



The Influence of Display Medium and Design on Energy-Saving Technology Adoption

Janelle LaMarche
jlamarche@fraunhofer.org

- Users will spend only about **1** minute per day monitoring their energy use! (Froehlich, BECC 2010)
 - *How can we maximize feedback effectiveness in such a short amount of time?*
 - Look at different designs
 - Look at different media
 - Learn about user preferences
 - What is most actionable?



Joining Forces

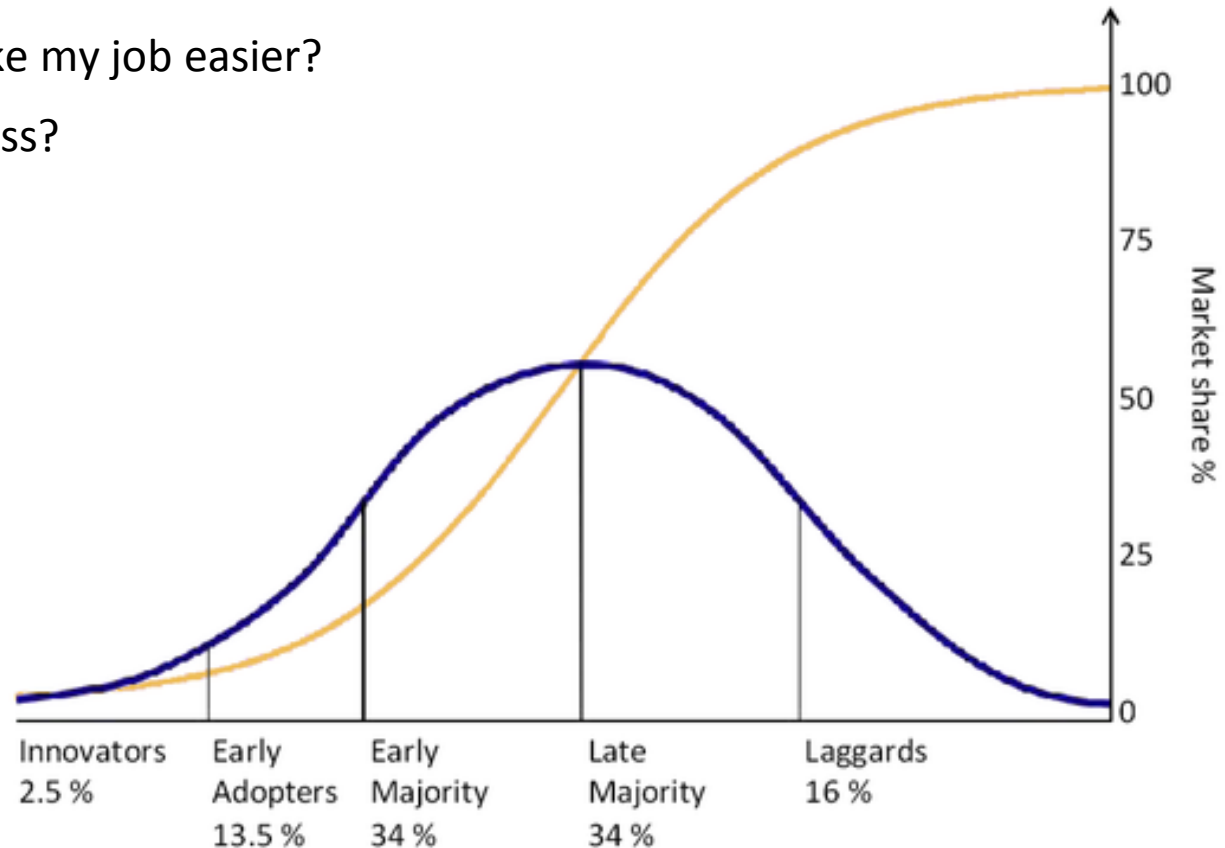
- The fields of sustainable energy and media design are becoming more and more interconnected...



- Research to date has not fully examined how the medium of energy display influences consumer preferences about technology adoption.

Technology Adoption

- Adoption: An individual's decision to become a regular user of a product
 - Does it make my job easier?
 - Is it effortless?

