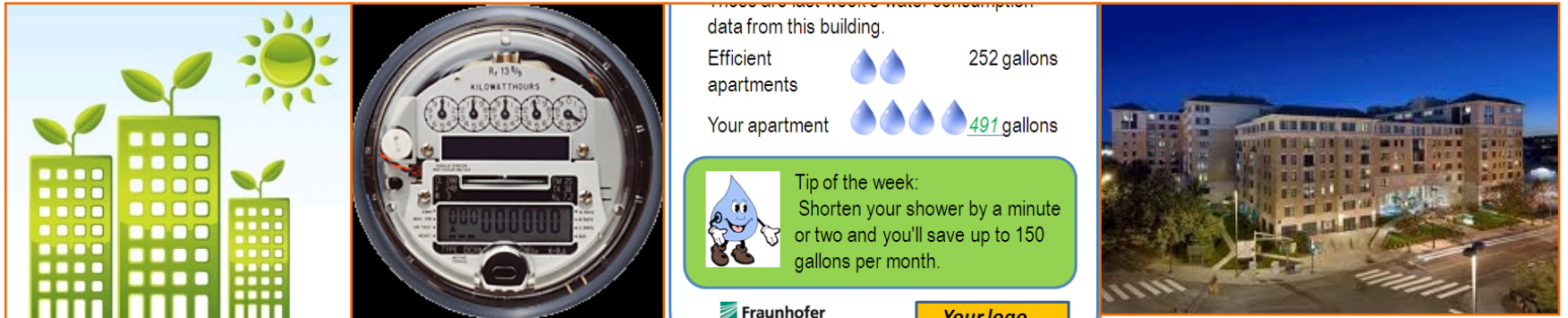# How to make psychology and technology work for you: features of feedback that support behavior change

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The Fraunhofer-Gesellschaft

- Europe's largest non-profit contract research organization

- 18,000+ employees

- > 60 research institutes at 40 locations in Germany

- Annual research budget of about
  US$ 2.3 billion

- 85% of the budget are research contracts for industry, or competitive government grants

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The Fraunhofer Center for Sustainable Energy Systems (CSE)

7th Center of Fraunhofer USA

Founded in April 2008

~40 employees

Startup funded by:

- Fraunhofer Gesellschaft

- Fraunhofer ISE

- Commonwealth of Massachusetts

- National Grid

- Anonymous private donors

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The Fraunhofer CSE Building Energy Efficiency Group: Mission Statement

We perform applied research and development to accelerate the *development*, *commercialization*, and *deployment* of the next generation of energy-saving building technologies and practices.

- Decrease primary energy consumption and CO_2 emissions

- Enhance Durability

- Create a Productive and Healthy Indoor Environment

*Key: An integrated, systems approach!*

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How can we increase feedback value?

- Find the right intervention for the right audience
  - Tailor feedback features to the stage of behavioral change process
- Maximize the opportunities offered by feedback platforms:
  - Web Dashboards
  - Home Energy Displays
  - Smartphone apps

Feedback and Behavior Change

- Feedback is only as good as its influence on behavior and resulting behavior change

- Behavior change is difficult, but it has been done:

Smoking cessation
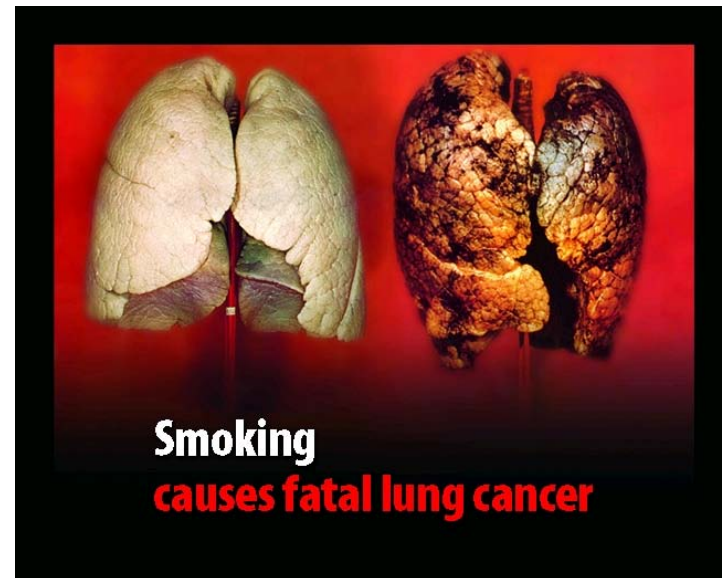
Smoking causes fatal lung cancer

