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Improving the Energy Audit:

Findings of the NELC Holistic Approach on Real Homes' Energy Consumption

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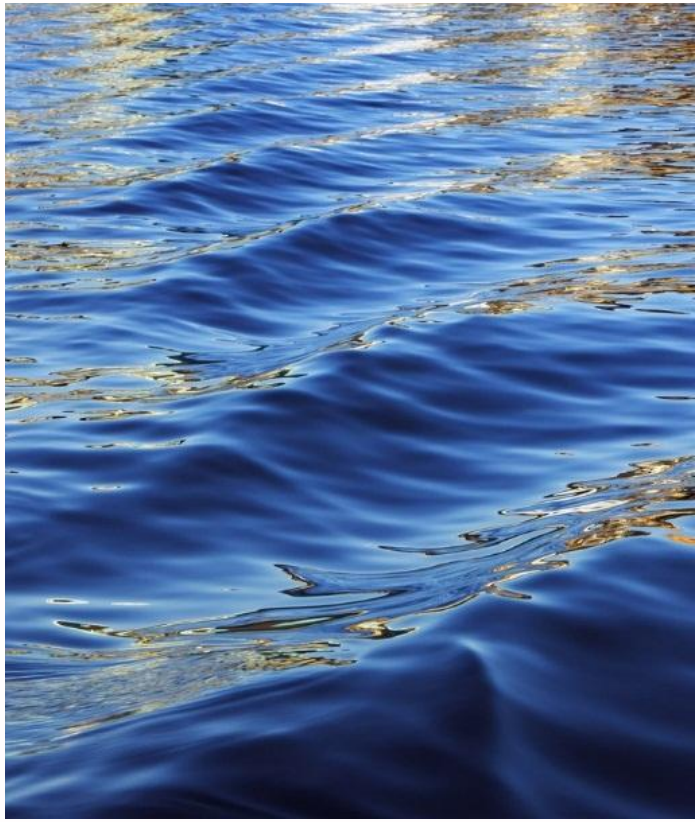

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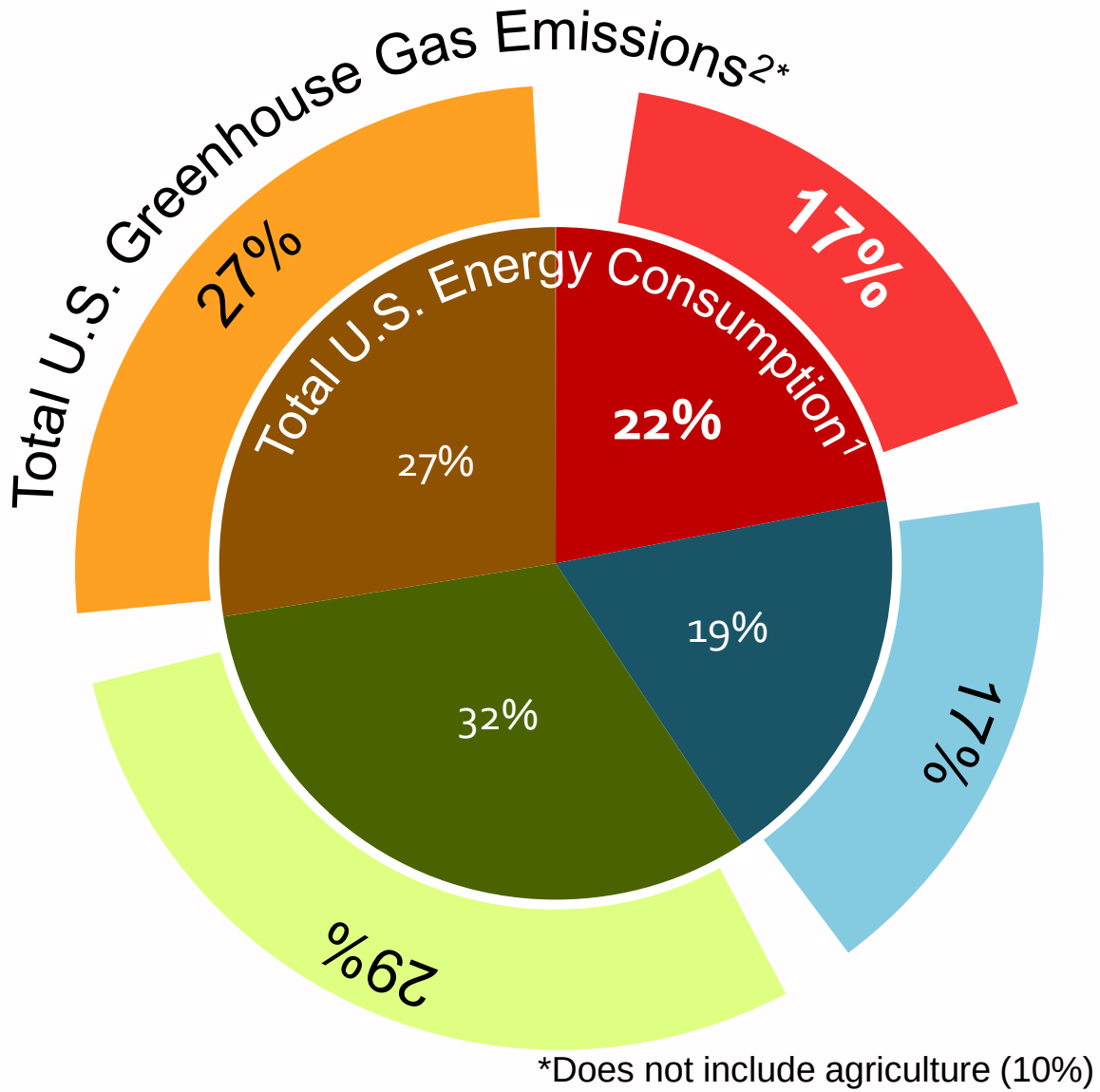
Residential Consumption



*Does not include agriculture (10%)

