Load Management Standards Workshop on Customer Education and Needs

Loren Lutzenhiser
Prof. of Urban Studies & Planning
Portland State University

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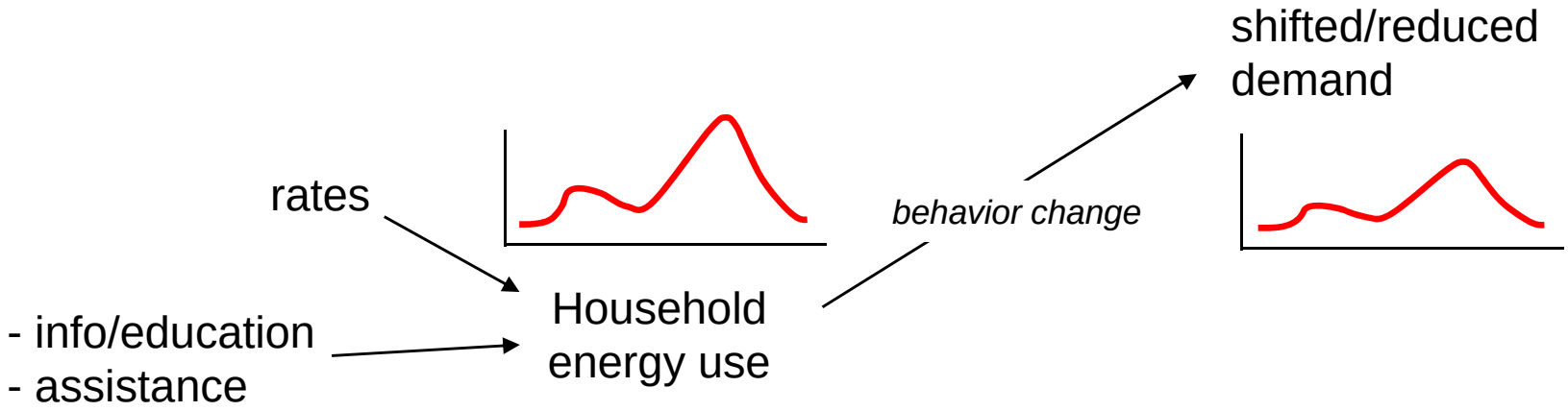
WORKSHOP TOPICS

- Potential customer impacts
- Customer needs to enable effective response (to TOU, etc.)
- Education/assistance for customers
- Possible LM standards



Observations

- These are important questions
- New behavioral role in policy – need to *engage* the energy user
- New services, communications, tools, and strategies required
- Permanent and temporary *behavior change* required
  - TOU means *changing habits*
  - CPP means *constant attention/information* or *automated control*

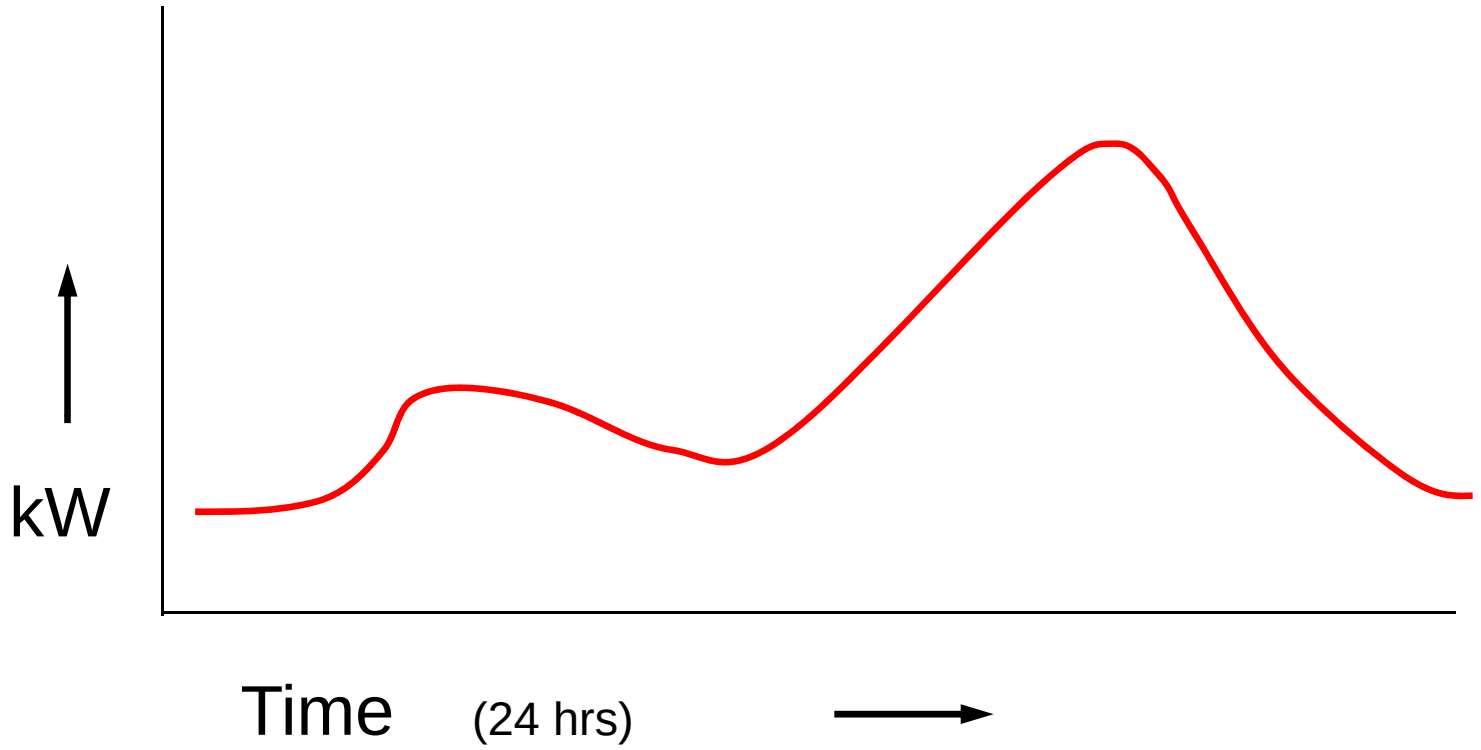
Observations

- Not likely to be easy
- Response not what we might expect
- Uncertainties can be reduced through research

