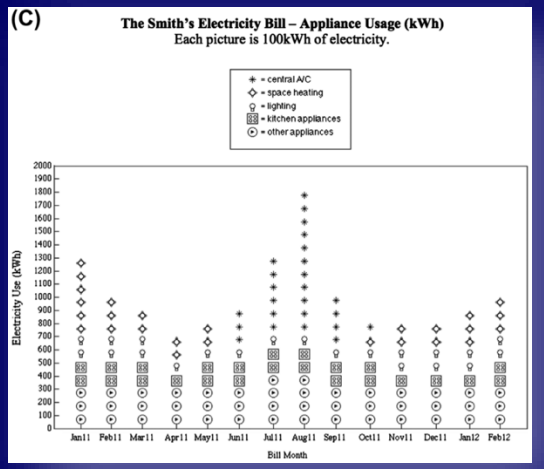
The Smith's Electricity Bill – Appliance Usage (kWh)

Bill Month	Electricity Use (kWh) Central A/C	Space Heating	Lighting	Kitchen Appliances	Other Appliances	Total (kWh)
Jan 11	0	600	200	200	300	1300
Feb 11	0	300	200	200	300	1000
Mar 11	0	200	200	200	300	900
Apr 11	0	200	100	100	300	700
May 11	0	200	100	200	300	800
Jun 11	300	0	100	200	300	900
Jul 11	600	0	100	200	400	1300
Aug 11	1100	0	100	200	400	1800
Sep 11	400	0	100	200	300	1000
Oct 11	100	100	100	200	300	800
Nov 11	0	200	200	100	300	800
Dec 11	0	200	200	100	300	800
Jan 12	0	300	200	100	300	900
Feb 12	0	300	200	200	300	1000

… a bar graph…



… or an icon graph.



Study 2 Description

State averages of consumption								
Source	**Texas average**	**Texas Family**	**California average**	**California Family**	**Colorado average**	**Colorado Family**	**Mass. average**	**Mass. Family**
Cooling	**4,249**		**1,289**		**489**		**322**	
Heating	5,099		5,597		16,411		19,108	
Water heating	4,396		4,601		5,832		5,070	
Refrigerator	1,318		1,055		1,142		1,025	
Other	7,883		6,916		6,652		6,682	
Total	**22,945**		**19,458**		**30,535**		**32,207**	

Opportunities to save energy may be very different for a family in Texas (cooling) and for a family in Massachussetts (heating)

Research Questions and Hypothesis

Research Questions:

- Can individuals "***translate***" energy use information into energy-saving actions (procedural knowledge)?
- Does it matter if we ask consumers to consider energy information represented as ***absolute numbers*** (kWh), ***percentage of total energy use*** (%), or in the form of ***money spent*** (USD)?

Hypothesis:

Absolute numbers (kWh) should be easier to understand and deal with than the percentage of total energy use and money.

Example

- Examples of the task given to participants:

kWh task, Colorado

The Wells family wants to reduce its household electricity use by 5,965 kWh next year.
Please complete two possible action plans that will help the Wells family achieve this goal. Please enter how many kWh should be used next year by each appliance and the total kWh each plan would use. **Enter only whole numbers.** Try to provide close estimations. You may use a calculator to complete the task.

Note: The Wells family used 9,233 more kWh than the average household in Colorado last year.

	Electricity Used Last Year by the Wells Family (kWh)	Average Electricity Used Last Year by Households in Colorado (kWh)	Action Plan 1	Action Plan 2
Cooling (Central A/C)	697	498		
Heating the Home	18,052	16,411		
Water Heating	11,667	5,832		
Refrigerator	1,370	1,142		
Other (Television, Lighting, Electronics, Washer/Dryer, etc.)	7,982	6,652		
Total kWh	39,768	30,535		

% task, Texas

The Smith family wants to reduce its household electricity use by 15% next year.
Please complete two possible action plans that will help the Smith family achieve this goal. Please enter how many kWh should be used next year by each appliance category and the total kWh each plan would use. **Enter only whole numbers.** Try to provide close estimations. You may use a calculator to complete the task.

Note: The Smith family used 6,101 more kWh than the average household in Texas last year.