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Feedback and Behavior Change

- Feedback is only as good as its influence on behavior and resulting behavior change

- Behavior change is difficult, but it has been done:

Cancer prevention

Feedback and Behavior Change

- Feedback is only as good as its influence on behavior and resulting behavior change

- Behavior change is difficult, but it has been done:

Health promotion

How Do People Change?

People change voluntarily only when they

- Become *concerned* about the need for change

- Become *convinced* that the change is in their best interests or will benefit them more than cost them

- Organize a *plan of action* that they are *committed* to implementing

- *Take the actions* that are necessary to make the change and sustain the change

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Stages of Change

A leading approach to health behavioral change applied to

energy use behavior

Developed from over 30 years of scientific research

Is currently in use in the fields of

- *Exercising Regularly, Medication Adherence, Smoking Cessation, Stress Management, Weight Management, Consumer Credit Debt Counseling, etc.*

People go through predictable stages in the process of changing behavior

We can help them move along this continuum to achieve Energy Efficiency

- Measure at which stage they are

- Design tailored behavioral tools to encourage progress at each stage

Prochaska & DiClemente, 1982

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Pre-Contemplation Stage

No intention to change, no awareness of problem.

Must raise awareness and goal intentions.

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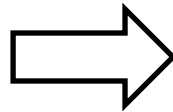USA

Interventions:

Personalize risks and begin a thought process

Provide vivid & personalized info inspiring fear or excitement

Feedback related to energy use, salient social norms

Contemplation Stage

Aware of the problem, thinking of but not yet committed to action.

Provide information and create behavior intention.

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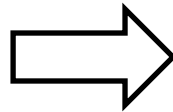**USA**

Contemplation Stage

Interventions:

Help overcome ambivalence

Provide info

Continue feedback

Add goal setting

Provide social support

"I am somewhat informed about energy issues, but I'd like to be more informed."

"I know the lights are left on."

"The system you've described sounds attractive and I'd love to learn more."

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Preparation Stage

Action intention. Getting ready to make change.
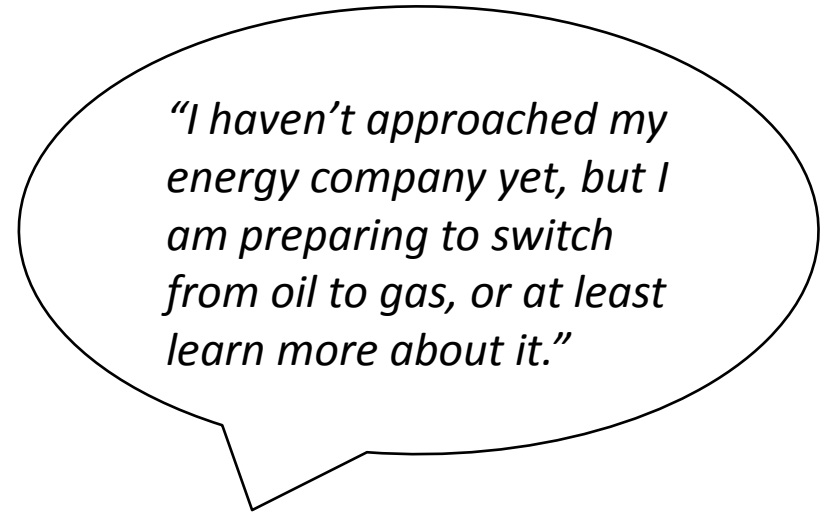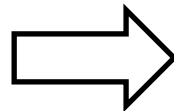
Reduce barriers to action.