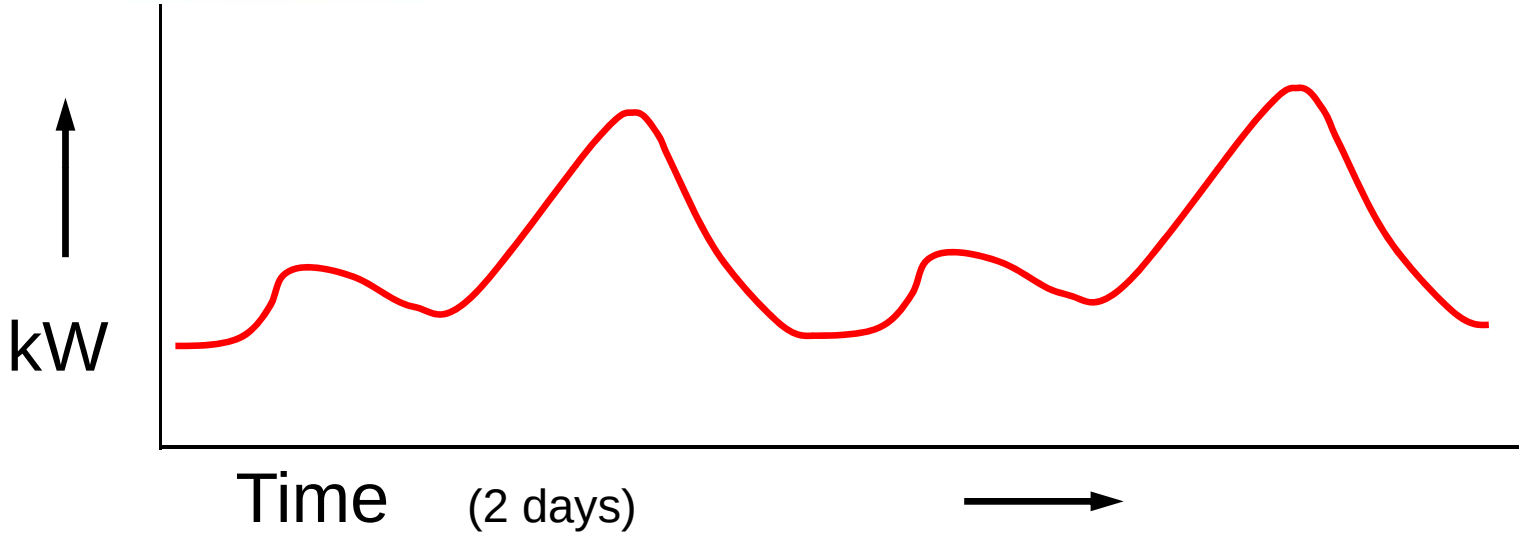
Points I'll cover

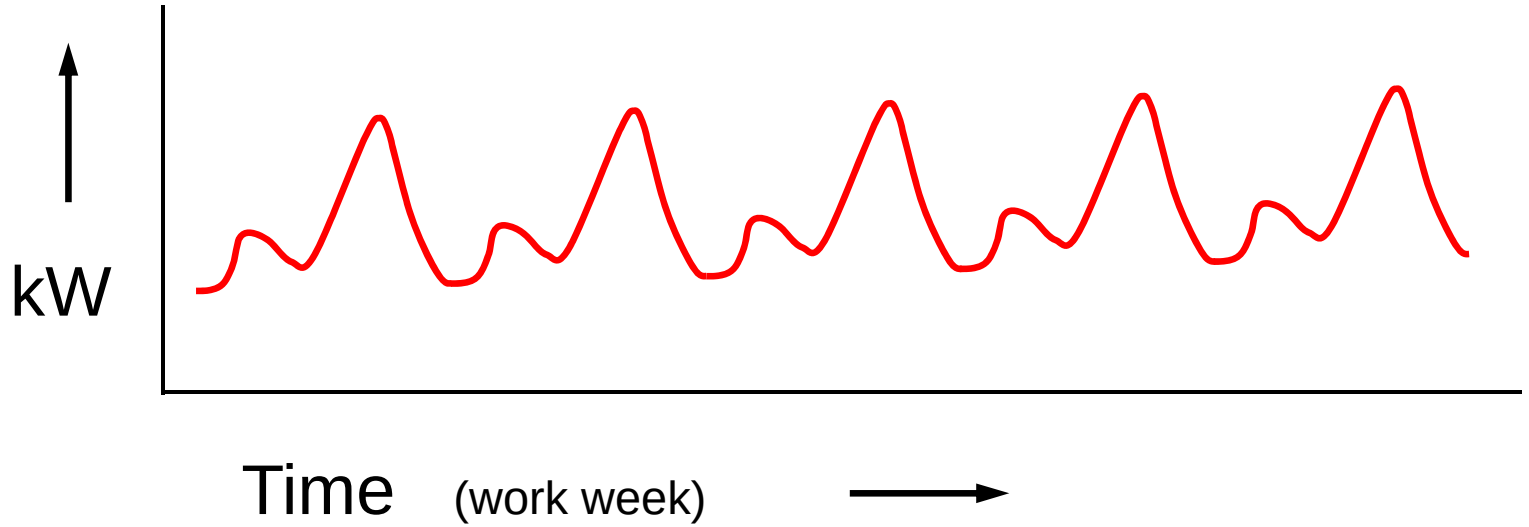
- ✓ Idealized loads – what we're trying to change
- ✓ Impacts, perceptions & responses vary
- ✓ Information environment & education issues
- ✓ Real loads, real systems & real research needs