	Electricity Used Last Year by the Smith Family (kWh)	Average Electricity Used Last Year by Households in Texas (kWh)	Action Plan 1	Action Plan 2
Cooling (Central A/C)	6,573	4,249		
Heating the Home	6,118	5,099		
Water Heating	5,257	4,396		
Refrigerator	2,639	1,318		
Other (Television, Lighting, Electronics, Washer/Dryer, etc.)	8,459	7,883		
Total kWh	29,046	22,945		

Example

- Examples of the task given to participants:

$ task, Colorado

The Davis family wants to reduce its household electricity bill by $1,042 next year. Please complete two possible action plans that will help the Davis family achieve this goal. Please enter how many kWh should be used next year by each appliance and the total kWh each plan would use. **Enter only whole numbers.** Try to provide close estimations. You may use a calculator to complete the task.

Note: The Davis family used 14,086 more kWh than the average household in Massachusetts last year.

	Electricity Used Last Year by the Davis Family (kWh)	Average Electricity Used Last Year by Households in Massachusetts (kWh)	Action Plan 1	Action Plan 2
Cooling (Central A/C)	419	322		
Heating the Home	26,751	19,108		
Water Heating	10,543	5,070		
Refrigerator	1,230	1,025		
Other (Television, Lighting, Electronics, Washer/Dryer, etc.)	7,350	6,682		
Total kWh	46,293	32,207		

Sample

- Mturk: N = 252 (149 male)
- Age: 20-76; > 30: 155
- Income: < 50k: 101, 50k–80k: 95, > 80k: 56
- Education: no college degree: 60, college degree: 101, graduate degree or some grad school: 90 (1 missing)
- Employment: 201 full time
- States: > 30 states

Energy-Saving Decisions: Turning Goals into Appliance-Specific Allocations

Results

- As expected, many energy users have great ***difficulty translating*** an overall energy-saving goal (e.g., to save 15% of the energy) ***into a plan*** that specifies the ***energy usage*** on the level of ***specific utilities***.
- In our study, **61% of action plans** had an **error that was larger than 1%** of the total used kWh. 47% of plans had an error that was larger than 5%, and 30% of plans had an error that was larger than 10%.

Thanks

Questions?

Energy-Saving Decisions: Turning Goals into Appliance-Specific Allocations

Studies

- Mturk samples.
- Consumers' declarative and procedural knowledge: General and domain-specific energy use.

Study 1 (*N* = 299)

Psychometric Measures

- Consumers' knowledge.
- Consumers' motivation.
- Consumers' values/attitudes toward energy-saving behaviors.
- Other measures described in the literature.

Study 2 (*N* = 204)

Procedural Knowledge and Symbolic Representation

- One component of participants' procedural knowledge.
- Describe plans to reach specified energy-saving goals.

Energy-Saving Decisions: Turning Goals into Appliance-Specific Allocations

Saving goal: Absolute kWh

The Wells family wants to reduce its household electricity use by 5,965 kWh next year.

Please complete two possible action plans that will help the Wells family achieve this goal. Please enter how many kWh should be used next year by each appliance and the total kWh each plan would use. **Enter only whole numbers.** Try to provide close estimations. You may use a calculator to complete the task.

Note: The Wells family used 9,233 more kWh than the average household in Colorado last year.

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Total kWh	39,768	30,535		

Source: Authors

Energy-Saving Decisions: Turning Goals into Appliance-Specific Allocations

Saving goal: Percentage

The Smith family wants to reduce its household electricity use by 15% next year. Please complete two possible action plans that will help the Smith family achieve this goal. Please enter how many kWh should be used next year by each appliance category and the total kWh each plan would use. **Enter only whole numbers.** Try to provide close estimations. You may use a calculator to complete the task.

Note: The Smith family used 6,101 more kWh than the average household in Texas last year.

	Electricity Used Last Year by the Smith Family (kWh)	Average Electricity Used Last Year by Households in Texas (kWh)	Action Plan 1	Action Plan 2
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Refrigerator	2,639	1,318		
Other (Television, Lighting, Electronics, Washer/Dryer, etc.)	8,459	7,883		
Total kWh	29,046	22,945		

Source: Authors

Energy-Saving Decisions: Turning Goals into Appliance-Specific Allocations

Saving goal: Money

The Davis family wants to reduce its household electricity bill by $1,042 next year. Please complete two possible action plans that will help the Davis family achieve this goal. Please enter how many kWh should be used next year by each appliance and the total kWh each plan would use. **Enter only whole numbers.** Try to provide close estimations. You may use a calculator to complete the task.