Transportation

Residential

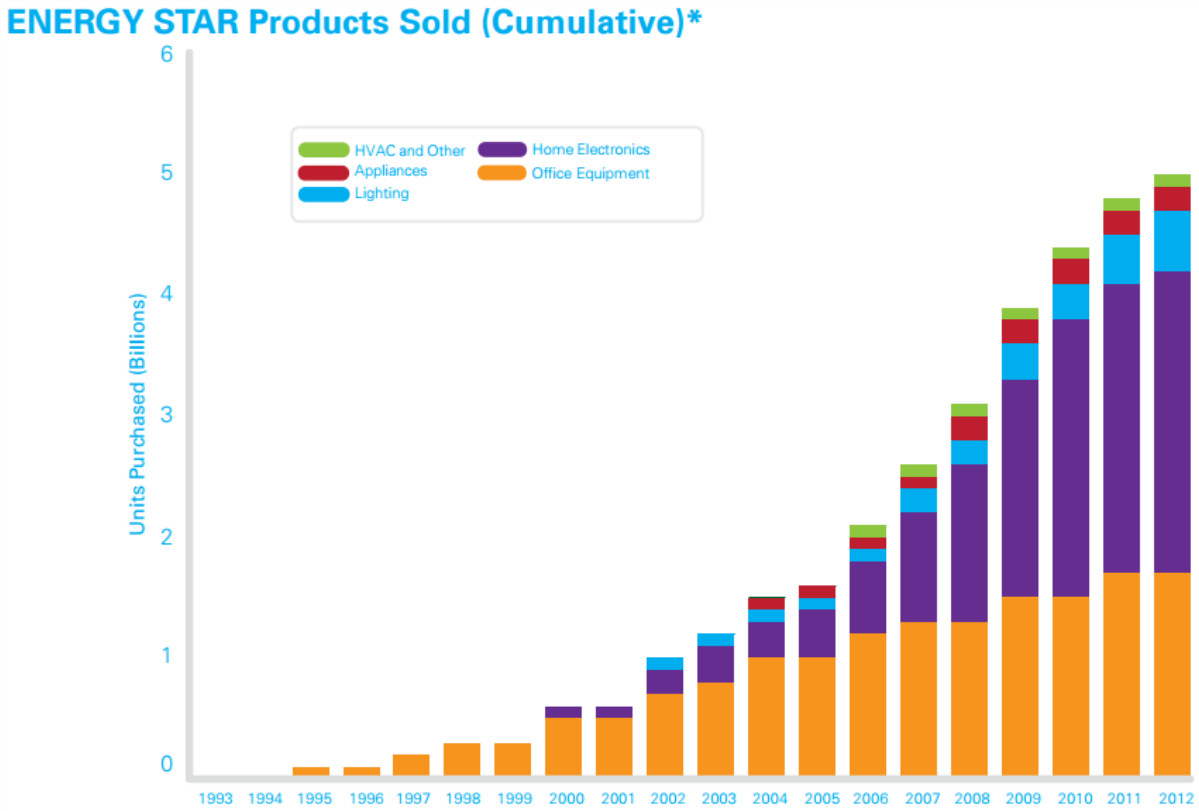
Industrial

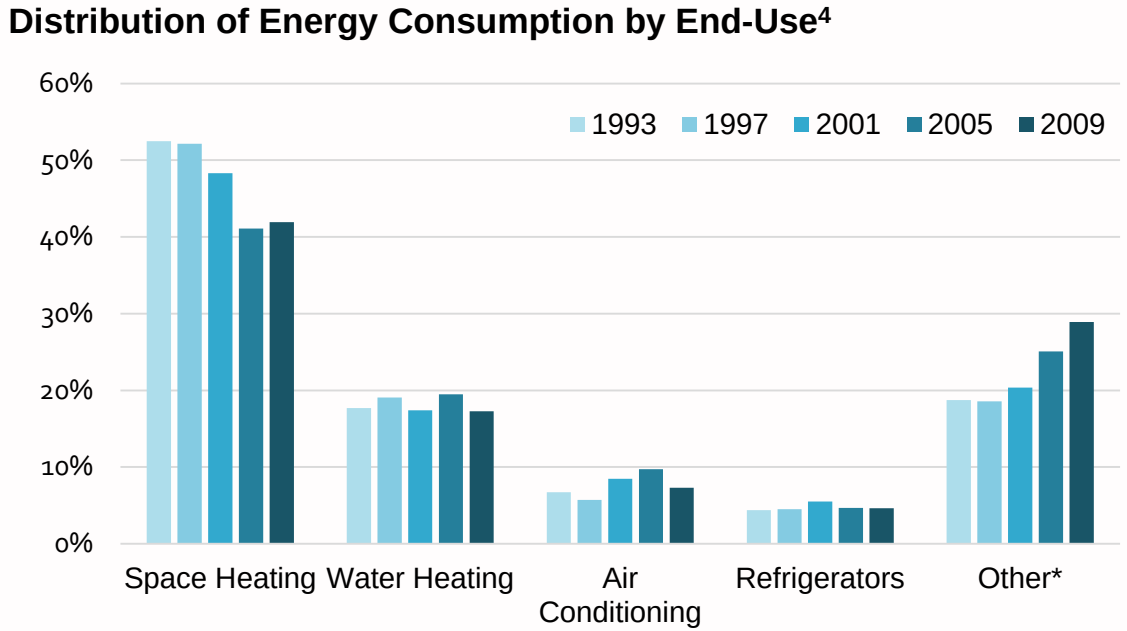
Commercial

1. U.S. EIA, Annual Energy Review 2011

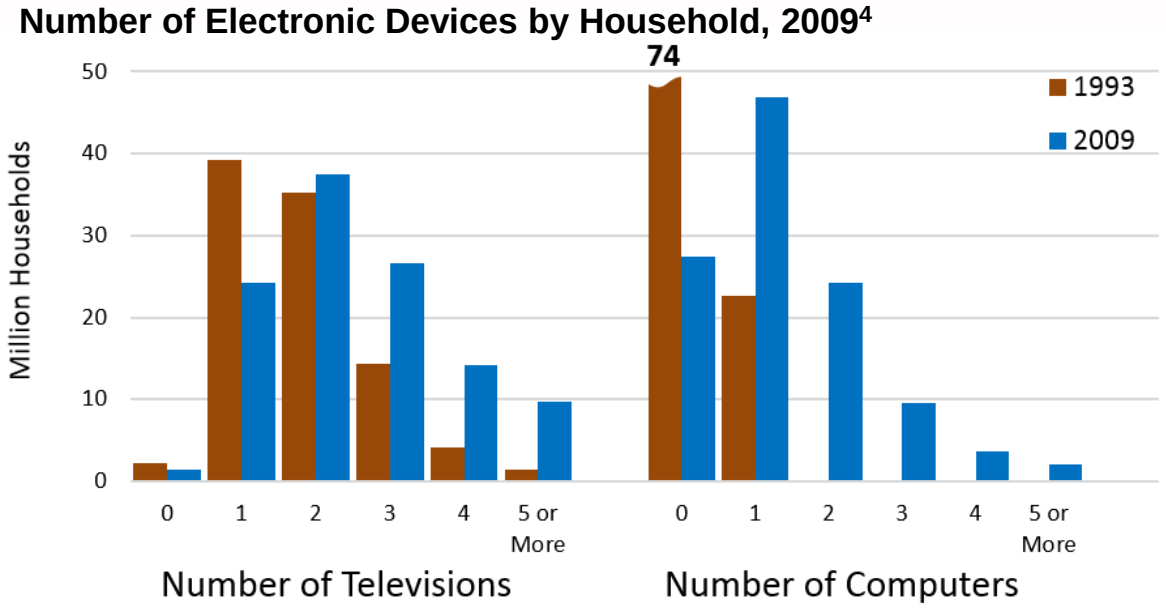
2. U.S. EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2012

Offsetting Trends





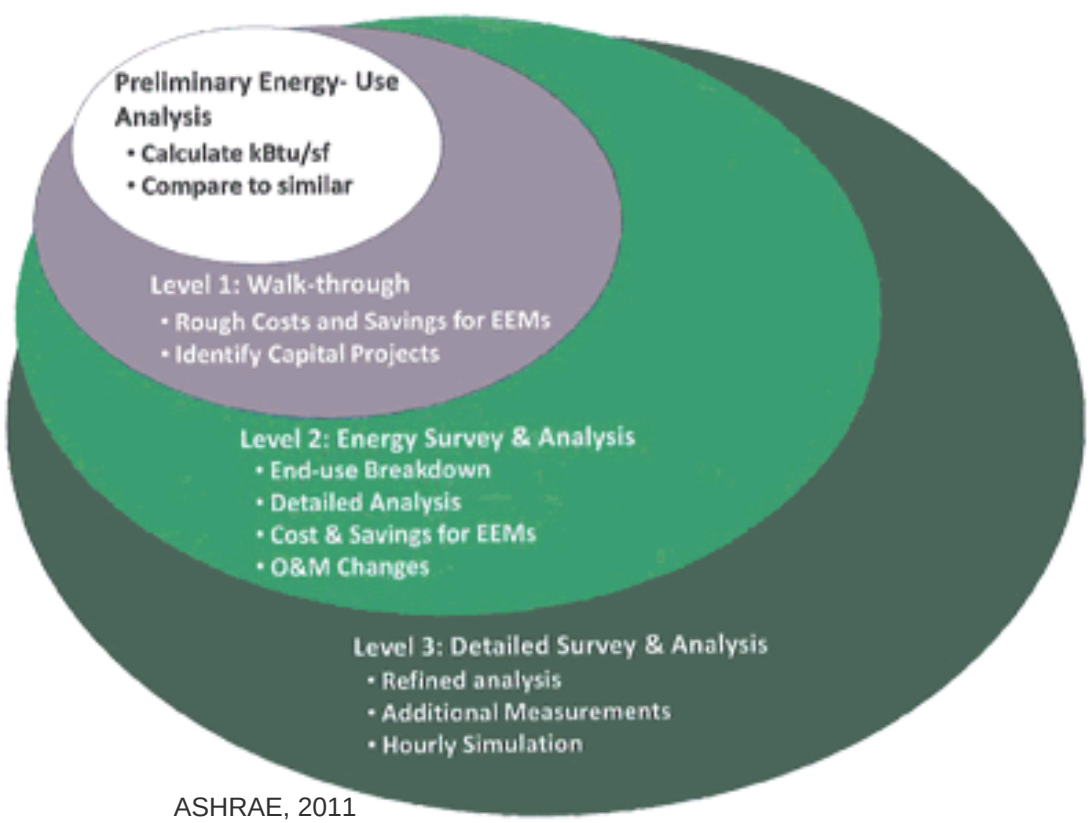
*"Other" includes end uses not shown separately (e.g., cooking appliances, clothes washers, dryers, dishwashers, televisions, computers, small electronic devices, pools, hot tubs, and lighting.)