Idealized load profile

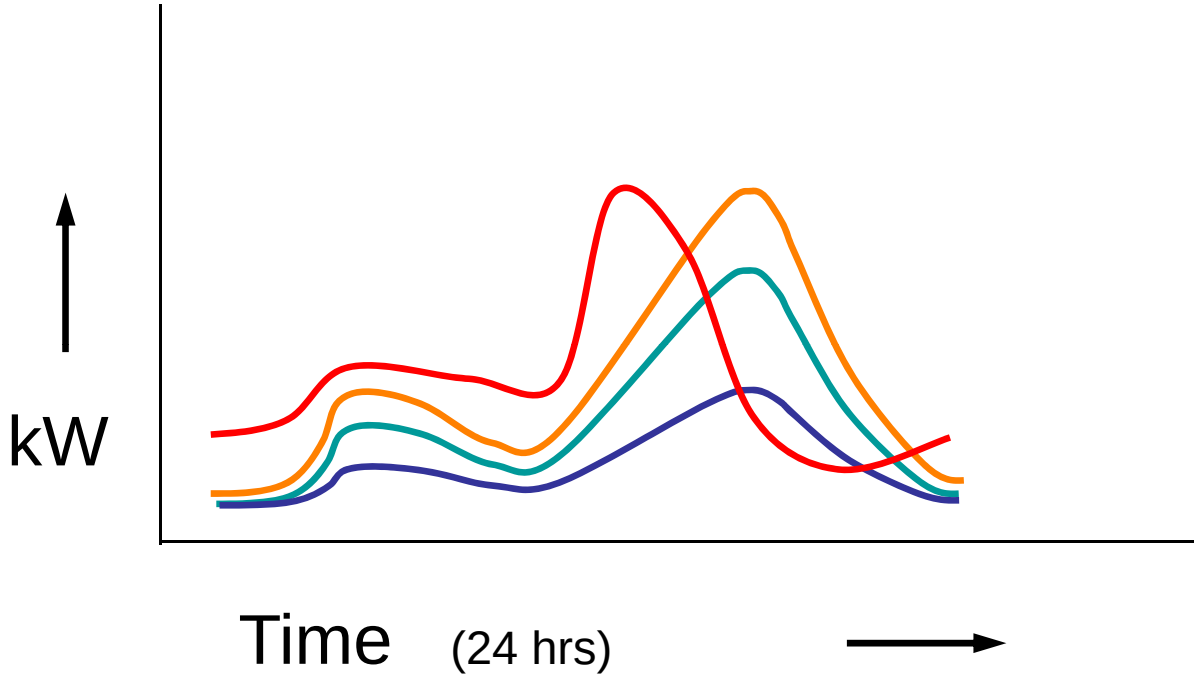


Repeating Patterns



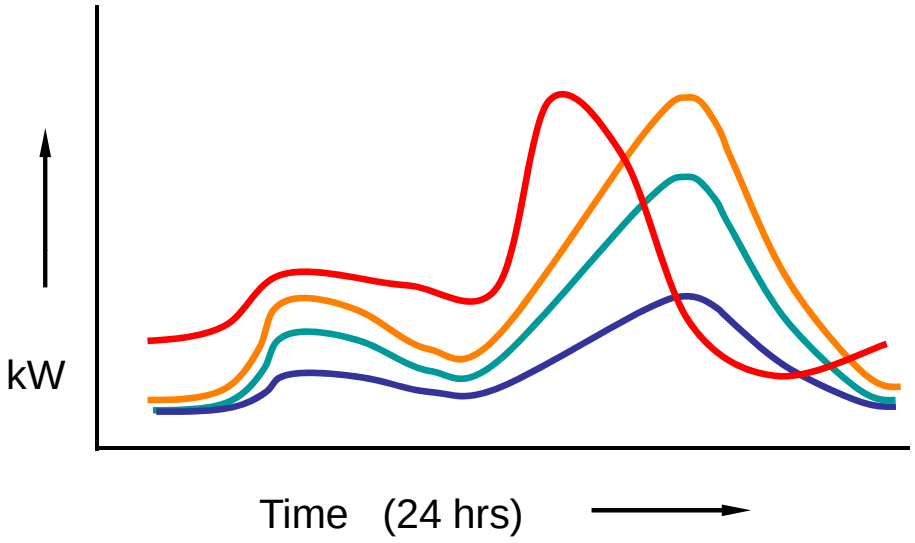


Similar across households

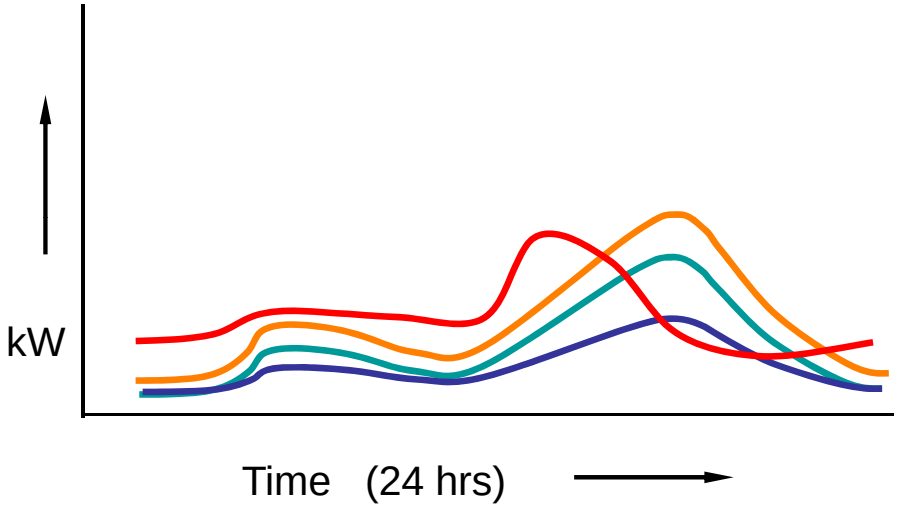


Desired effects of policies

Before TOU, etc.



After TOU, etc.



Mechanisms: How can rates/incentives affect usage?