Note: The Davis family used 14,086 more kWh than the average household in Massachusetts last year.

	Electricity Used Last Year by the Davis Family (kWh)	Average Electricity Used Last Year by Households in Massachusetts (kWh)	Action Plan 1	Action Plan 2
Cooling (Central A/C)	419	322		
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Water Heating	10,543	5,070		
Refrigerator	1,230	1,025		
Other (Television, Lighting, Electronics, Washer/Dryer, etc.)	7,350	6,682		
Total kWh	46,293	32,207		

Source: Authors

Energy-Saving Decisions: Turning Goals into Appliance-Specific Allocations

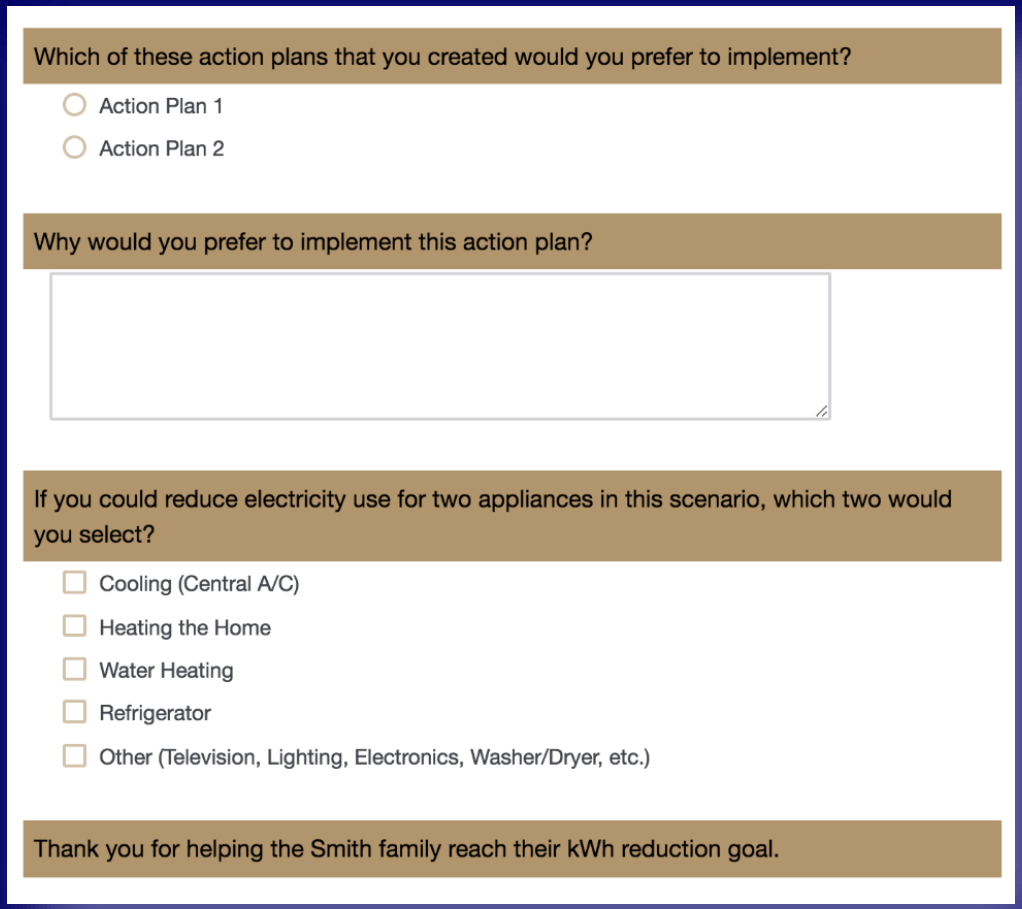
Study 2

Breakdown of the states given to participants

State averages for consumption								
Source	**Texas average**	**Texas Family**	**California average**	**California Family**	**Colorado average**	**Colorado Family**	**Mass. average**	**Mass. Family**
Cooling	**4,249**	**6,573**	**1,289**	**2,581**	489	697	322	419
Heating	5,099	6,118	5,597	6,157	**16,411**	**18,052**	**19,108**	**26,751**
Water heating	4,396	5,257	4,601	5,061	**5,832**	**11,667**	**5,070**	**10,543**
Refrigerator	1,318	2,639	1,055	1,266	1,142	1,370	1,025	1,230
Other	7,883	8,459	6,916	7,608	6,652	7,982	6,682	7,350
Total	22,945	29,046	19,458	22,673	30,535	39,768	32,207	46,293

Energy-Saving Decisions: Turning Goals into Appliance-Specific Allocations

Study 2



After the task, participants were asked:

- Preferred reduction plan.
- Rationale.
- Two appliances they would want to reduce.