3. U.S. EPA, Energy Star® Products 20 years of helping America save energy save money and protect the environment

4. U.S. EIA, Residential Energy Consumption Survey 2009, 2005, 2001, 1997, 1993

Energy Audits within Information Strategies



ASHRAE, 2011

Antecedent[5] (or **psychological**[6]) information strategies

Deliver varying levels of information on home energy profile *aimed at enacting change* **PRIOR** *to a energy investments*

Under the premise, ***an informed homeowner will make energy efficient decisions***

5. Abrahamse, W., et al., 2005

6. Steg, L., 2008

Heterogeneity in Homes

- Energy audits lack influence [7]
  - 19% stated the energy audit was influential,
  - 60% investment rates for audit recipients versus non-recipients
  - **Comfort over technical information** [8-11]
- Other Factors
  - **Socioeconomic status:** wealth, education, age of household members, age of housing unit[10, 13-16]
  - **Homeowner perceptions:** responsibility[8], self-presentation[8], hassle[11], uncertainty in savings[11],
  - **Homeowner expectations:** discourage optimistic, encourage pessimistic[12]

Complexity of residential sector demands targeted energy efficiency measures

7. Barr, S., A.W. Gilg, and N. Ford, 2005 8. Ingle, A., et al., 2012 9. Bruel, R. and J. Hoekstra, 2005 10. Ingle, A., Moezzi, M., Lutzenhiser, L., Diamond, R., 2012 11. Frondel, M. and C. Vance, 2013
12. Achtnicht, M. and R. Madlener, 2014 13. Gamtessa, S.F., 2013 14. Nair, G., Gustavsson, L., and Mahapatra, K., 2010 15. Martinsson, J., L.J. Lundqvist, and A. Sundström, 2011

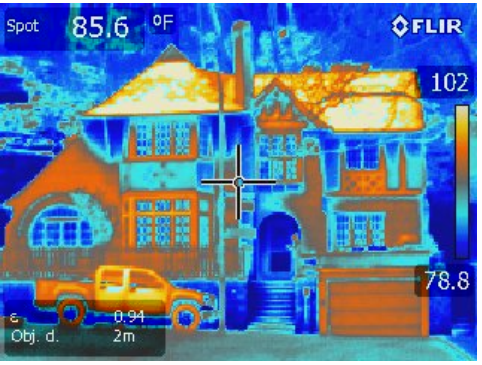
The **N**ational **E**nergy **L**eadership **C**orps *Holistic Energy Assessment* Approach

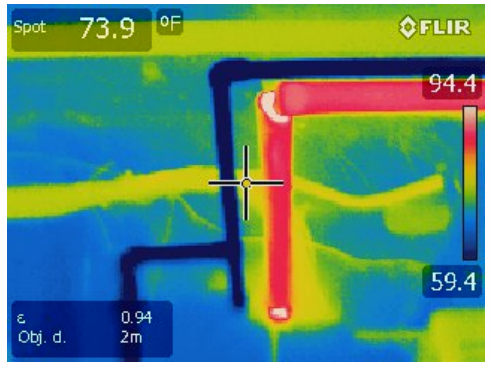
NELC
NATIONAL ENERGY LEADERSHIP CORPS

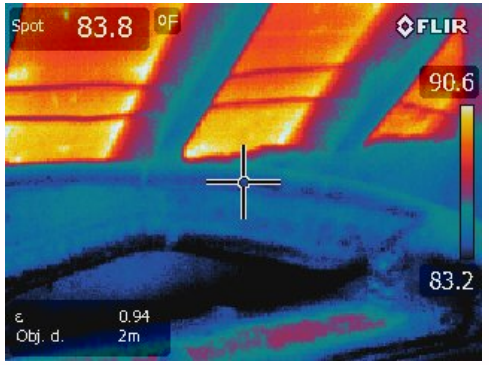
- Intended to teach students and personally engage homeowners in home energy and sustainability concepts
  - Prepares students in a flipped-classroom before performing real energy assessments in the community
  - Fosters student leadership and communication skills
  - Fuses homeowners' perceptions, expectations, and interests with traditional assessment processes
  - Defines a path forward towards energy independence for homeowners

A holistic energy assessment differs from an ASHRAE Level 2 energy audit:

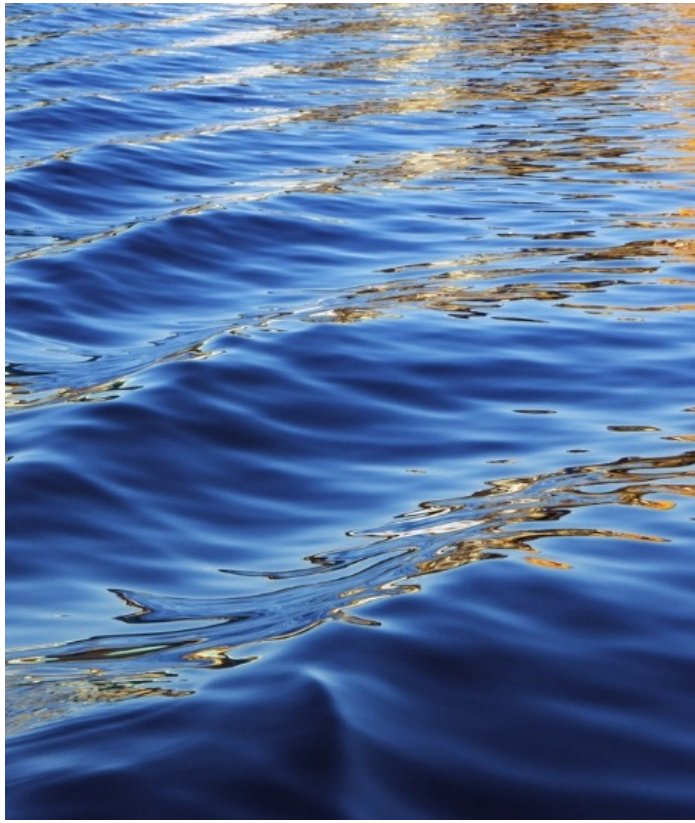
- Reallocate focus to include homeowners *perceptions*, *expectations*, and *interests*
- *Harmonize* with appropriate energy efficiency measures







Holistic Assessment Process

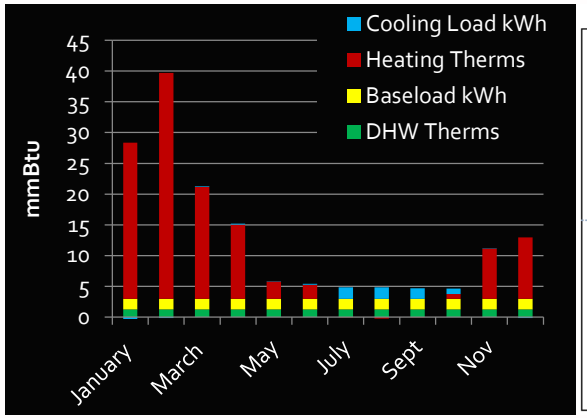


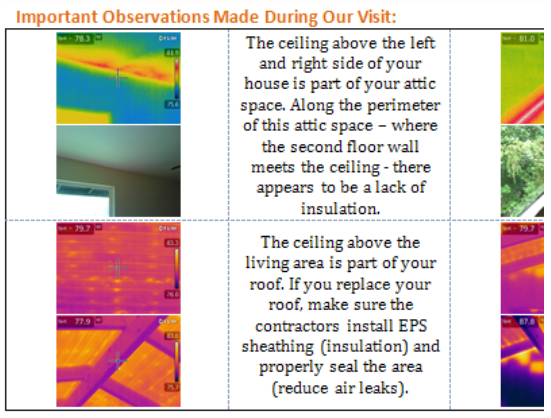
Holistic Assessment Process

Homeowners identified through neighborhood meetings, not-for-profit organizations and social groups; **voluntary participation**

Assessment Steps:

1. Homeowner informal interview and table talk session
2. Walkthrough inspection, including thermal imagery and utility bill collection
3. Energy analysis and report writing





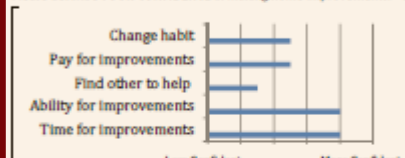
Energy Assessment Report Design

Your home



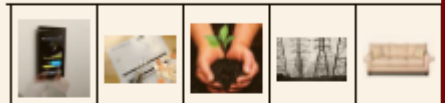
Confidence and Commitments:

Please describe YOUR CONFIDENCE in making home improvements.