A variety of imaginable responses

- Changes in perspective (recognition of peak problem and need for response)
- Changes in behavior
  - Shifting loads to off-peak times
  - On-peak conservation
- Long-term hardware/building changes
  - Permanent efficiency (lowers both on and off-peak demand)

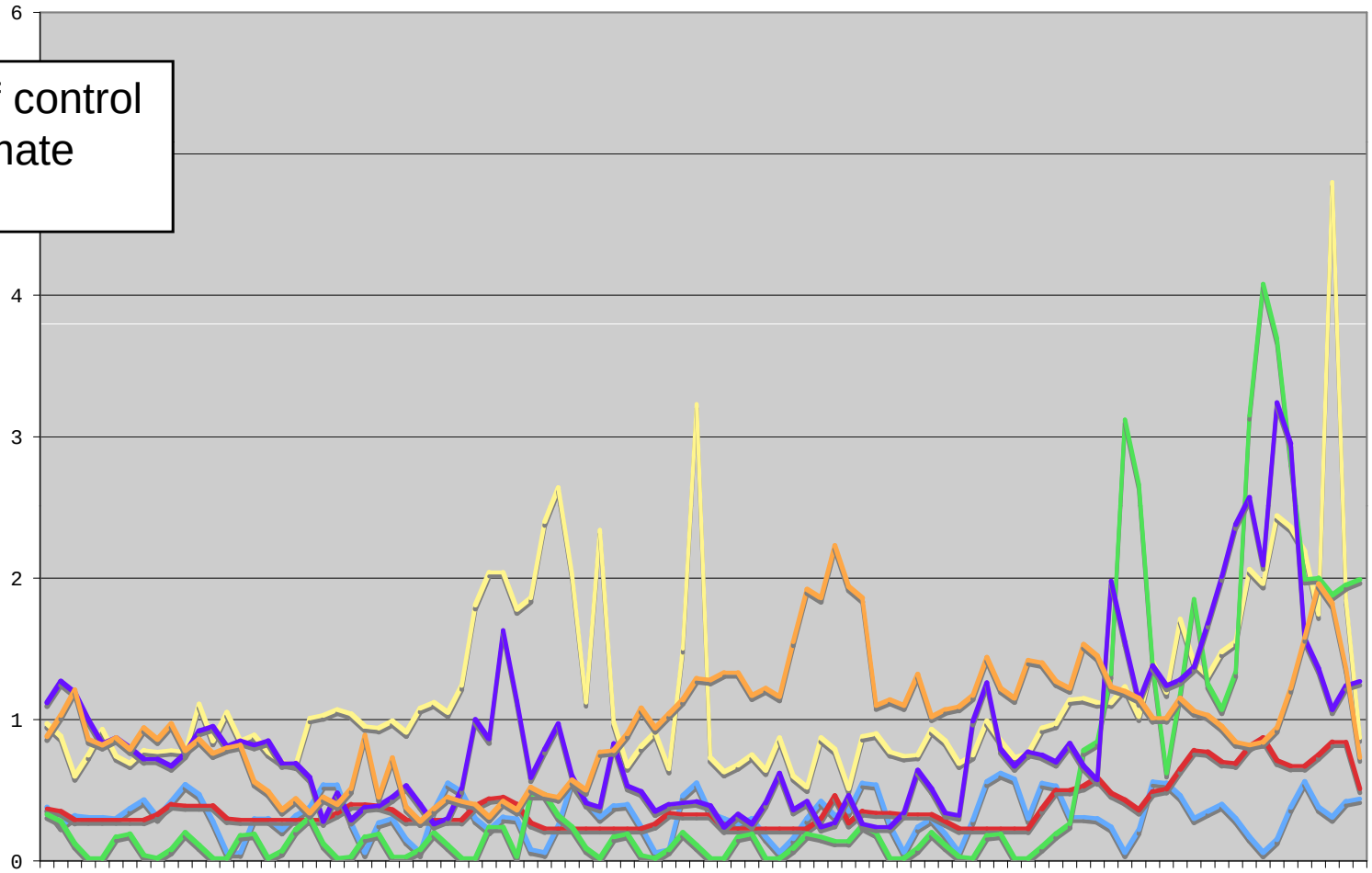
POTENTIAL IMPACTS ON CUSTOMERS AND THEIR RESPONSES

- Highly variable
- Depends upon real energy use patterns – idealized loads don't exist
- Awareness & interest – key response factors
- Perceptions and actions governed by:
  - Understandings
  - Resources
  - Constraints
- Impacts and responses not what might be imagined

Real data – same day, same weather

6 households

SPP standard tariff control group - coastal climate
July 1, 2001



kW

Time (24 hrs)

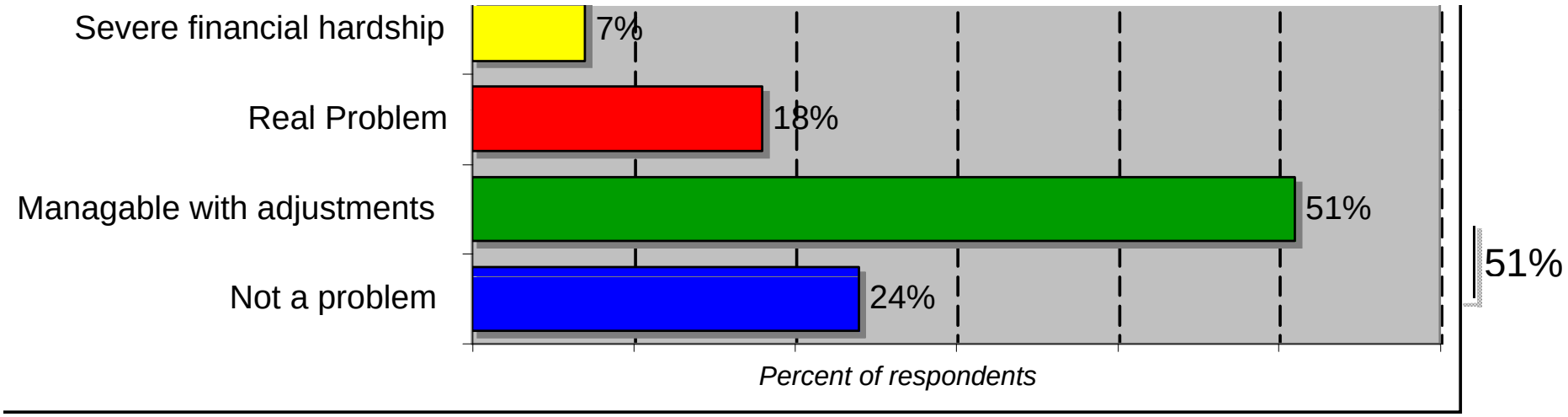
Possible impacts of rates (TOU and/or CPP)