Energy-Saving Decisions: Turning Goals into Appliance-Specific Allocations

Results

Perceived Knowledge			
	Frequency	%	Cumulative Percent
Agree	44	17.5	17.5
Somewhat agree	103	40.9	58.3
Neither/nor	40	15.9	74.2
Somewhat disagree	43	17.1	91.3
Disagree	22	8.7	100.0
Total	252	100.0	

Actual Knowledge			
Right Resp.	Frequency	%	Cumulative Percent
0	4	1.6	1.6
1	22	8.7	10.3
2	32	12.7	23.0
3	25	9.9	32.9
4	26	10.3	43.3
5	33	13.1	56.3
6	47	18.7	75.0
7	42	16.7	91.7
8	21	8.3	100.0
Total	252	100.0	

Correlation: -.25

De Waters & Powers (2011)

Results

Correlations (N = 242)			
	Error	**Perceived Knowledge**	**Actual Knowledge**
Error			
Perceived Knowledge	.154*		
Actual Knowledge	-.451**	-.245**	

Notes: * p = .016, ** p < .001

Questions/Hypotheses

Gigerenzer, Peters

Reimer, Jones, & Skubisz (2015) describe that people often have trouble transforming information in one format to information in another format; some formats are easier to comprehend than others (frequencies vs. probabilities)

Research Questions:

- Can individuals “translate” energy use information into energy-saving actions (procedural knowledge)?
- Does it matter if we ask consumers to consider energy information represented as absolute numbers (kWh), percentage of total energy use (%), or in the form of money spent (USD)?

Hypothesis:

- Absolute numbers (kWh) should be easier to understand and deal with than the percentage of total energy use and money.

Study 2 Description

- Ranking of energy expenditures

State averages for consumption				
Source	Texas	California	Colorado	Massachusetts
Cooling	1	2	3	4
Heating	4	3	2	1
Water heating	4	3	1	2
Refrigerator	1	3	2	4
Other	1	2	4	3
Total	3	4	2	1

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Cooling	4,249	6,573	1,289	2,581	489	697	322	419
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Total	22,945	29,046	19,458	22,673	30,535	39,768	32,207	46,293

Energy-Saving Decisions: Turning Goals into Appliance-Specific Allocations

Representation format

Nudging

interventions designed to steer people in a particular direction while preserving their freedom of choice.

Boosting

interventions designed to foster people's competence to make their own choices (i.e., to exercise their own agency)

Hertwig & Grüne-Yanoff (2017)

Energy-Saving Decisions: Turning Goals into Appliance-Specific Allocations

Results

	N	Minimum	Maximum	Mean	SD
Error	242	0	10269.00	2800.63	2392.27
kWh	76	0	9803.50	2203.91	2282.37
%	77	0	9664.00	2522.86	2333.66
$	89	2	10269.00	3550.51	2363.56

Energy-Saving Decisions: Turning Goals into Appliance-Specific Allocations

Results

Calculator	*N*	Minimum	Maximum	Mean	SD
Yes	58	0	9131.00	3824.99	2344.32
No	184	0	10269.00	2477.73	2321.12

Calculator	Presentation	*N*	Minimum	Maximum	Mean	SD
Yes	**kWh**	57	0	9803.50	1792.93	1998.41
	%	63	0	9664.00	2376.58	2259.15
	$	64	2	10269.00	3187.21	2476.12
No	**kWh**	19	0	8689.00	3436.84	2672.27
	%	14	1	9131.00	3181.12	2631.86
	$	25	851.50	7802.00	4480.55	1770.91