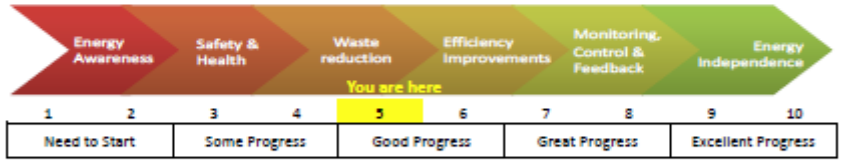
Your Priorities and Goals:

What are the reasons motive you to save energy?



Increase control	Reduce energy costs	Protect the Environment	Utility independence	Improve comfort

Your Status to Energy Independence (Your assessment)



Energy Yardstick Score: 7.8 / 10

This score is an assessment of your home's energy efficiency based on size, number of occupants, electricity and heating usage.

Energy Yardstick is a home energy efficiency assessment tool available on energystar.gov

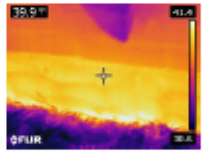
Identified issues of Your Home

Safety and Health Concerns:

No carbon monoxide detectors: There is no carbon monoxide detector. Carbon monoxide is a hazard when you burn anything. *We strongly recommend you invest in carbon monoxide detectors in the basement and on every floors especially within 10 feet of a bedroom door to alert you in case of build-up while you are sleep. Some types are combined with smoke detectors for dual purposes of increased safety.*

Add a ventilation fan in the bathroom: There's a window in the bathroom, which is used as ventilation. The ventilation performance of a window is not as good as a ventilation fan. Bad ventilation condition can cause moisture issues. *We recommend you introduce a ventilation fan in your bathroom instead of windows for ventilation. This would be a good improvement, although not that needed.*

No insulation on heating/cooling supply duct work outside of the thermal barrier, insulate this ductwork would increase the energy efficiency



Add wall insulation in the house would decrease energy loss and increase energy efficiency

Caulk gaps on window frame: Several gaps around window frame, which results air infiltration and energy loss. Caulking those gaps would improve energy efficiency

No insulation on hot water pipe, add pipe insulation 6" above the hot water tank would decrease energy loss caused by energy (hot water) transfer

Add weather-stripping around your front door, which will make the door close more tightly, and prevent energy loss from the gaps around the door

Top 5 Value-based Recommendations

1 **Insulate Duct Work (Duct Work in Garage)** — Save on heating expenses by insulating duct work.

- Self installation of pipe insulation is very low cost and has a one year payback on top of yearly savings.
- Save money by reducing the conduction heat losses from uninsulated distribution pipes.
- This easy step will increase the value of your home and your overall comfort while saving you money.

Potential Energy Reduction: 3% - 5% | Estimated 5 Year Savings: $200 - $330

Insulate Duct Work (Duct Work in Garage)

2 **Add Wall Insulation** — Reduce energy consumption by insulating the wall

- Blocks energy loss by sealing off leaks, gaps and penetrations which helps protect the environment by lowering your carbon footprint.
- Reduce your energy consumption by investing in proper insulation which will increase your energy independence.
- Save money and enhance your home by limiting the amount of energy that can escape through this measure which will lower your utility bills.

Potential Energy Reduction: 10% - 18% | Estimated 5 Year Savings: $630 - $1065

Add Wall Insulation

3 **Add CO Detectors** — Save money by protecting against home health risks.

- Protect your family against gas leakage especially in regards to the risky effects it can have on your health.
- Gain more control over the quality of indoor air in your home by investing in these detectors.
- These detectors will ensure that the fuel burning appliances in your home are not releasing lethal amounts of gases.

Potential Energy Reduction: N/A | Estimated 5 Year Savings: N/A

Add Smoke/CO Detectors

4 **Insulate Hotwater Pipes of Water Heater** — Save money on your hot water heating costs.

- Save more on your monthly hot water heating costs by taking this step to ensure you are getting the most from the energy you pay for.
- Enable yourself to have more control over your energy use by insulating your hotwayer pipes of water heater.
- Enhance the comfort and performance of your water heater by fortifying it with insulation.

Potential Energy Reduction: ~1% | Estimated 5 Year Savings: $25 - $40

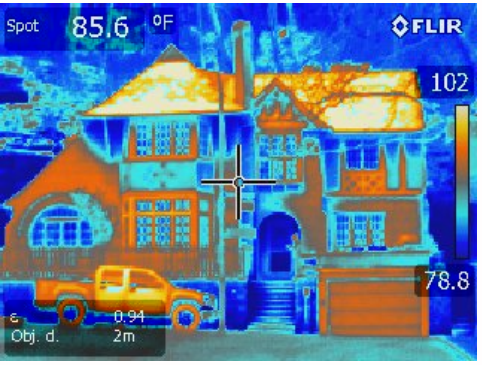
Insulate Hotwater Pipes of Water Heater

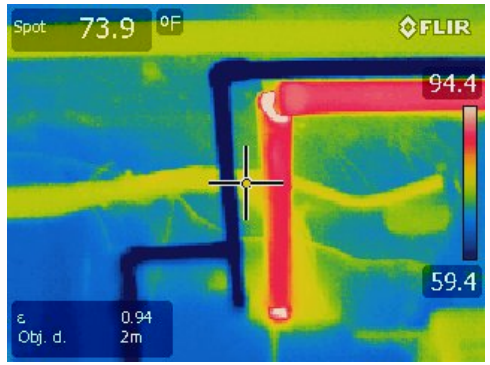
5 **Add weather stripping on doors** — Reduce energy leakage from the door.

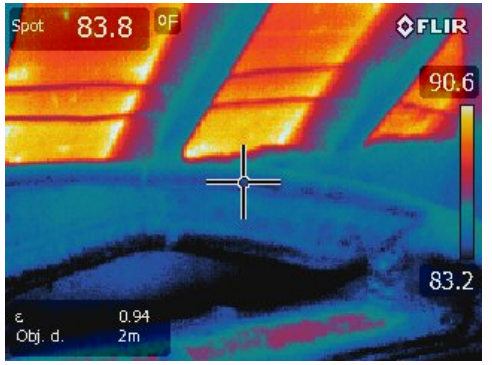
- Reduce energy leakage through the gaps of the door.
- Reduce your energy consumption and improve the energy efficiency.
- Save money and enhance your home by limiting the amount of energy that can escape through this measure which will lower your utility bills.