Preparation Stage

Interventions:

Create commitment and reduce barriers to action

Making a plan

Incentives

Technology to make new behavior easier

"*I haven't approached my energy company yet, but I am preparing to switch from oil to gas, or at least learn more about it.*"

Action Stage

New habit formation, Large scale changes (lifestyle, routines)
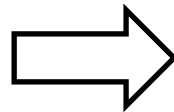
Support new behavior

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Interventions:

Help overcome behavior barriers

Concrete tips on what to do and how

Incentives

Technology to make new behavior easier

> *"We changed all of our bulbs, have looked into getting a smart meter, and just put plastic on the windows the other night!"*

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Stages of behavior change: practical implications

- Learn at which stage your customers are

- Depending on the stage, think about

  - Interventions that should work , e.g., social norms for pre-contemplators

  - interventions that may not work, e.g., providing incentives to pre-contemplators

- Maximize the use of features of your feedback platform to fit the needs of all stages and tailor them, if possible

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How to make feedback more actionable?

Users will spend only about 1 minute per day monitoring their energy use!

- *Goal: Let's try to maximize this as much as we can*
  - *Look at different media*
  - *Look at different designs*
  - *Which is most <u>actionable?</u>*

Source: Froehlich (2010)

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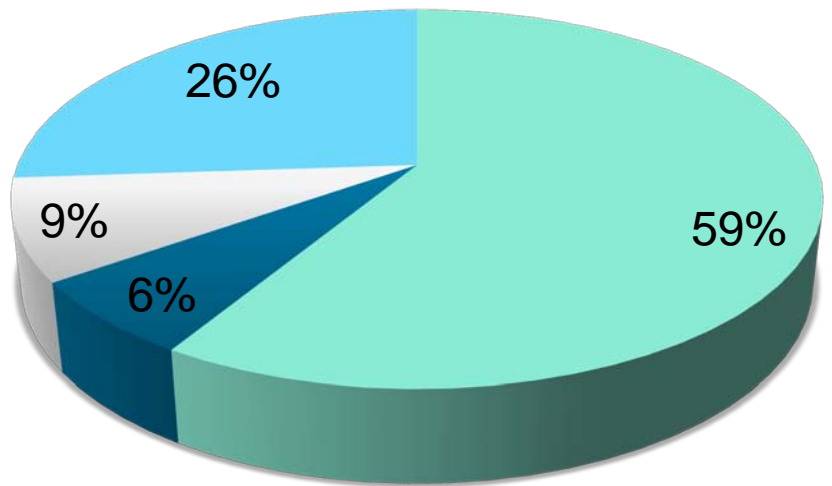USA

HEDs

Web dashboards

Smartphone apps

Study Topics

- Preferred features of HEM

- Hypothetical usage scenarios including time of day and preferred medium

- Influence of brand, and willingness to pay

Source: LaMarche et al. (2011)

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Which feature of home energy management would you be most interested in? (check one)

59%

26%

9%

6%

- Real-time electricity consumption monitoring
- Cost and bill information or prediction
- Carbon footprint
- Energy-reducing tips and education

If you knew it would reduce your energy consumption and bills, approximately how much would you be willing to pay for home energy management?

Less than $100	50%
$100-$300	33%
$300-$500	15%
Over $500	2%

Source: LaMarche et al. (2011)

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What time of day would you be most likely to check your home energy use?

Morning	9%
Commute	4%
At work	4%
Evening	65%
Before bed	17%

What other things would you want your home energy management system to have, if any?

(Check all that apply)

Social networking	0%
Energy facts/news	11%
Games	1%
Automation features	40%
Weather	21%
Goal setting	23%
None, just energy	4%

Source: LaMarche et al. (2011)