References

- Canfield, C., Bruine de Bruin, W., & Wong-Parodi, G. (2017). Perceptions of electricity-use communications: Effects of information, format, and individual differences. *Journal of Risk Research*, *20*(9), 1132–1153. https://doi.org/10.1080/13669877.2015.1121909
- DeWaters, J. E., & Powers, S. E. (2011). Energy literacy of secondary students in New York State (USA): A measure of knowledge, affect, and behavior. *Energy Policy, 39*(3), 1699–1710. https://doi.org/10.1016/j.enpol.2010.12.049
- Hertwig, R., & Grüne-Yanoff, T. (2017). Nudging and boosting: Steering or empowering good decisions. *Perspectives on Psychological Science*, *12*(6), 973–986. https://doi.org/10.1177/1745691617702496

Representation

- Numeric communication of energy use
- *Save 10% of your energy!*
- Examine numerical feedback about energy use commonly provided on electricity bills
  - Often presented in kWh or percentage of overall use
  - Not money (USD) despite our familiarity with paying for energy

Canfield, Bruine de Bruin, & Wong-Parodi, 2017

- Apply numeric health/risk communication principles to energy use
  - Graphs and tables
  - Presented family's historic use, use compared to neighbors, and appliance breakdown in various formats

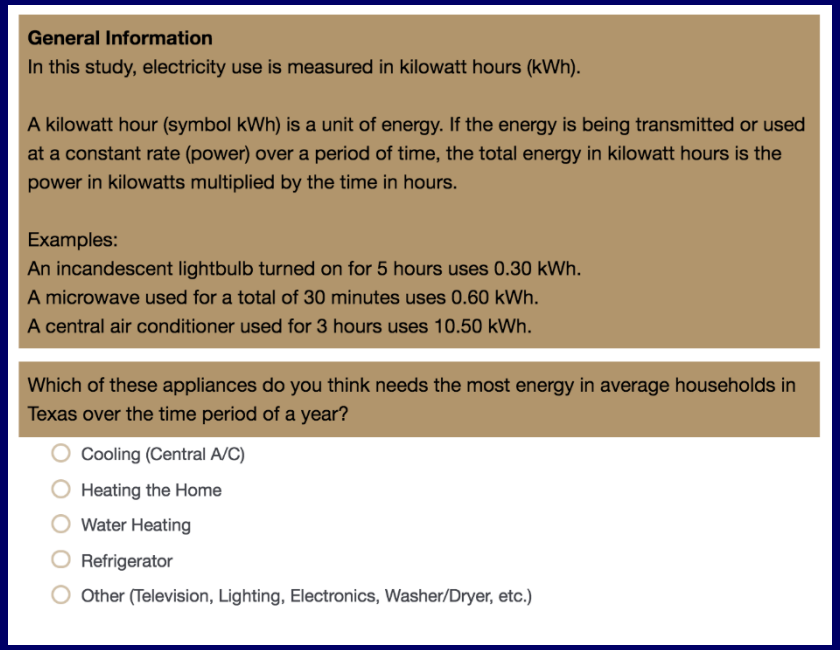
- Findings:
  - Tables were best for understanding information
  - Those with lower energy literacy scores had more problems understand the provided information

Methods

- Participants receive energy use information found on electricity bills of various families
- Four families from different states in the U.S.: California, Texas, Colorado, Massachusetts
  - Each family has a bill that shows appliance breakdown data over the last year
  - Information is provided in the form of kWh, %, or USD
- Each participant was asked to come up with two action plans for a 15% saving for each of two states
- Presentation format was manipulated between subjects
- 24 different blocks of experimental materials to which participants were randomly assigned

Example

- Participants were first asked which energy source needs the most energy, and then were asked to rank how much energy the average family from the state used each source