Potential Energy Reduction: 2% - 3% | Estimated 5 Year Savings: $130 - $200

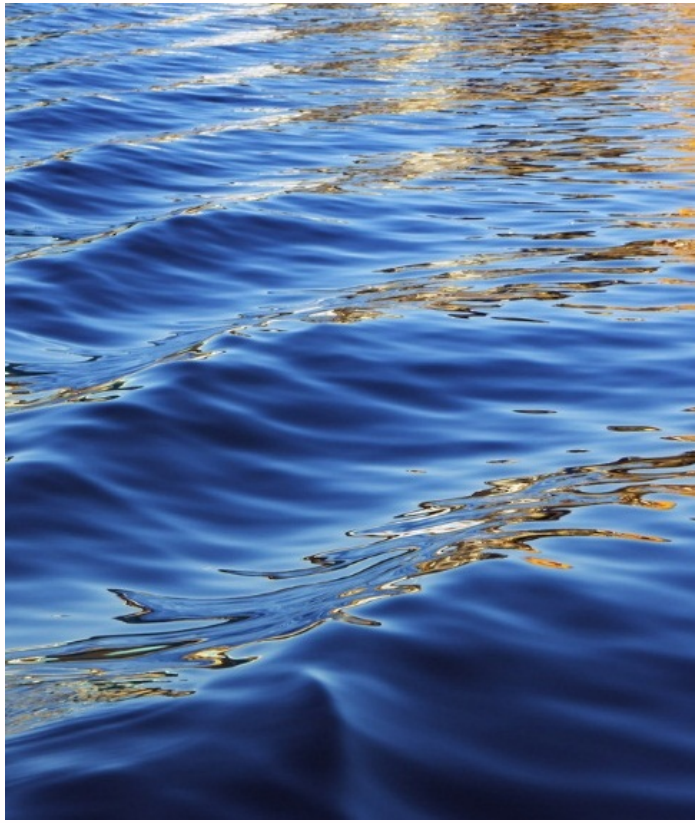
Add weather stripping on doors





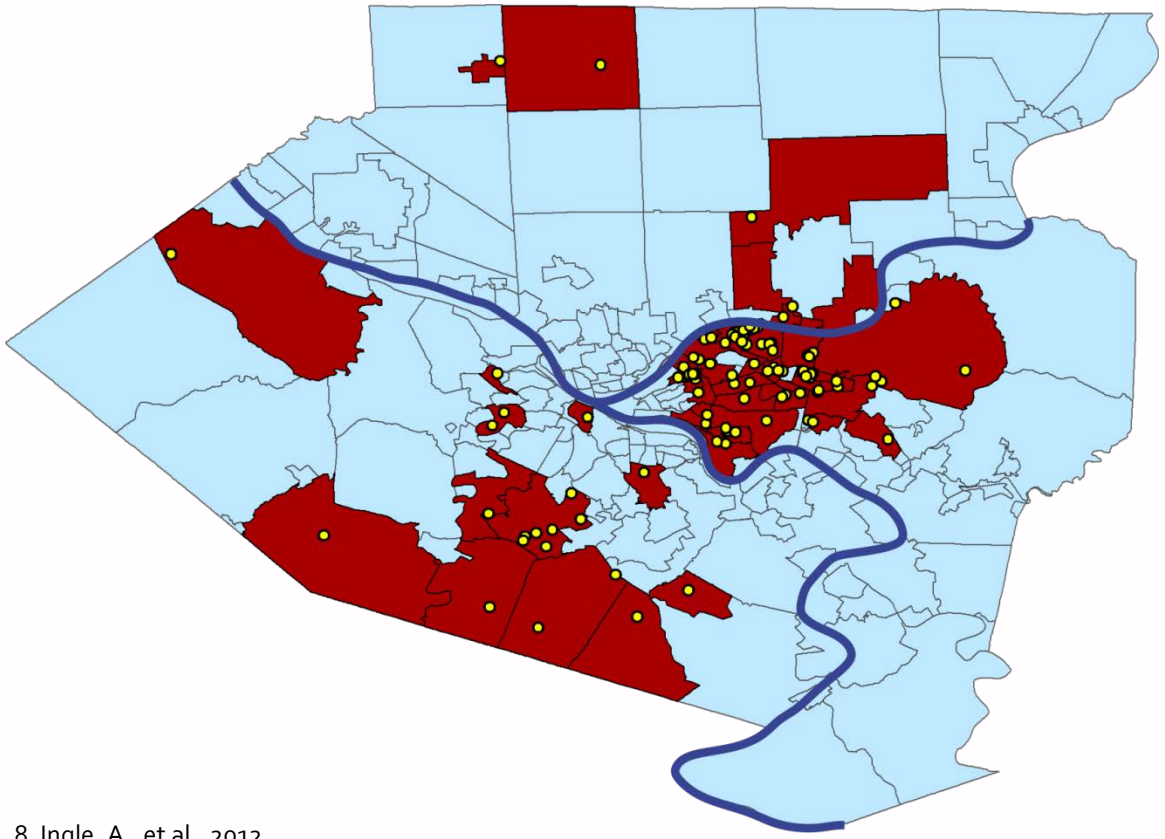


Survey Design and Implementation

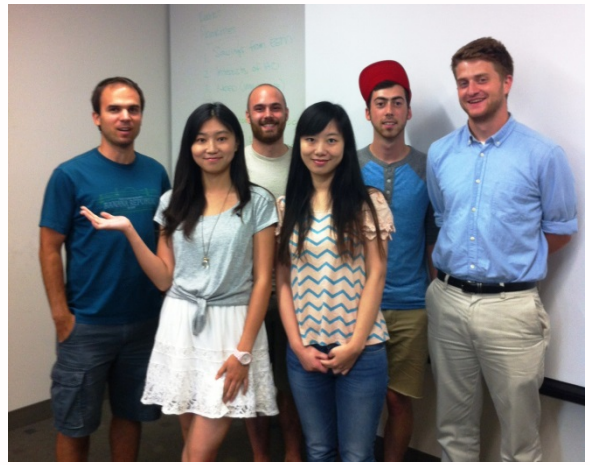


Survey Population

Assessment Period	Number of Homes Assessed	Number of Homes Receiving Survey	Number of Survey Respondents	Response Rate	Years Since Assessment
Spring 2012	13	10	5	50%	3
Summer 2012	7	0	0	-	2 ¾
Spring 2013	9	7	5	71%	2
Summer 2013	49	36	6	17%	1 ¾
Spring 2014	12	12	7	58%	1
Summer 2014	19	17	4	24%	¾
Spring 2015	11	0	0	-	0
	120	82	27	33%	

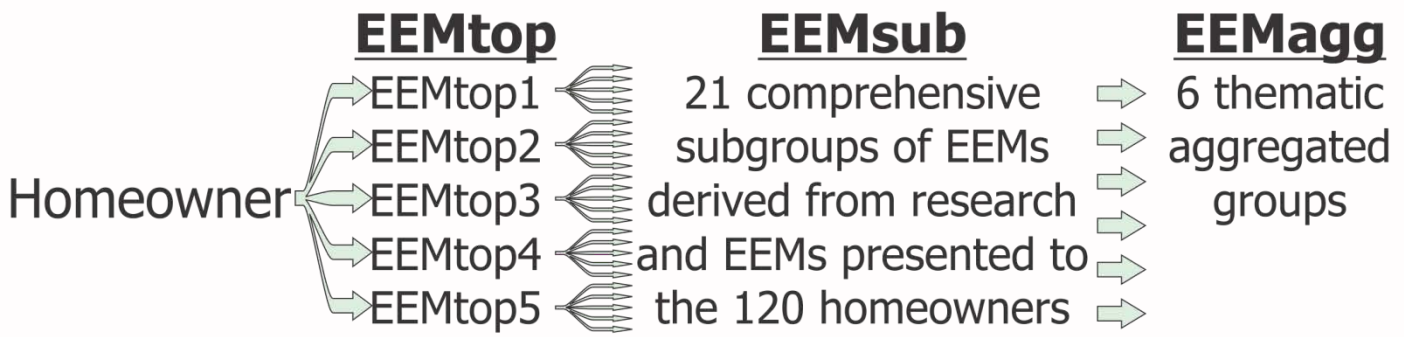


- Qualification for Participation in Survey
  1. Minimum 9 months since energy assessment[8]
  2. Valid email address
- Participants had choice to skip questions
- University of Pittsburgh's Internal Review Board exemption approval #PRO15030578



8. Ingle, A., et al., 2012

Survey Design



Section 1

EEMtop1

Your Number 1 Energy Efficiency Recommendation was EEMtop1

Q1.1 Have you implemented this energy efficiency recommendation?

Q2.1 I have made my decision on this home energy efficiency recommendation, because:
SAVE, COMF, BUDG, TIME, INFO, SKIL, PRIO

Q3.1 Please provide any feedback you have for this energy efficiency recommendation.

• • •

EEMtop5

Your Number 5 Energy Efficiency Recommendation was EEMtop5

Q1.5 Have you implemented this energy efficiency recommendation?