▪ Positive benefit – load shape perfectly matches rates
▪ Little/no impact (good load shape match) ▪ Cost impact / not noticed ▪ Cost impact noticed / little budget effect
▪ Significant impact → time shifting of usage ▪ Sig impact → conservation / EE (may or may not match peak) ▪ Sig impact → failed shift / conservation attempts
▪ Sig impact → budget crunch / reduced $$ for other needs ▪ Sig impact → crisis, welfare decline and failure to pay

And ... changing over time from one category to another

Observed with 30% natural gas price increase

Northern California
Winter 2005-06

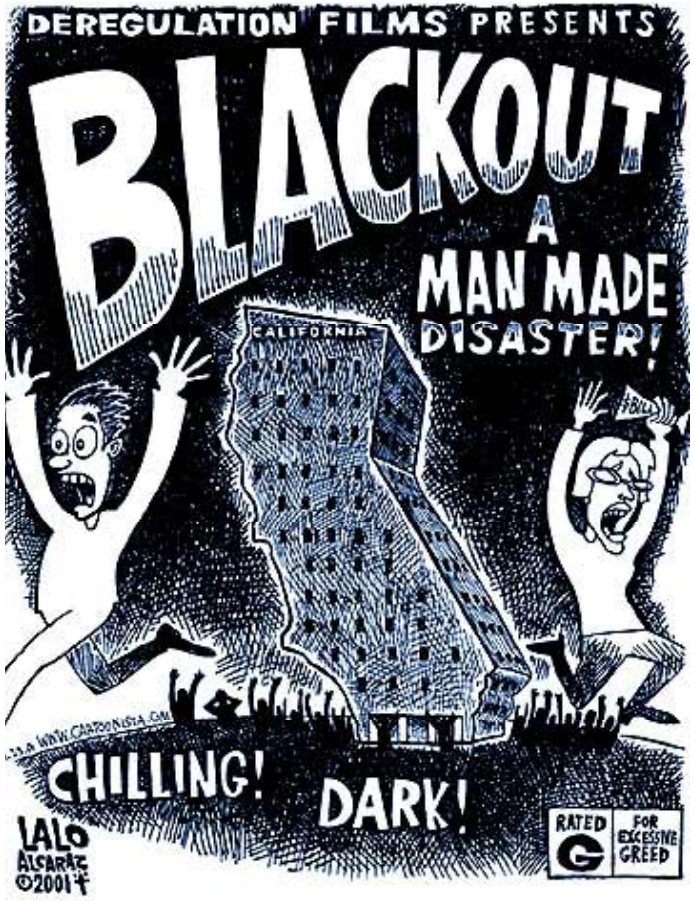


- "severe hardship" or "real problem" (25% overall)
  - Low income - less than $35k (33%)
  - African American (38%)
  - Latino (34%)
- "cut back spending" – renters (61%) owners (45%)

Customer behavioral responses

- Used less heat/lowering temperatures (67%)
- Substituted non-NG fuels (electricity, wood) (13%)
- Stopped using heat (10%)
- Less water and/or laundry (19%)
- Used less electricity (10%)
- Managed doors and windows (7%)
- Home EE improvements (7%)

Insights from 2001-02 California Crisis



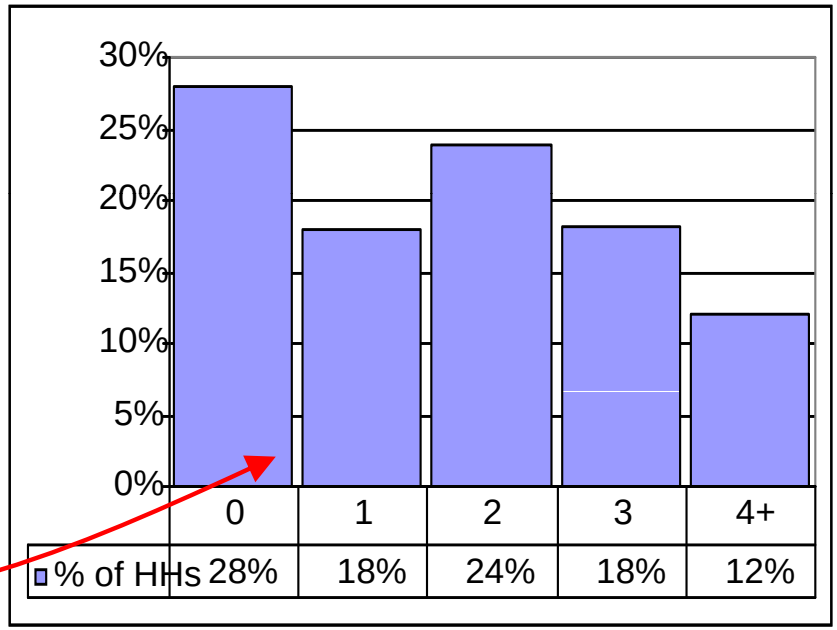
- Supply disruption
- Utility bankruptcy
- State as power buyer
- Conservation needed
  - Only **hardware incentives** on offer $990M
  - Risky requests for **voluntary conservation** 5,000MW