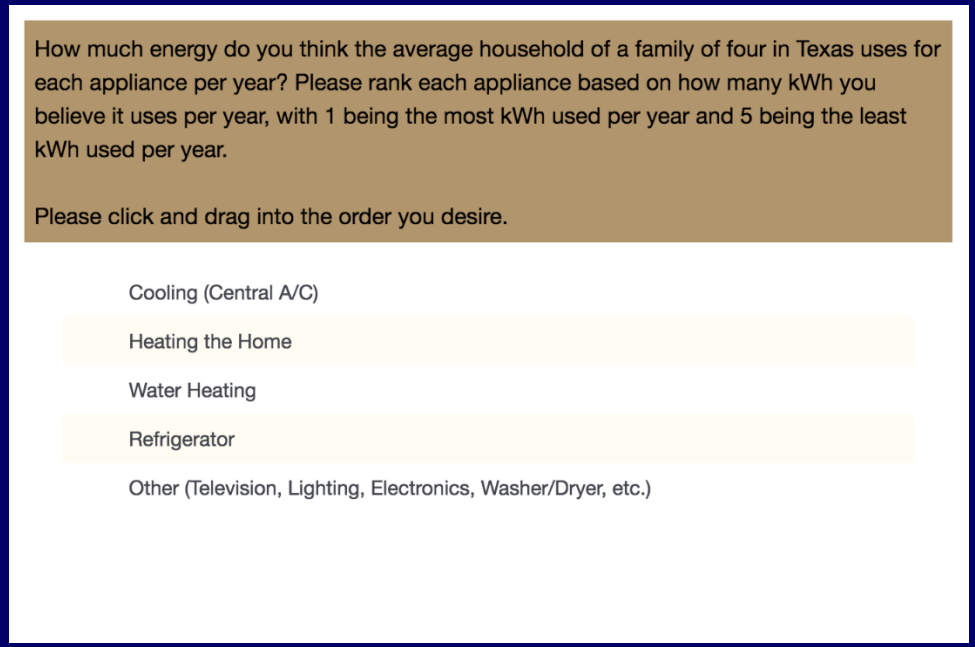
General Information
In this study, electricity use is measured in kilowatt hours (kWh).

A kilowatt hour (symbol kWh) is a unit of energy. If the energy is being transmitted or used at a constant rate (power) over a period of time, the total energy in kilowatt hours is the power in kilowatts multiplied by the time in hours.

Examples:
An incandescent lightbulb turned on for 5 hours uses 0.30 kWh.
A microwave used for a total of 30 minutes uses 0.60 kWh.
A central air conditioner used for 3 hours uses 10.50 kWh.

Which of these appliances do you think needs the most energy in average households in Texas over the time period of a year?

- Cooling (Central A/C)
- Heating the Home
- Water Heating
- Refrigerator
- Other (Television, Lighting, Electronics, Washer/Dryer, etc.)



How much energy do you think the average household of a family of four in Texas uses for each appliance per year? Please rank each appliance based on how many kWh you believe it uses per year, with 1 being the most kWh used per year and 5 being the least kWh used per year.

Please click and drag into the order you desire.

- Cooling (Central A/C)
- Heating the Home
- Water Heating
- Refrigerator
- Other (Television, Lighting, Electronics, Washer/Dryer, etc.)

Study 2 Description

- Ranking of energy expenditures

State averages for consumption				
Source	Texas	California	Colorado	Massachusetts
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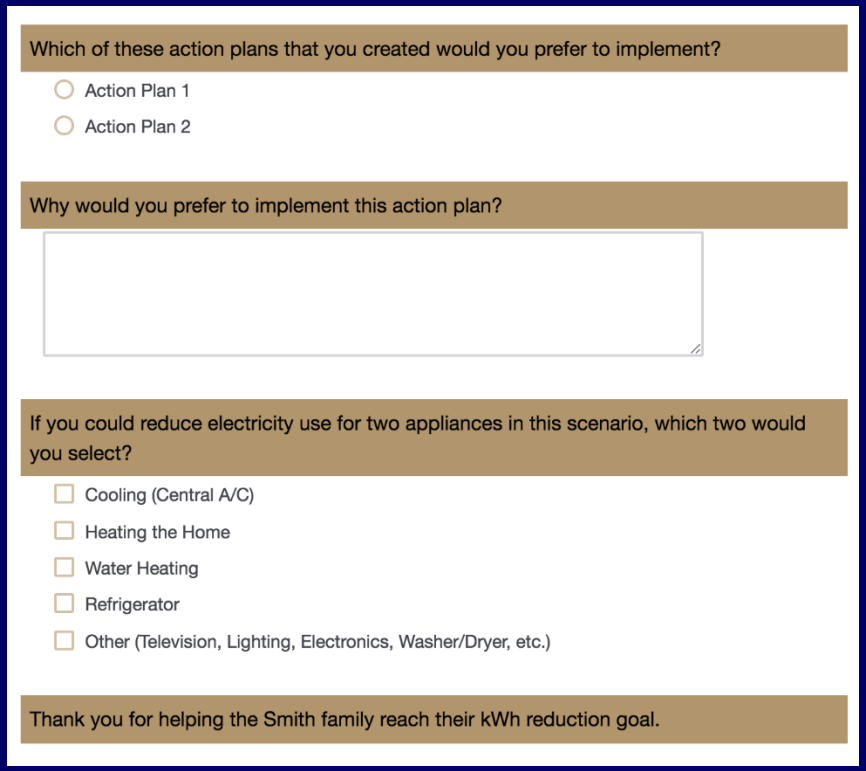
Water heating	4	3	1	2
Refrigerator	1	3	2	4
Other	1	2	4	3
Total	3	4	2	1

Methods

- After the task, participants were asked about their preferred reduction plan, rationale, and which two appliances they would want to reduce in particular.