Q2.5 I have made my decision on this home energy efficiency recommendation, because:
SAVE, COMF, BUDG, TIME, INFO, SKIL, PRIO

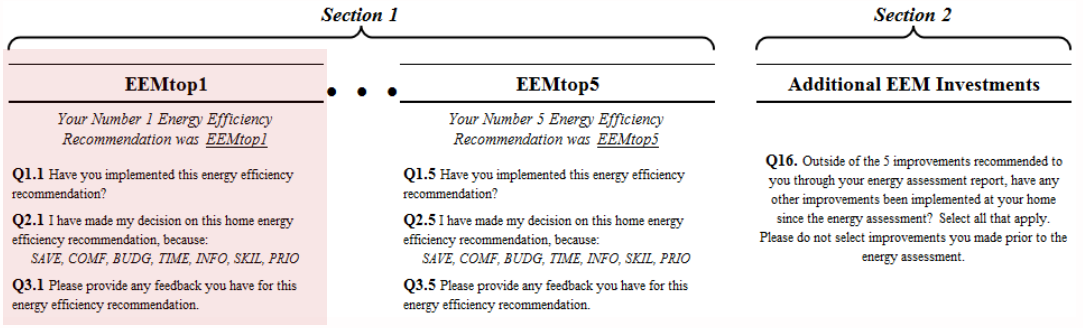
Q3.5 Please provide any feedback you have for this energy efficiency recommendation.

Section 2

Additional EEM Investments

Q16. Outside of the 5 improvements recommended to you through your energy assessment report, have any other improvements been implemented at your home since the energy assessment? Select all that apply. Please do not select improvements you made prior to the energy assessment.

Section 1 – Direct Impact



Binomial Coding

Your **Number 1** Energy Efficiency Recommendation was **EEM1**

Have you implemented this energy efficiency recommendation

1 0 0 0 0

- Yes, I have done it.
- I will do it in the next month.
- I will do it in the next year.
- I do not anticipate ever making this improvement.
- I am uncertain.

Whether you ***have completed***, ***plan to*** or ***do not plan*** to perform this recommendation, please answer the following questions describing your motivation for your decision by indicating the strength of agreement with each statement: Strongly Disagree, Disagree, Agree, or Strongly Agree.

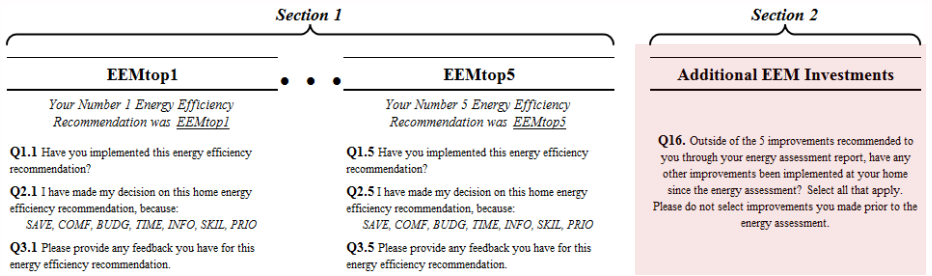
I have made my decision on this home energy efficiency recommendation, because:

Survey Coding		Strongly Disagree	Disagree	Agree	Strongly Agree
SAVE	This recommendation will save me money on my utility bills.	0	0	1	1
COMF	This recommendation will improve the comfort of my home.	Binomial Coding			
BUDG	The cost of performing this recommendation is within budget.				
TIME	I will have time to complete this recommendation.	○	○	○	○
INFO	I have the information needed to perform this recommendation.	○	○	○	○
SKIL	I have skills and/or abilities needed to perform this recommendation.	○	○	○	○
PRIO	This recommendation is a priority on my list of home improvement projects.	○	○	○	○

Section 2 – Catalytic Impact

Outside of the 5 improvements recommended to you through your energy assessment report, have **any other** improvements been implemented at your home since the energy assessment? *Select all that apply. Please do not select improvements you made prior to the energy assessment.*

- ☐ Upgraded light bulbs to **compact fluorescent** or **LEDs**
- ☐ Upgraded any major appliance (e.g. **refrigerator, clothes washer, clothes dryer**)
- ☐ Added a **home energy management system**
- ☐ Upgraded to **smart power strips**
- ☐ Upgraded your primary heating source (e.g. **furnace, boiler, heat pump**)
- ☐ Upgraded **programmable thermostat**
- ☐ Upgraded **central air conditioner**
- ☐ Added **whole house fan**
- ☐ Added **ductless air conditioner**
- ☐ Upgraded the **water heater**
- ☐ Added water heater and/or pipe **insulation**
- ☐ Installed water reducing technology (e.g. **faucet aerators, low-flow fixtures**)
- ☐ Added **air duct insulation** and/or **air sealant**
- ☐ Added **insulation** in attic, walls, and/or floors
- ☐ Upgraded windows (e.g. **storm windows, double pane**)
- ☐ Weatherized **doors or windows**
- ☐ Repointed brick exterior
- ☐ Purchased renewable energy from a utility
- ☐ Installed on-site renewable energy (e.g. **solar panels, solar lights, wind turbine, solar water heating**)
- ☐ Added **smoke detectors**
- ☐ Added **carbon monoxide detectors**



Appliances
- B. Major appliances
- D. Power strips

HVAC
- E. Primary heating source
- F. Programmable thermostat
- H. Air ducts
- I. Central AC
- J. Whole house fan
- K. Ductless AC

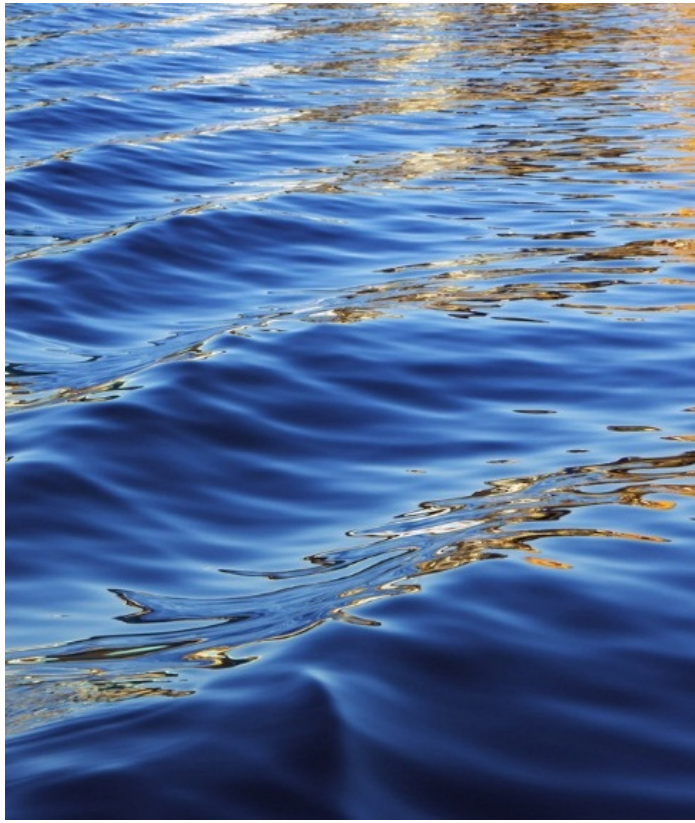
Envelope
- G. Weatherization
- O. Repointed brick
- P. Insulation
- Q. Windows

Water Heating & Water Reduction
- L. Water heater
- M. Water heater insulation
- N. Water reduction

Lighting
- A. Lighting

Other Improvements
- C. Home energy management system
- R. Purchase 'green' energy from a utility
- S. Smoke detectors
- T. CO detectors
- U. On-site renewable energy

Survey Results



Statistical Methods

2-sample hypothesis test on the difference in proportions

Analyze relationship between homeowners' perceptions on motivators and adoption rates

- 95% confidence level
- Two-tailed — Lower-tailed
- $H_0: p_1 = p_2$, $H_1: p_1 \neq p_2$ — $H_0: p_1 = p_2$, $H_1: p_1 < p_2$

Contingency Tables

Analyze independence of homeowners' perceptions on motivators and adoption rates

- Chi-square test for independence

Binomial Coding of Results – perceptions should mirror adoption

Results: 2-sample test on difference in proportion

	Adopted	N_{EEM1}	Adoption Rate
EEMtop1	11	27	41%

			P-value	
Motivation	Event	$N_{motivator}$	Two-tail	Lower-tail
SAVE	24	26	0.000	0.000
COMF	21	26	0.001	0.001
BUDG	19	26	0.012	0.006
TIME	18	26	0.030	0.015
INFO	20	26	0.004	0.002
SKIL	***15***	***26***	***0.211***	***0.105***
PRIO	18	26	0.030	0.015