Flex your POWER℠

Impacts and behavioral response

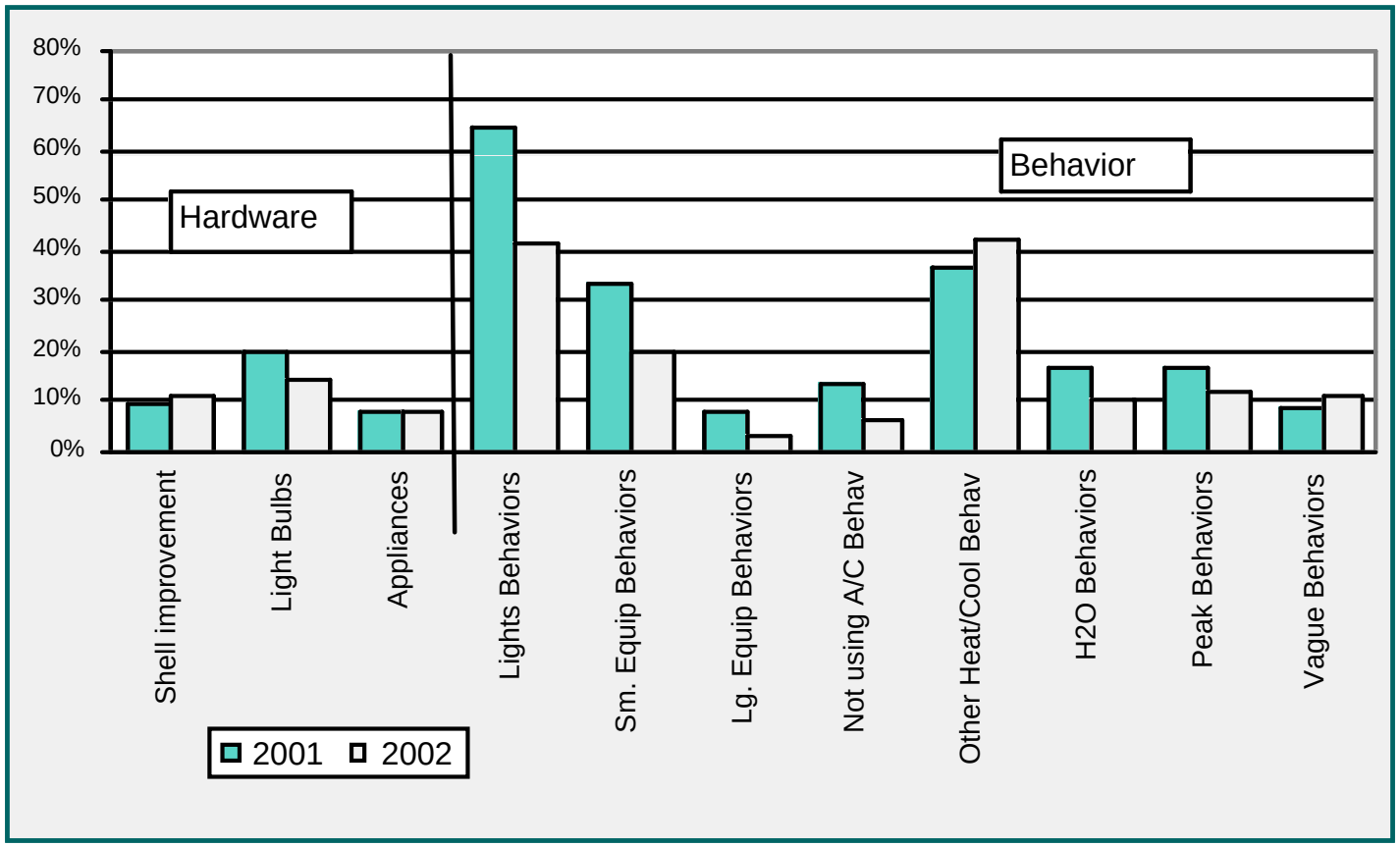
- Surprising widespread response
- Altruistic, civic, environmental motives
- Real system peak reduction
- Peak load shifting requested, but little was reported
- Large proportions did little or nothing

Number of conservation behaviors reported



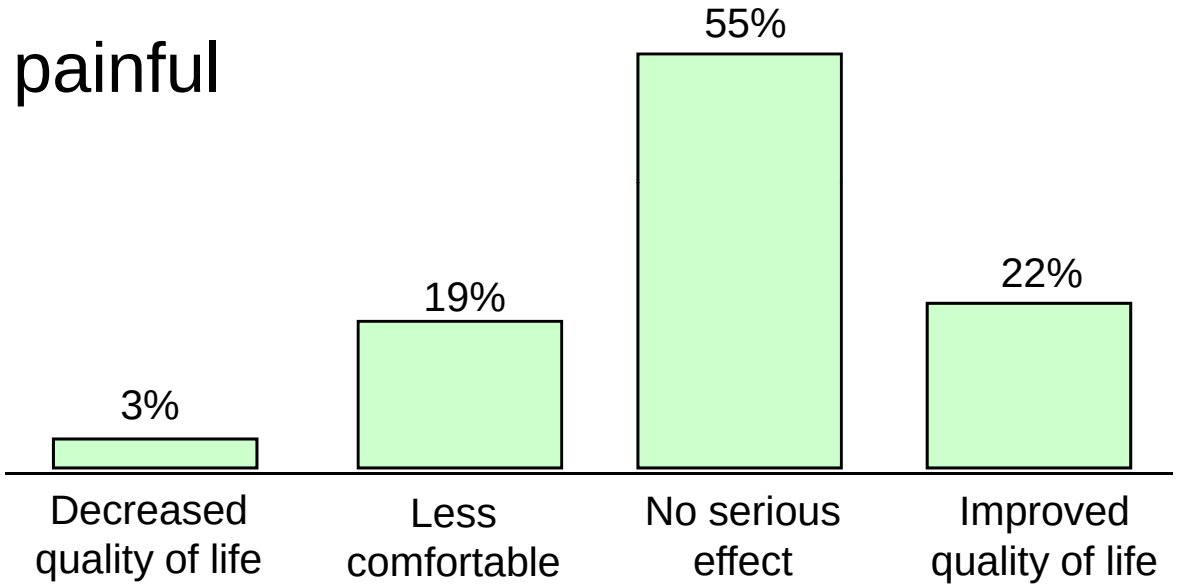
Behavior Change

- People did what they weren't asked to do
- Surprising contributor: turning off air conditioners



