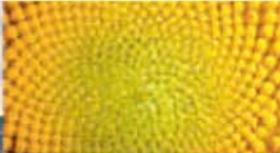
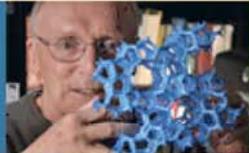


The Persistence of Feedback-Induced Energy Savings in the Residential Sector: Evidence from a Meta-Review



Karen Ehrhardt-Martinez, Ph.D.
 Behavior, Energy and Climate Change Conference
 November 16, 2010



The complete research report is entitled:

Advanced Metering Initiatives and Residential Feedback Programs

June 2010

Karen Ehrhardt-Martinez – RASEI

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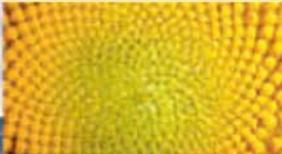
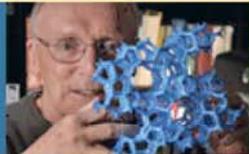
Kat A. Donnelly – Empower Devices



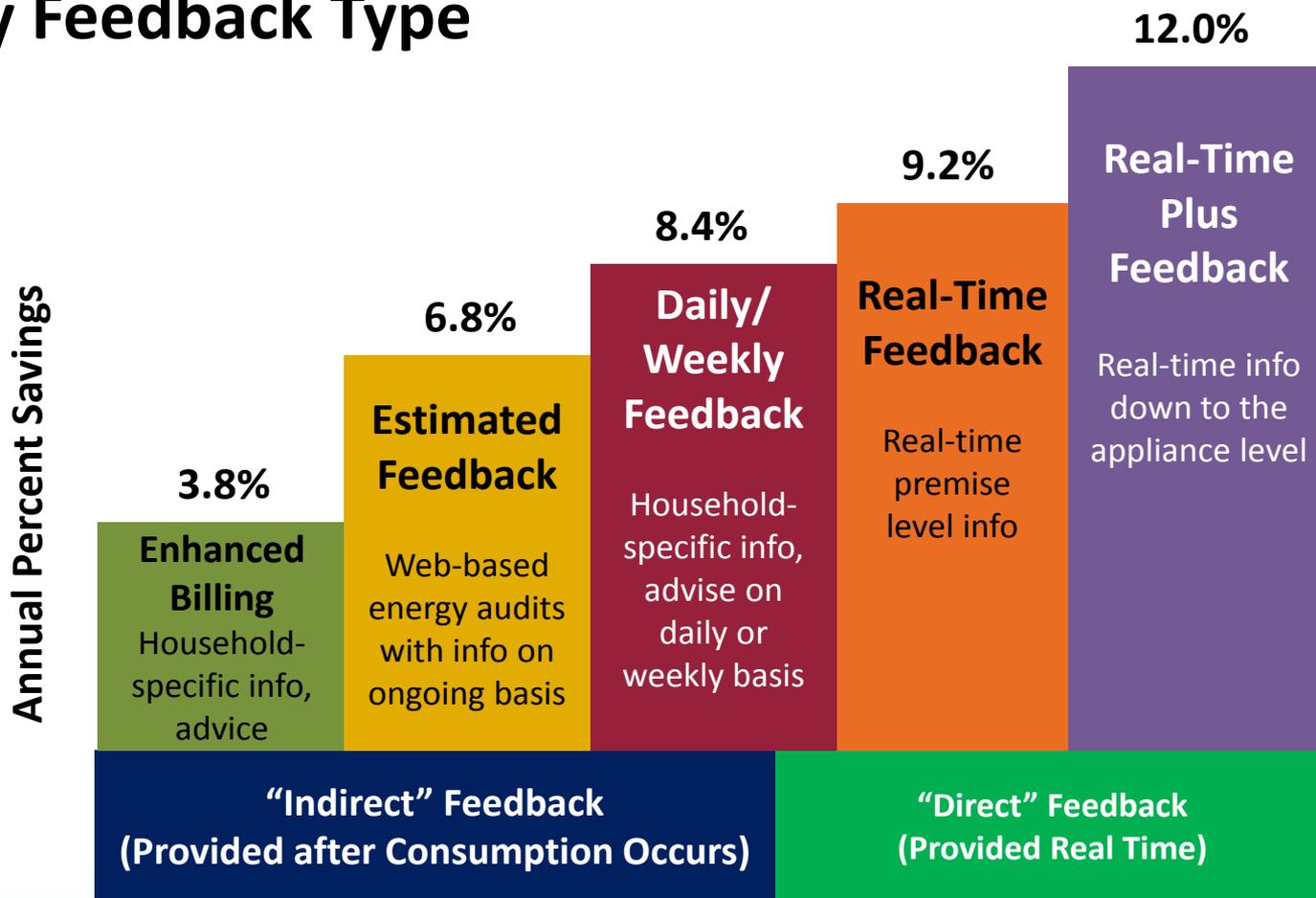
An assessment of 61 primary research studies of 57 feedback initiatives:

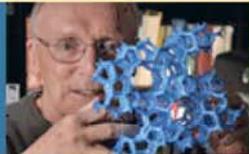
- Several continents and 9 countries
- 21 studies 1974-1994 – What we call the “Energy Crisis Era”
- 36 studies 1995-2010 – What we call the “Climate Era”

Region	Number of Studies	Percent
United States	33	57%
Europe	13	22%
Canada	9	16%
Other	3	5%



Average Household Electricity Savings of 4-12 Percent by Feedback Type

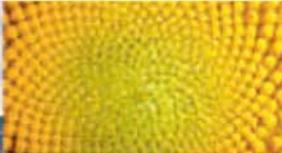
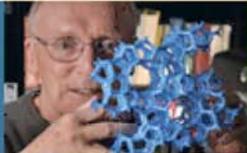




Which Behaviors Change?

Frequency of Action

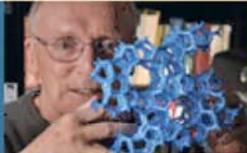
		<i>Infrequent</i>	<i>Frequent</i>
Cost	<i>Low-cost / no cost</i>	Energy Stocktaking Behavior Install CFLs Pull fridge away from wall Inflate tires adequately Install Weather Stripping	Habitual Behaviors and Lifestyles Slower Highway Driving Slower Acceleration Air Dry Laundry Turn Off Computer/Other Devices
	<i>Higher cost / Investment</i>	Consumer Behavior New EE Windows New EE Appliances Additional Insulation New EE Car New EE AC or Furnace	



The Question of Persistence

Do the feedback-induced behaviors and energy savings persist over time?

- What should we expect?
- What methods were used to evaluate the persistence of savings?
- What does the historical evidence tell us?



The Question of Persistence

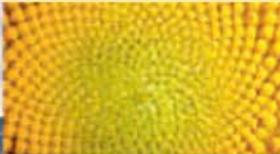
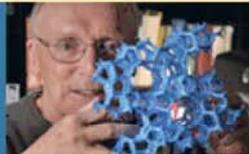
What we might expect:

Why Feedback is **Likely** to Result in Persistent Savings:

- Feedback helps consumers to learn the energy consequences of specific behaviors, and that information reduces uncertainty about the effectiveness of new behaviors.
- Feedback helps people to establish new habits and they no longer need to be energy conscious all the time. New behaviors become automatic.
- Feedback elicits energy conserving behaviors and after a while people adapt their attitudes to their new behaviors and energy conservation becomes a new part of their identity.

Why Feedback is **Unlikely** to Result in Persistent Savings

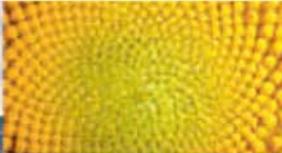
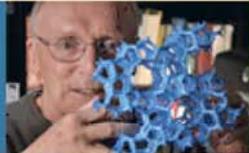
- The novelty of energy feedback may wear off and people will fall back into old habits and practices.



The Question of Persistence

What Methods were used to Assess Persistence?

- An evaluation of the relationship between study duration and energy savings.
- A qualitative evaluation of the 28 studies that reported the on persistence of energy savings.
- A qualitative evaluation of the 9 studies that considered the question of persistence over the longest periods of time.

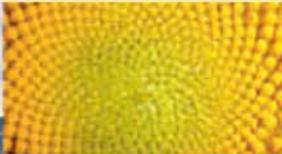


Study Duration and Energy Savings

	Number of Studies		Range of Savings	Average Savings	Median Savings
	#	%			
Shorter Duration Studies (6 months or less)	31	57%	0.5 -32%	10.10%	9.30%
Longer Duration Studies (> 6 months)	23	43%	-5.5 -21%	7.50%	7.20%



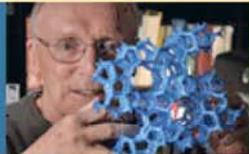
Strike One



Study Duration and Energy Savings

	Small (≤ 100)			Large (> 100)			Total		
	Average Savings	Median Savings	Number of Studies	Average Savings	Median Savings	Number of Studies	Average Savings	Median Savings	Number of Studies
DURATION									
Short (≤ 6 months)	13.3%	13.0%	18	6.6%	6.0%	13	10.1%	9.3%	31
Long (> 6 months)	8.7%	7.2%	9	6.7%	6.3%	14	7.7%	7.4%	23
Total	11.6%	12.0%	27	6.6%	6.0%	27	9.1%	8.5%	54

- ✓ Among the larger studies there is no clear distinction between duration and energy savings.
- ✗ Among the smaller studies, the relationship continues to be evident.