	Adopted	N_{EEM2}	Adoption Rate
EEMtop2	6	27	22%

			P-value	
Motivation	Event	$N_{motivator}$	Two-tail	Lower-tail
SAVE	22	25	0.000	0.000
COMF	19	25	0.000	0.000
BUDG	13	24	0.014	0.007
TIME	14	25	0.008	0.004
INFO	16	25	0.001	0.000
SKIL	***10***	***25***	***0.160***	***0.080***
PRIO	13	24	0.014	0.007

	Adopted	N_{EEM3}	Adoption Rate
EEMtop3	11	25	44%

			P-value	
Motivation	Event	$N_{motivator}$	Two-tail	Lower-tail
SAVE	17	23	0.027	0.013
COMF	***14***	***23***	***0.235***	***0.118***
BUDG	***14***	***23***	***0.235***	***0.118***
TIME	19	23	0.002	0.001
INFO	20	23	0.000	0.000
SKIL	***15***	***23***	***0.131***	***0.065***
PRIO	***14***	***23***	***0.235***	***0.118***

	Adopted	N_{EEM4}	Adoption Rate
EEMtop4	7	25	28%

			P-value	
Motivation	Event	$N_{motivator}$	Two-tail	Lower-tail
SAVE	20	23	0.000	0.000
COMF	15	23	0.005	0.003
BUDG	15	23	0.005	0.003
TIME	17	23	0.000	0.000
INFO	17	23	0.000	0.000
SKIL	***11***	***23***	***0.149***	***0.075***
PRIO	14	23	0.015	0.008

	Adopted	N_{EEM5}	Adoption Rate
EEMtop5			

Motivation	
SAVE	
COMF	
BUDG	
TIME	
INFO	
SKIL	
PRIO	

	Appliances		HVAC		Envelope		Water Heating and Water Reduction		Lighting		Other Improvements	
	Rec.	**Adopt.**	Rec.	**Adopt.**	Rec.	**Adopt.**	Rec.	**Adopt.**	Rec.	**Adopt.**	Rec.	**Adopt.**
EEMtop1	0	**0**	5	**0**	14	**8**	2	**0**	4	**3**	2	**0**
EEMtop2	2	**1**	6	**1**	13	**2**	1	**0**	2	**2**	3	**0**
EEMtop3	1	**0**	7	**3**	11	**5**	3	**1**	1	**1**	2	**1**
EEMtop4	4	**2**	3	**1**	10	**3**	7	**1**	0	**0**	1	**0**
EEMtop5	8	**1**	2	**0**	7	**2**	5	**0**	0	**0**	2	**1**
Total and **Rate**	15	**27%**	23	**22%**	55	**36%**	18	**11%**	7	**86%**	10	**20%**

Results: 2-sample test on difference in proportion

	Adopted	N_{EEM1}	Adoption Rate
EEMtop1	11	27	41%

			P-value	
Motivation	Event	$N_{motivator}$	Two-tail	Lower-tail
SAVE	24	26	0.000	0.000
COMF	21	26	0.001	0.001
BUDG	19	26	0.012	0.006
TIME	18	26	0.030	0.015
INFO	20	26	0.004	0.002
SKIL	***15***	***26***	***0.211***	***0.105***
PRIO	18	26	0.030	0.015

	Adopted	N_{EEM2}	Adoption Rate
EEMtop2	6	27	22%

			P-value	
Motivation	Event	$N_{motivator}$	Two-tail	Lower-tail
SAVE	22	25	0.000	0.000
COMF	19	25	0.000	0.000
BUDG	13	24	0.014	0.007
TIME	14	25	0.008	0.004
INFO	16	25	0.001	0.000
SKIL	***10***	***25***	***0.160***	***0.080***
PRIO	13	24	0.014	0.007

	Adopted	N_{EEM3}	Adoption Rate
EEMtop3	11	25	44%

			P-value	
Motivation	Event	$N_{motivator}$	Two-tail	Lower-tail
SAVE	17	23	0.027	0.013
COMF	***14***	***23***	***0.235***	***0.118***
BUDG	***14***	***23***	***0.235***	***0.118***
TIME	19	23	0.002	0.001
INFO	20	23	0.000	0.000
SKIL	***15***	***23***	***0.131***	***0.065***
PRIO	***14***	***23***	***0.235***	***0.118***

	Adopted	N_{EEM4}	Adoption Rate
EEMtop4	7	25	28%

			P-value	
Motivation	Event	$N_{motivator}$	Two-tail	Lower-tail
SAVE	20	23	0.000	0.000
COMF	15	23	0.005	0.003
BUDG	15	23	0.005	0.003
TIME	17	23	0.000	0.000
INFO	17	23	0.000	0.000
SKIL	***11***	***23***	***0.149***	***0.075***
PRIO	14	23	0.015	0.008

	Adopted	N_{EEM5}	Adoption Rate
EEMtop5	4	24	17%

			P-value	
Motivation	Event	$N_{motivator}$	Two-tail	Lower-tail
SAVE	17	21	0.000	0.000
COMF	11	20	0.004	0.002
BUDG	10	20	0.014	0.007
TIME	14	20	0.000	0.000
INFO	11	20	0.004	0.002
SKIL	10	20	0.014	0.007
PRIO	***8***	***20***	***0.080***	0.040

Results: 2-sample test on difference in proportion

	Adopted	N_{EEM1}	Adoption Rate
EEMtop1	11	27	41%

			P-value	
Motivation	Event	$N_{motivator}$	Two-tail	Lower-tail
SAVE	24	26	0.000	0.000
COMF	21	26	0.001	0.001
BUDG	19	26	0.012	0.006
TIME	18	26	0.030	0.015
INFO	20	26	0.004	0.002
SKIL	***15***	***26***	***0.211***	***0.105***
PRIO	18	26	0.030	0.015

	Adopted	N_{EEM2}	Adoption Rate
EEMtop2	6	27	22%

			P-value	
Motivation	Event	$N_{motivator}$	Two-tail	Lower-tail
SAVE	22	25	0.000	0.000
COMF				
BUDG				
TIME				
INFO				
SKIL				
PRIO				

	Adopted	N_{EEM3}	Adoption Rate
EEMtop3	11	25	44%

			P-value	
Motivation	Event	$N_{motivator}$	Two-tail	Lower-tail
SAVE	17	23	0.027	0.013

	Adopted	N_{EEM4}	Adoption Rate
EEMtop4	7	25	28%

			P-value	
Motivation	Event	$N_{motivator}$	Two-tail	Lower-tail
SAVE	20	23	0.000	0.000
COMF	15	23	0.005	0.003
BUDG	15	23	0.005	0.003
TIME	17	23	0.000	0.000
INFO	17	23	0.000	0.000
SKIL	***11***	***23***	***0.149***	***0.075***
PRIO	14	23	0.015	0.008

	A
EEMtop5	

Motivation	Event	$N_{motivator}$	Two-tail	Lower-tail
SAVE				
COMF	11	20	0.004	0.002
BUDG	10	20	0.014	0.007
TIME	14	20	0.000	0.000
INFO	11	20	0.004	0.002
SKIL	10	20	0.014	0.007
PRIO	***8***	***20***	***0.080***	0.040

	Appliances		HVAC		Envelope		Water Heating and Water Reduction		Lighting		Other Improvements	
	Rec.	**Adopt.**	Rec.	**Adopt.**	Rec.	**Adopt.**	Rec.	**Adopt.**	Rec.	**Adopt.**	Rec.	**Adopt.**
EEMtop1	0	**0**	5	**0**	14	**8**	2	**0**	4	**3**	2	**0**
EEMtop2	2	**1**	6	**1**	13	**2**	1	**0**	2	**2**	3	**0**
EEMtop3	1	**0**	7	**3**	11	**5**	3	**1**	1	**1**	2	**1**
EEMtop4	4	**2**	3	**1**	10	**3**	7	**1**	0	**0**	1	**0**
EEMtop5	8	**1**	2	**0**	7	**2**	5	**0**	0	**0**	2	**1**
Total and **Rate**	15	**27%**	23	**22%**	55	**36%**	18	**11%**	7	**86%**	10	**20%**