The good news

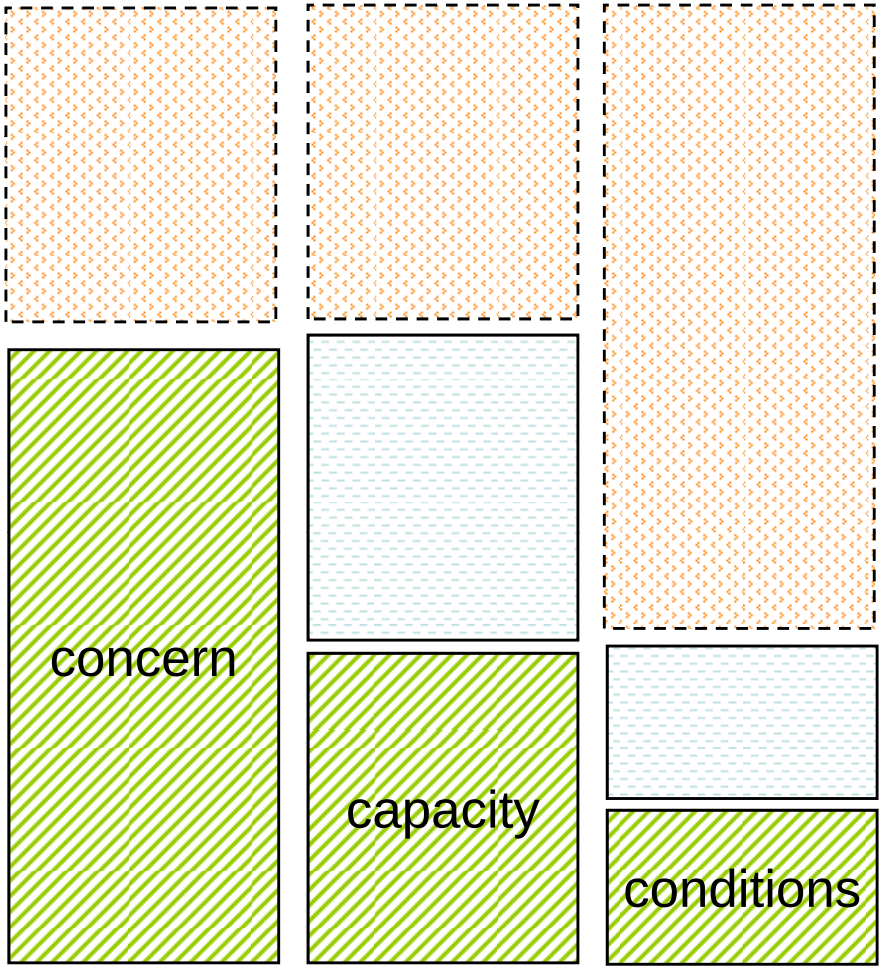
- Behavior change not painful



- Pessimism about energy future problems
- See need for lifestyle change
- Want action by business & government

Modest expectations: Prerequisites for conservation action

- Concerns
  - Problems are real, salient, actionable
- Capacities
  - Knowledge, skills, resources
- Conditions
  - Time, attention, products, suppliers



INFORMATION ENVIRONMENT

What do people know? Not much . . .

- Bills infrequent and unintelligible
- Media coverage and “tips” simplistic
- Energy flows (purposely) invisible
- No feedback from use or conservation action
- Habits, rules-of-thumb, heuristics crucial

Education issues

- More involved than simply *providing information*
- Quality and effectiveness of information/ messaging depends on:
  - Content ("what's said")
  - Form ("how it's said")
  - Context ("when & where" it's said, and "what else is being said")
  - Delivery mechanism ("who is saying it, to whom")
- Many ways to get it wrong / seldom done right

Energy literacy: Potentially a daunting task

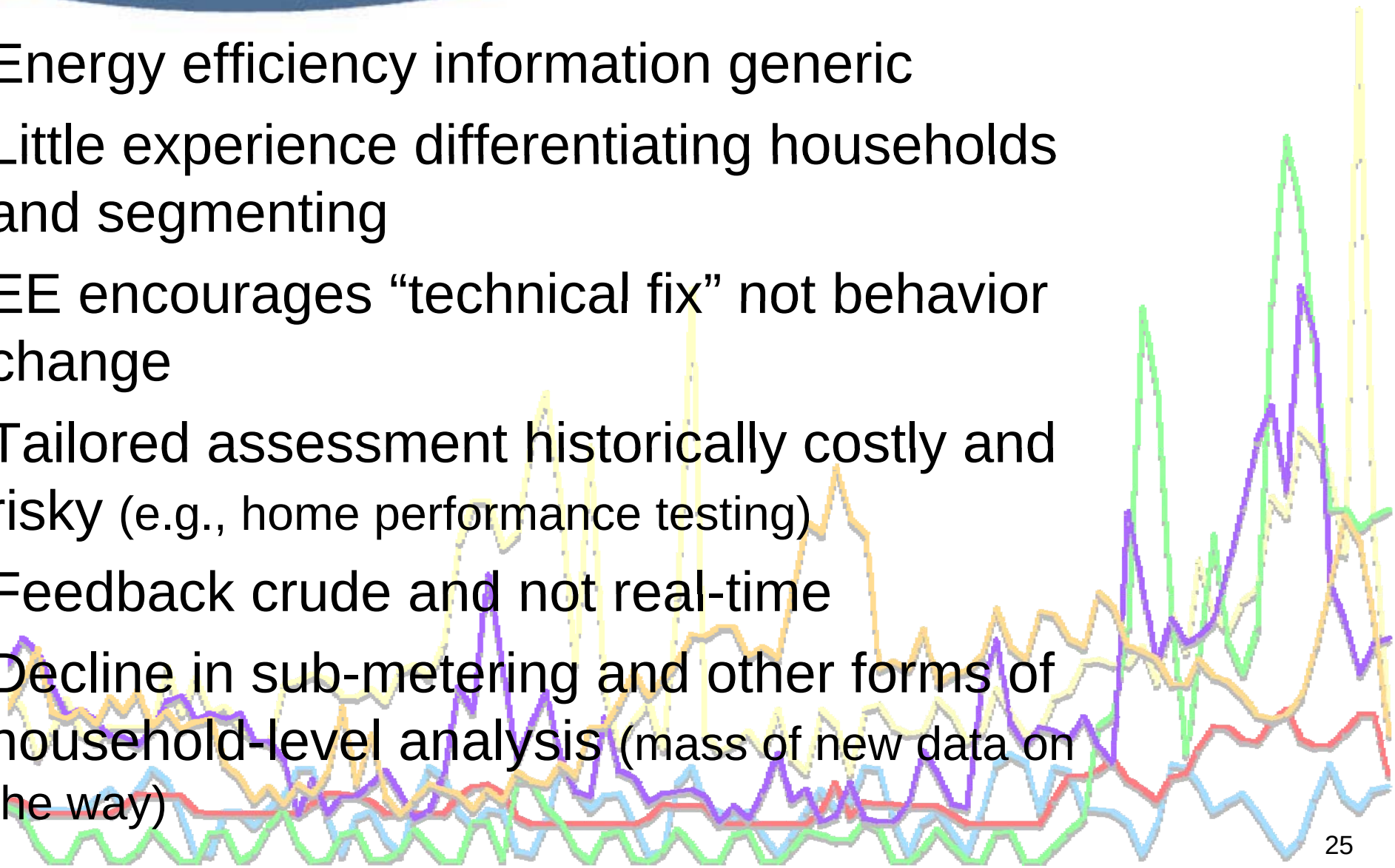
- Universal education in the U.S.
- Emphasis on news and current affairs
- Growth of higher education
- High drop-out rates
- Poor performance = limited grasp of the subject matter
- Myths and misunderstandings: 20% of Americans believe sun revolves around the earth
- Best guess: few people see energy bills or energy information and have more than a superficial understanding