Persistence of Savings Across 28 Studies

Persistent Feedback	Number	Percent
Persistent Savings	12	60%
Increased Savings	2	10%
Diminished Savings	2	10%
Unclear/ Other	4	20%
Total	20	100%

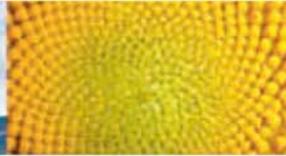
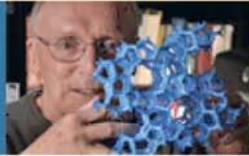
✓ 70% of studies showed persistent or increased savings.

Feedback was Discontinued	Number	Percent
Persistent Savings	3	50%
Increased Savings	2	33%
Diminished Savings	1	17%
Total	6	100%

✓ 83% of studies showed persistent or increased savings.

Persistence Measured in Terms of Device Usage (2 studies)

*use of device was found to decline over time.

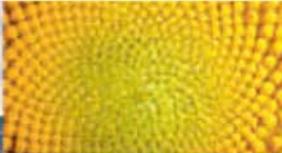
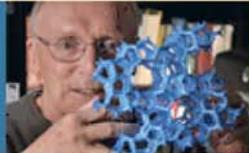


Evidence from 9 Longest Studies

Study Duration: 12 to 36 months

Most Studies did not test the effect of removing feedback.

- ✓ All Studies with consistent feedback had persistent savings – 2 found that savings *increased* with time.
- ✗ Two Studies tested for persistence following the removal of feedback. Savings did not persist in one (Van Houwelling 1989), they did in the other (Staats et al. 2004).
- ✓



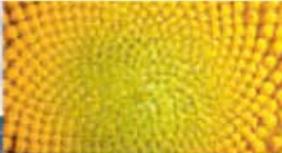
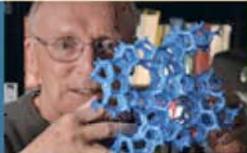
A Supportive Social Environment Matters

Staats et al. (2004)

Study: Looked at a range of sustainability behaviors of participants in the EcoTeam Program over 3 years.

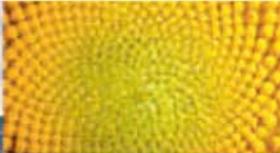
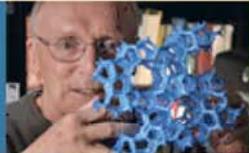
Purpose: to assess the ability of feedback and a supportive social environment to create durable changes in behaviors.

	T0		T1		T2	
	M	% change	M	% change	M	% change
Solid Waste (kg per person per day)	0.216	0.0%	0.153	28.5%	0.145	32.1%
Natural Gas (cubic meters per person per day)	0.299	0.0%	0.237	20.5%	0.248	16.9%
Electricity (Kwh per person per week)	27.20	0.0%	25.90	4.6%	25.10	7.6%
Water (cubic meters per person per week)	0.854	0.0%	0.830	2.8%	0.796	6.7%



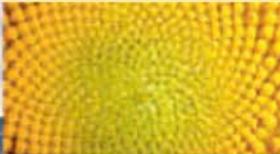
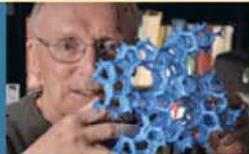
Some Conclusions

- Most Feedback-induced savings come from changes in everyday practices or energy stocktaking.
- In some cases, shorter studies had larger savings. These savings were likely to result from trials that were held during the summer months and did not indicate a lack of persistence.
- A qualitative assessment of all 23 studies, indicated that three-quarters had persistent savings.
- An assessment of the 9 longest studies indicated that savings are persistent when feedback is persistent or when feedback is provided in a supportive social environment.



Selected References

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This presentation is based on recent research by:

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Kat A. Donnelly, EMpower Devices

The complete research report is entitled:

Advanced Metering Initiatives and Residential Feedback Programs

Available from the American Council for an Energy-Efficient Economy:

<http://www.ACEEE.org/pubs/e105.htm>