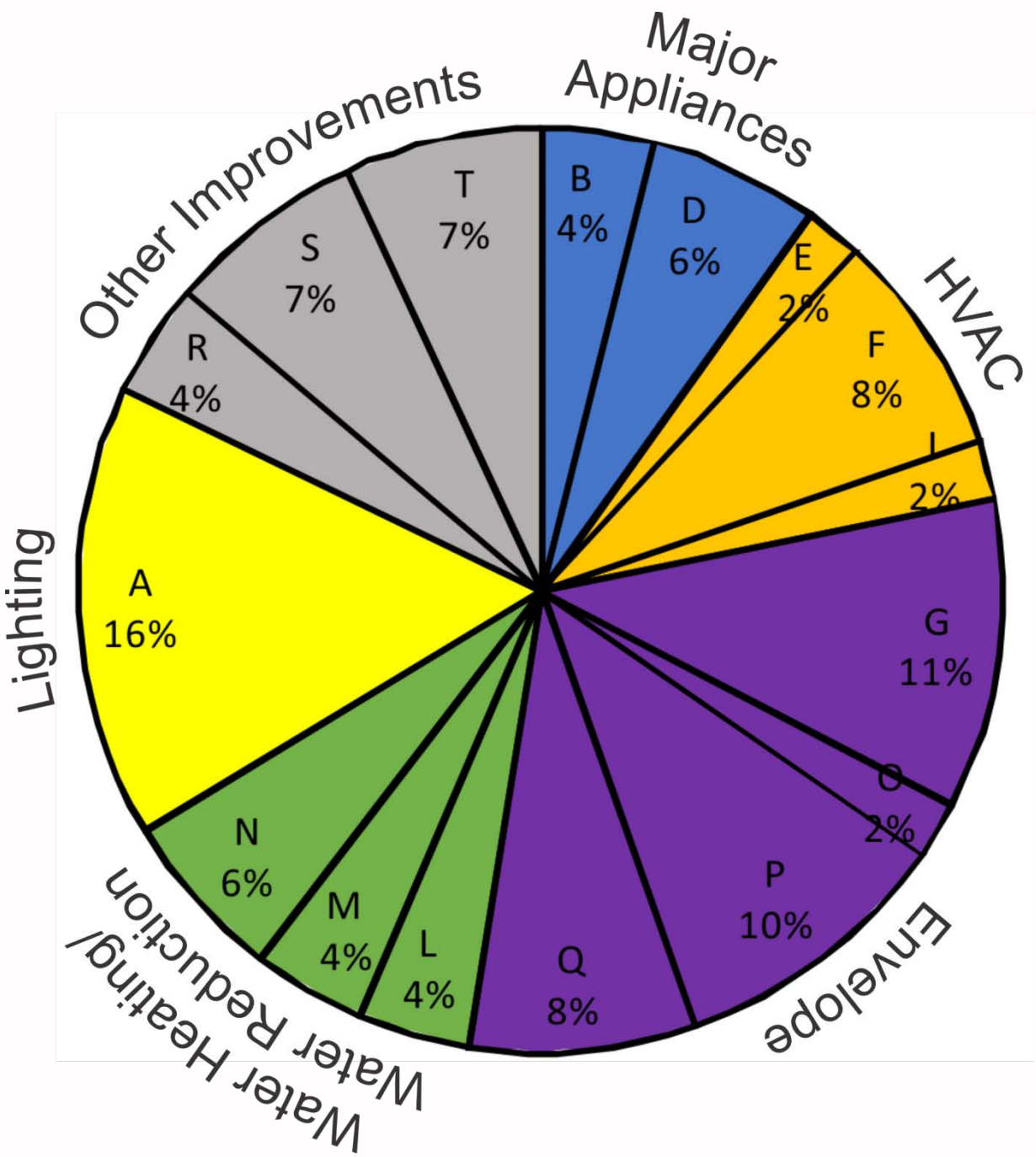
Results: Contingency Tables

			Chi-Square Test Statistic for each Barrier (chi-square critical = 3.84)						
EEMagg Grouping	$N_{\chi 2}$	df	SAVE	COMF	BUDG	TIME	INFO	SKIL	PRIO
Appliances	15	1	1.33	0.15	1.33	1.33	2.86	1.33	1.03
HVAC	23	1	2.05	1.09	0.53	0.69	1.54	0.13	**5.97**
Envelope	55	1	2.71	2.69	**20.28**	**12.46**	**10.13**	**4.64**	**13.94**
Water Heating & Water Reduction	18	1	0.45	0.94	1.24	1.24	0.49	1.59	2.01

	Appliances		HVAC		Envelope		Water Heating and Water Reduction		Lighting		Other Improvements	
	Rec.	**Adopt.**	Rec.	**Adopt.**	Rec.	**Adopt.**	Rec.	**Adopt.**	Rec.	**Adopt.**	Rec.	**Adopt.**
EEMtop1	0	**0**	5	**0**	14	**8**	2	**0**	4	**3**	2	**0**
EEMtop2	2	**1**	6	**1**	13	**2**	1	**0**	2	**2**	3	**0**
EEMtop3	1	**0**	7	**3**	11	**5**	3	**1**	1	**1**	2	**1**
EEMtop4	4	**2**	3	**1**	10	**3**	7	**1**	0	**0**	1	**0**
EEMtop5	8	**1**	2	**0**	7	**2**	5	**0**	0	**0**	2	**1**
Total and **Rate**	15	**27%**	23	**22%**	55	**36%**	18	**11%**	7	**86%**	10	**20%**

Catalytic Impacts

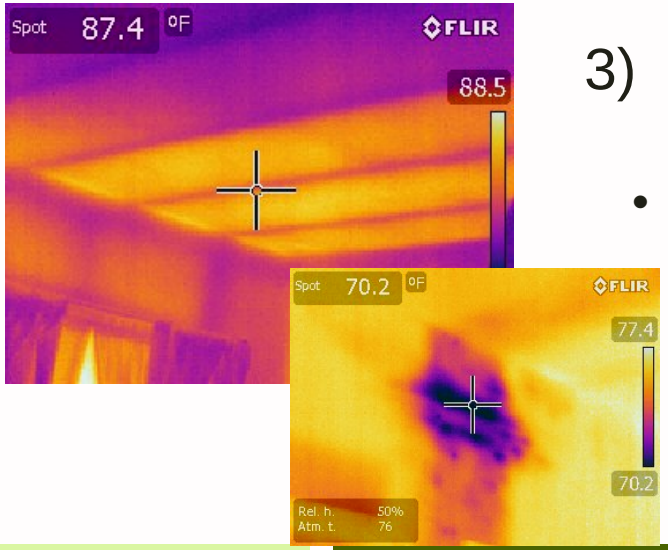
EEMagg	EEMsub	Description	Total Implemented	
Appliances	B	Major appliances	4	10
	D	Power strips	6	
HVAC	E	Primary heating source	2	12
	F	Programmable thermostat	8	
	I	Central AC	2	
Envelope	G	Weatherization	11	31
	O	Repointed brick	2	
	P	Insulation	10	
	Q	Windows	8	
Water Heating and Water Reduction	L	Water heater	4	14
	M	Water heater insulation	4	
	N	Water reduction	6	
Lighting	A	Lighting	16	16
Other Improvements	R	Purchase renewable energy	4	18
	S	Smoke detectors	7	
	T	CO detectors	7	



Lessons Learned, in the context of Program Efficacy

1) Adoption rates are within the range of other reported programs (30% by EEM and 85% by household)
   - Suggests a holistic approach is neither good nor bad

2) Programs should track catalytic impacts of energy conservation strategies
   - Catalytic impacts in this sample suggest an EEM implementation rate over 100%
   - Continued participation is difficult



3) The “low-hanging fruit” are becoming well established in homes, leaving comprehensive improvements
   - These will be harder to get homeowners to invest, because of BUDG, TIME, SKIL, and PRIO, as seen in the survey results

Lessons Learned, in the context of the NELC

1) Students enter the course with minimal understanding of the “home as a system,” but grow quickly
   - A longitudinal study would provide insight to student retention, future energy decisions, and involvement in energy efficiency; a tenet of the NELC is to support the energy audit workforce

2) Time investments are extremely high during initial phases of program implementation
   - Community engagement
   - Partnerships with local organizations