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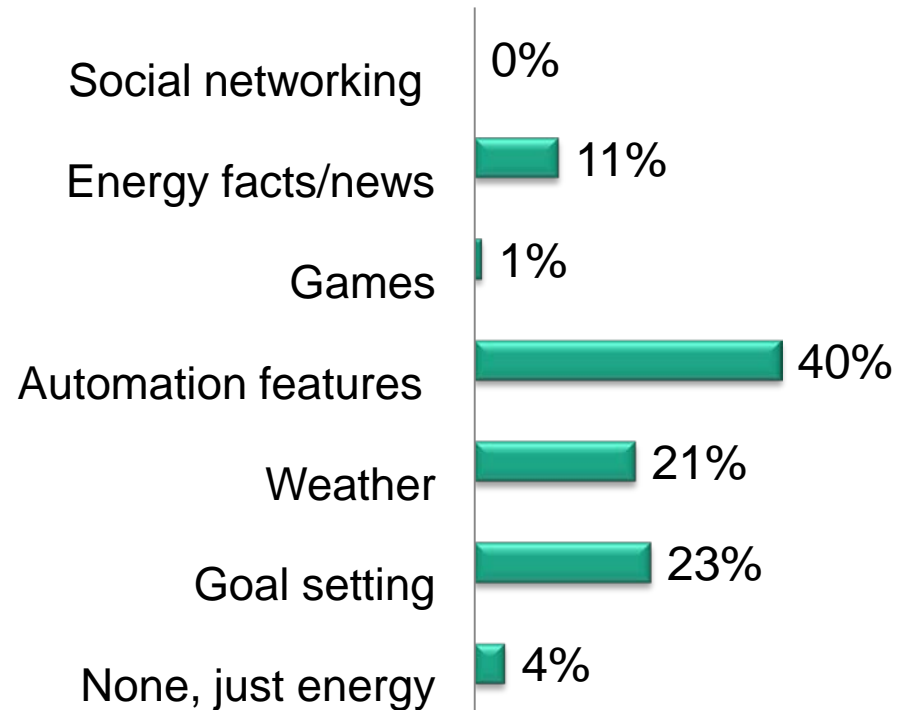
Which medium of home energy management do you think you'd most prefer?

Please indicate your level of agreement with the following statements. "I care about…"

35%

28%

9%

28%
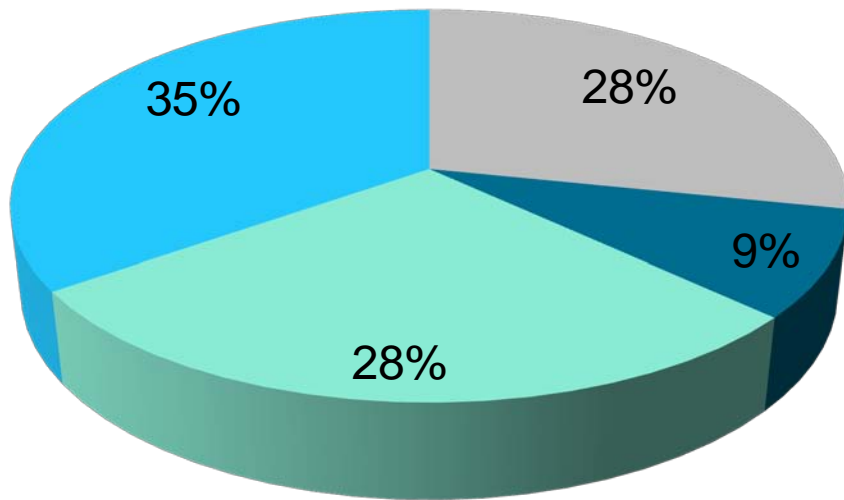
- A display that sat on your counter or wall
- A web portal you could log into
- A smart phone application
- I'd like them all

BRAND

Disagree 26%
Agree **52%**

USER-FRIENDLINESS

Agree 41%
Strongly Agree **54%**

PRICE

Agree 48%
Strongly Agree **50%**

Source: LaMarche et al. (2011)

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Summary: How to make feedback more actionable?

- Keep real-time monitor approach but push the visual interface
  - Enhance with tips and education, not cost and prediction
- Keep costs low but flexibility high
- Tailor goals and provide automation whenever possible
  - But don't get too kitschy with device actions, weather will do.
- Web portal looks + mobility is the way of the future

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How can we increase feedback value?

- Tailor feedback features to the stage of change of your customers

- Maximize the effectiveness of your feedback platforms:

  - Usability, esthetics

  - Flexibility and customization

  - Tailored tips and education

- Join us in the DOE Building America Home Energy Management Standing Technical Committee to discuss this issue further!