Which of these action plans that you created would you prefer to implement?

- ○ Action Plan 1
- ○ Action Plan 2

Why would you prefer to implement this action plan?

If you could reduce electricity use for two appliances in this scenario, which two would you select?

- ☐ Cooling (Central A/C)
- ☐ Heating the Home
- ☐ Water Heating
- ☐ Refrigerator
- ☐ Other (Television, Lighting, Electronics, Washer/Dryer, etc.)

Thank you for helping the Smith family reach their kWh reduction goal.

Methods

- After completing the tasks for four families:
  - Survey for environmental literacy (using Canfield 2011 as a guide)
  - Dummy check “do not answer” question
  - Surveyed for environmental values based on previous study on recycling
  - Demographic survey

Results: Basic Descriptives

- Energy use: *I consume more energy than average*: 90, less: 121, do not know: 41

- Perceived knowledge (single item)
- Energy literacy/general knowledge (eight items)
- Accuracy of the plans: Error = absolute difference from correct answer

Results: Basic Descriptives

Perceived_Knowledge					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	44	17.5	17.5	17.5
	Somewhat agree	103	40.9	40.9	58.3
	Neither/nor	40	15.9	15.9	74.2
	Somewhat disagree	43	17.1	17.1	91.3
	Disagree	22	8.7	8.7	100.0
	Total	252	100.0	100.0	

I consider myself knowledgeable about how much energy utilities such as a dishwasher or lighting use.

De Waters & Powers (2011)

Actual_Knowledge					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	4	1.6	1.6	1.6
	1.00	22	8.7	8.7	10.3
	2.00	32	12.7	12.7	23.0
	3.00	25	9.9	9.9	32.9
	4.00	26	10.3	10.3	43.3
	5.00	33	13.1	13.1	56.3
	6.00	47	18.7	18.7	75.0
	7.00	42	16.7	16.7	91.7
	8.00	21	8.3	8.3	100.0
	Total	252	100.0	100.0	

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Correlation: -.25

„Energy Literacy/Knowledge“

INDIVIDUAL DIFFERENCES IN ENERGY LITERACY

Energy literacy questions adapted from DeWaters and Powers (2011)

The amount of ELECTRICAL ENERGY (ELECTRICITY) we use is measured in units called …

- Kilowatt (kW)
- **Kilowatt-hours (kWh)**
- British Thermal Units (BTU)
- Volts (V)
- Horsepower (HP)

The amount of ENERGY consumed by an electrical appliance is equal to the power rating of the appliance (watts or kilowatts) …

- Multiplied by the cost of electricity
- Added to the cost of electricity
- **Multiplied by the time it’s used**
- Divided by the time it’s used
- Added to the time it’s used

„Energy Literacy/Knowledge“

When you turn on an incandescent light bulb, which of the following energy conversion takes place?

- Electrical energy to radient energy (light)
- Chemical energy to radient energy (light)
- **Electrical energy to radient energy (light) and thermal energy (heat)**
- Chemical energy to radient energy (light) and thermal energy (heat)
- Electrical energy to radient energy (light) and mechanical energy

The best reason to buy an ENERGY STAR® appliance is …

- ENERGY STAR appliances are usually bigger
- ENERGY STAR appliances cost more
- **ENERGY STAR appliances use less energy**
- ENERGY STAR appliances are more modern looking
- ENERGY STAR appliances cost less

Which uses the MOST ENERGY in the average American home in one year?

- Refrigerating food and beverages
- Washing and drying clothing
- **Heating and cooling rooms**
- Heating and cooling water
- Lighting the home

„Energy Literacy/Knowledge“

Which of the following items uses the MOST ELECTRICITY in the average home in one year?

Lights **Refrigerator** Telephone Television Computer

Which of the following sources provides most of the ELECTRICITY in the United States?