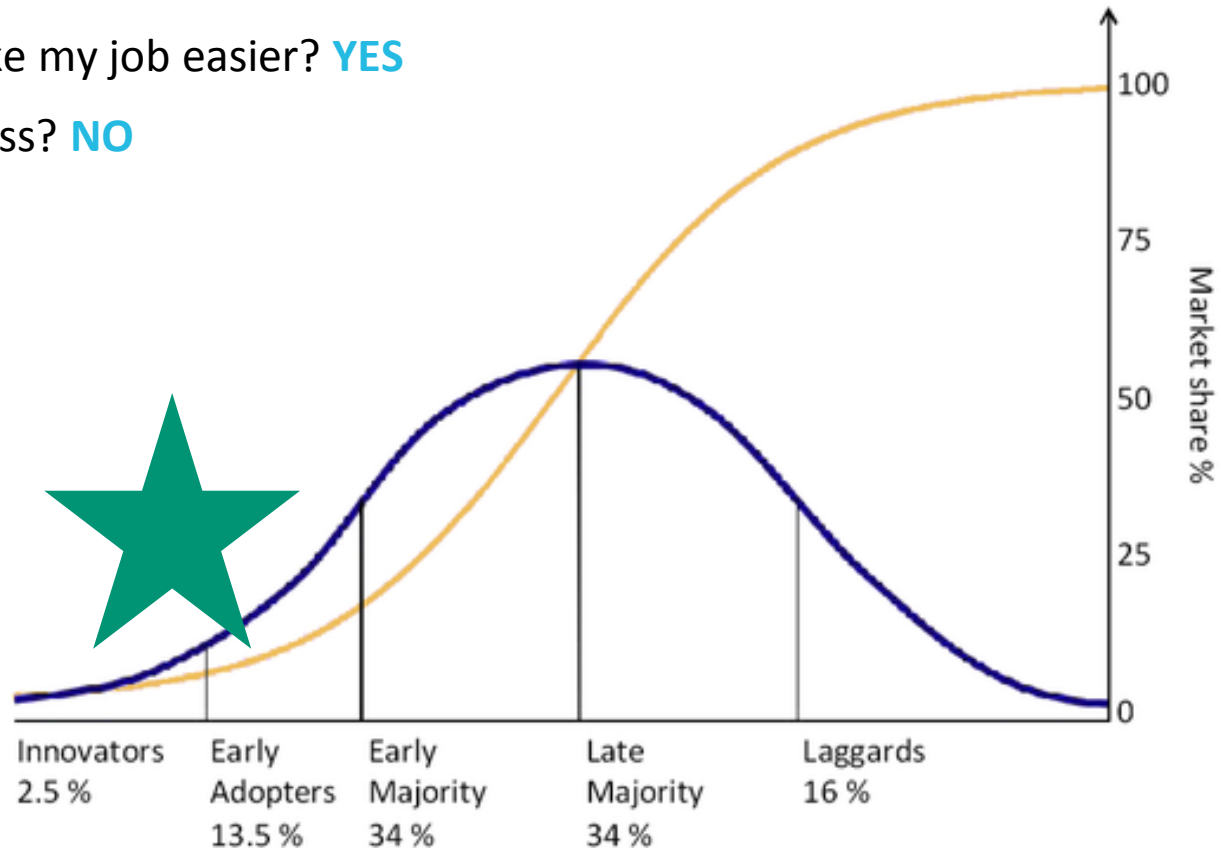


Rogers, 1962, Davis, 1989

Technology Adoption

- Adoption: An individual's decision to become a regular user of a product
 - Does it make my job easier? **YES**
 - Is it effortless? **NO**

Home energy management technologies have a long way to go...start with the early adopters!