- Nuclear power
- Burning petroleum
- **Burning coal**
- Solar energy
- Water (hydro) power

Some people think that if we run out of fossil fuels we can just switch over to electric cars. What is wrong with this idea?

- **Most electricity is currently produced from fossil fuels (coal, oil, natural gas)**
- Switching to electric cars will make unemployment rates go up
- It has been proven that it is impossible to build electric cars in great quantities
- You can’t use electricity to operate a car
- There is nothing wrong with this idea

Results: Correlation with Error?

Results: Correlation with Error?

Correlations				
		Error	Perceived_ Knowledge	Actual_ Knowledge
Error	Pearson Correlation	1	.154*	-.451**
	Sig. (2-tailed)		.016	.000
	N	242	242	242
Perceived_Knowledge	Pearson Correlation	.154*	1	-.245**
	Sig. (2-tailed)	.016		.000
	N	242	252	252
Actual_Knowledge	Pearson Correlation	-.451**	-.245**	1
	Sig. (2-tailed)	.000	.000	
	N	242	252	252

Results

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
error	242	.00	10269.00	2800.6284	2392.27411
Valid N (listwise)	242				

Descriptive Statistics						
Presentation		N	Minimum	Maximum	Mean	Std. Deviation
kWh	Error	76	.00	9803.50	2203.9068	2282.37058
	Valid N (listwise)	76				
%	Error	77	.00	9664.00	2522.8561	2333.65921
	Valid N (listwise)	77				
P	error	89	2.00	10269.00	3550.5084	2363.55645
	Valid N (listwise)	89				

Results: Calculators help!

Descriptive Statistics

calculator		N	Minimum	Maximum	Mean	Std. Deviation
no	error	58	.00	9131.00	3824.987	2344.32139
	Valid N (listwise)	58				
yes	error	184	.00	10269.00	2477.732	2321.11935
	Valid N (listwise)	184				

Descriptive Statistics

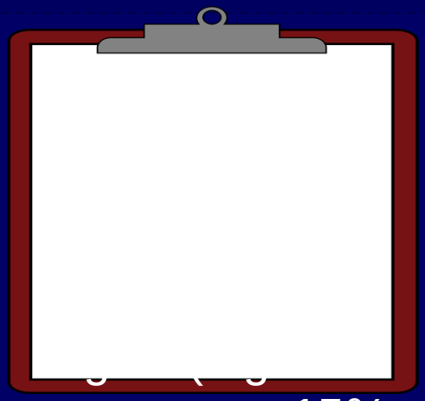
calculator	presentation		N	Minimum	Maximum	Mean	Std. Deviation
no	kWh	Error	19	.00	8689.00	3436.8377	2672.27004
		Valid N (listwise)	19				
	%	Error	14	1.00	9131.00	3181.1190	2631.85995
		Valid N (listwise)	14				
	$	Error	25	851.50	7802.00	4480.5467	1770.91311
		Valid N (listwise)	25				
yes	kWh	Error	57	.00	9803.50	1792.9298	1998.40561
		Valid N (listwise)	57				
	%	Error	63	.00	9664.00	2376.5754	2259.14634
		Valid N (listwise)	63				
	$	Error	64	2.00	10269.00	3187.2122	2476.12299
		Valid N (listwise)	64				

Status of the Project – Learning-based Feedback

Scenario

- Tables for six families in different states of the US showing their electricity consumption in the previous year.
- Data of an average household in the same state.

Category	Energy [kWh]	
	Your Home	State Average
Cooling (Central A/C)	6,813	4,542
Heating the Home	2,461	1,641
Water Heating	3,559	2,373
Refrigerator	4,804	1,201
Other (Television, Lighting, Electronics, Washer/Dryer, etc.)	10,374	6,916
Total kWh	28,011	16,673



consume 15% less than last year).

Results

Difficulty translating an overall energy-saving goal into a plan that specifies the usage of energy on the level of specific utilities.

- 61% of action plans with error > 1% of the total used KWh.
- 47% of action plans with error > 5%.
- 30% of plans with error > 10%.

Follow-Up Study

- Include conditions, in which we
  (a) round numbers and
  (b) add a 25% condition
  Both are aspected to reduce error because they simplify calculations

- Include measure what people think how urgent and worthwhile it would be to save energy. We will see if the order of the three conditions are reversed here:
  $ > % > kWh