Rogers, 1962, Davis, 1989

Methods Overview

- Sample size: **50**
 - 74% owners, 26% renters
 - Geographical spread, 9 states
 - Mean Age: **35** Range: 21-67
-
- Online survey!
 - Early adopters rated 12 home energy management (HEM) systems across 3 different media (in-home, web, phone).
 - Is it nice to look at? Understandable? Want to explore more?
 - Hypothetical “length of use” (mins.) was used as a loose metric of adoption
 - *How long/day would you be willing to use this?*
 - Open-ended responses optional



Dashboard My Energy Alerts My Account Billing

Your daily usage spiked above normal on Monday, JUL 29

Welcome Back, **Annabelle Leaferton**
 Account # 246731209
 Switch Accounts
 Current Bill Period
 JUL 02 - AUG 03
 View a Previous Bill

Pay Your Bill Online? [Go to billing](#)

Current Costs

\$127
As of Jul 15
121

[Details](#)

Your Rate Plan is BE_G_RIS
General Service - Residential

Energy Usage

Usage is up
32%

[Details](#)

This billing period so far compared to last billing period at this time.

Environmental Impact

Propane Tanks
16

[Details](#)

Burning this much propane equals your impact within this bill period.

Cut Energy Costs

Keep It Cool
Cool your home at 70° or warmer with the thermostat fan switch on "auto." For additional savings, raise your thermostat to 82° or warmer when you're away from home.
[More Savings Tips](#)

Be Energy Efficient

Consumption At A Glance
Though accounting for only 5 percent of the world's population, Americans consume 25 percent of the world's energy.
[More Usage Tips](#)

Reduce Your Impact

Renewable Energy
Within 15 years, renewable energy could be generating enough electricity to power 40 million homes and offset 70 days of oil imports.
[More Green Tips](#)

TEKNORIL Energize

WELCOME CARLA | MESSAGES (1) | PROFILE | PAGES | SETTINGS | HELP | SIGN OUT

CURRENT ENERGY USE 8.0
\$1.04 per hour

CURRENT TIME Off-Peak

APPLIANCES

OUTSIDE TEMPERATURE 43°

CURRENT MODE 68°
Home

DASHBOARD YOUR HOUSEHOLD RECOMMENDATIONS YOUR COMMUNITY PRICING PLAN ASK AN EXPERT

Goal Progress This Week | Billing Period | Year to Date

Your Goal This Billing Period: **\$97**

Estimated Cost To Date **\$52 of \$97**

Projected Cost This Period **\$102 of \$97**

You need to save \$5 in the next 4 days to make your goal this week.
[See your 15% goal](#) | [How is this calculated?](#)

Meet your goal! Add these to your checklist:

- Save up to \$15 per year Use your dishwasher's Economy mode
- Save up to \$10 per year Buy an EnergyStar Freezer
- Save up to \$10 per year Install powerstrips on your home entertainment center

[Get more recommendations](#) | [Your Checklist](#)

File Edit Export Advanced Help

TED LIVE DASHBOARD HISTORY GRAPHING LOAD PROFILE

PRESENT READINGS

December 2 2010 11:31 PM
Days Left in Billing Cycle: 28
Current Rate in Effect: \$0.0549
Plan Type: Tiered
Tier: 1

PRESENT SPENDING PER HOUR

Watts: 512w

RECORDINGS

Peak kW Today: 3.742 kW @ 5:57 PM
Peak \$ Spent Today: \$0.29 @ 5:57 PM
Low Voltage Today: 122.5 V @ 6:34 AM
High Voltage Today: 124.9 V @ 1:36 AM

Peak kW MTD: 3.742 kW on Dec 2
Peak \$ Spent MTD: \$0.29 on Dec 2
Low Voltage MTD: 121.8 V on Dec 1
High Voltage MTD: 124.8 V on Dec 2

MONEY SPENT SINCE MIDNIGHT

\$ 1.52

MONEY SPENT THIS MONTH

\$ 9.01

PROJECTED BILL

\$ 53.12

PRESENT VOLTAGE

122.4 volts

AVERAGE DAILY SPENDING

\$ 1.52

WEATHER
Fri 10/23
No Weather Information Available
7-Day Forecast
What's the Forecast?

Copyright 2010, The Energy Detective

Watts
512w

Appliances/Circuits On Now

- Refrigerator (80w)
- Oil Boiler (25w)
- Kids Room + Basement (60w)
- Ceiling Fan (60w)
- Three Office (20w)

My 30-Day Carbon Footprint

MT Avg: 523 lbs
My CO2: 800lb

Where I've used electricity in the last 30 days

Electricity cost this month

Estimated cost is below \$1
Goal to save this bill was \$1

Top 3 Users, Last 30 days

30-day Proportion Power Cost: \$28

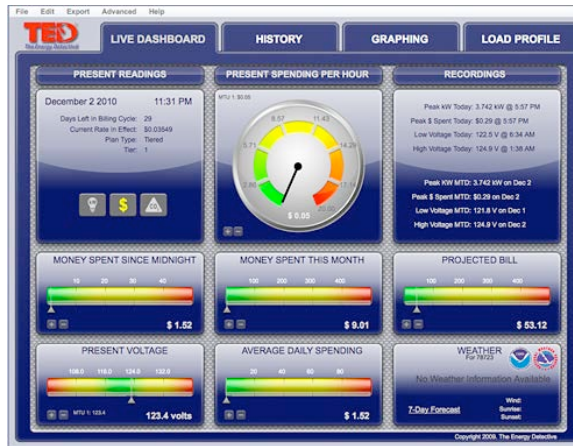
- Home Office: \$11
- Kids \$5
- Basement: \$12

My month | My day | My day | My week | My month | My year

VER CIRCUIT DETAIL



“OLD SCHOOL”



“This makes me dizzy”

“HIDEOUSLY illegible, my eyes are bleeding”



“Reminds me of an iPhone. I can haz for my apartment?”



“I LIKE THE FEET!”



“GIMMICKY”

■ Results by medium:

Time willing to spend using:	IN-HOME	WEB	PHONE
None	14%	8%	30%
1-5min	65%	53%	56%
10-15min	19%	35%	13%
Over 15 min	2%	4%	2%

Mean of the 4 exemplars rated for each of the three mediums

Largest percentages for all media fall within the expected 1-5 minute category

A large percentage of users are willing to spend more time with web portals (this could be due to screen size:content)

Interestingly, a large percentage of users are not even willing to interact with current energy smartphone apps

■ Results by 'usability'

	GOOD	BAD
None	6%	28%
1-5min	63%	57%
10-15min	27%	14%
Over 15 min	4%	1%

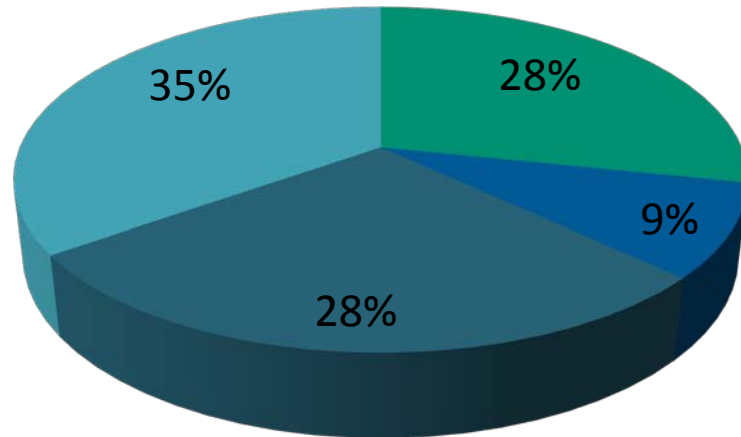
Across media, mean of the top or bottom rated collapsed across our three questions

(note: all questions have a similar pattern on their own)

Usability is a good predictor of time willing to spend using

Users are more willing to spend time with an energy feedback device if it rates highly on aesthetics, ease of understanding, and prompts exploration

Which medium of HEM do you think you'd most prefer?



- 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

Surprisingly, web portals are the least preferred medium of energy feedback!

Wait, didn't I just say users want to spend more time with them?

It's more likely that users just want multimedia options, which is most preferred...

■ What can we take away?

- The “1 minute” may vary depending on medium as well as usability factors
- Current HEM products (e.g. home energy displays) are not fulfilling user needs
- Multimedia is NECESSARY, users want flexibility
- At this point, apps aren’t where they need to be, but they are highly desired
- Web portal looks + mobility is the way of the future for energy monitoring

■ Next steps

- Providing multimedia options in-field and observing frequency of use/medium
 - Task specific?
- **More research is needed that examines how design and user behavior jointly influence HEM technology adoption**