STATE OF OUR KNOWLEDGE about customer behavior and energy loads

- Limited basis for information/education programs
- Wide diversity of loads and behaviors
- Household demand system is extremely complex
- Range of research needs

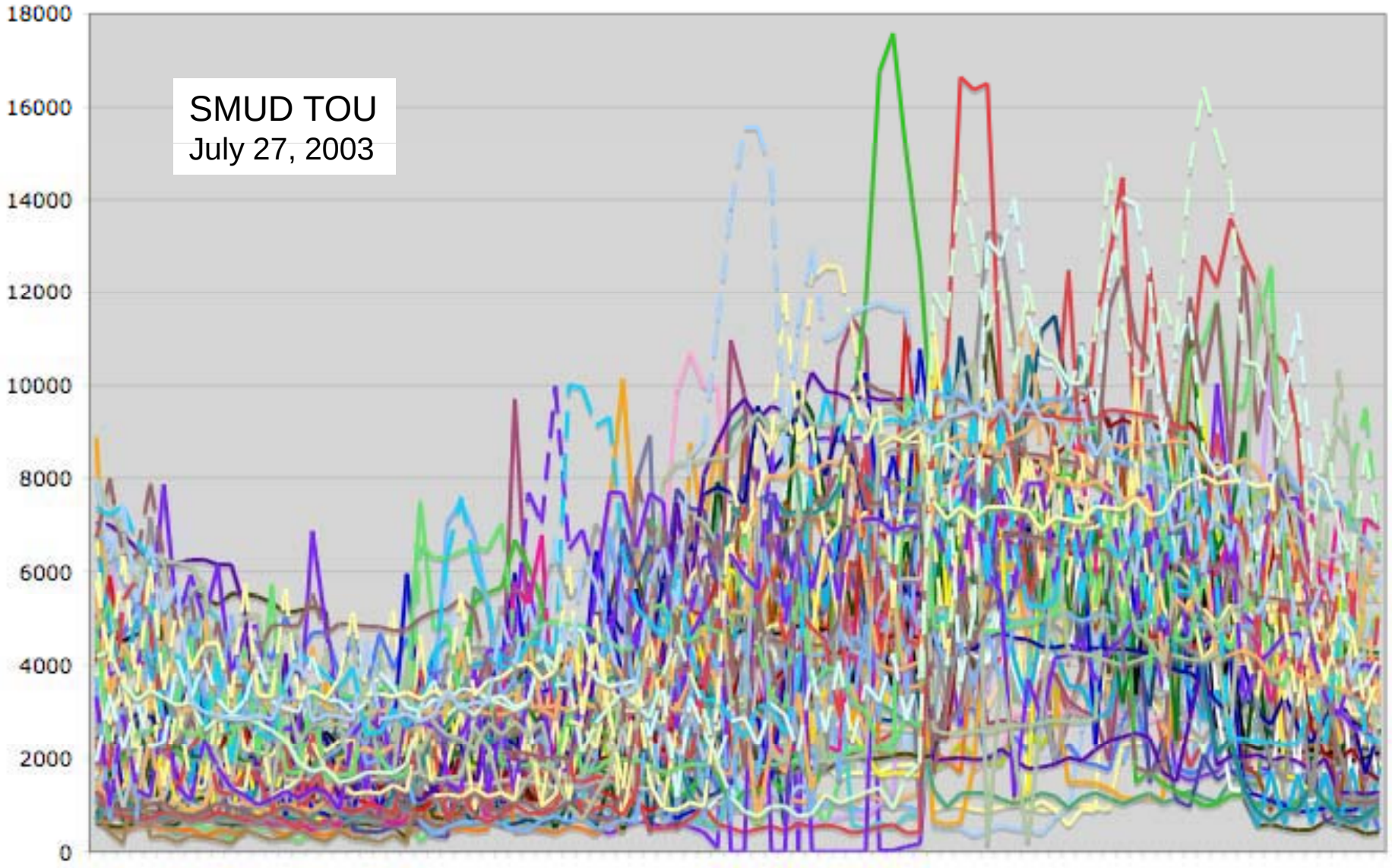
Limited capacity to differentiate load profiles and advise customers

- Energy efficiency information generic
- Little experience differentiating households and segmenting
- EE encourages “technical fix” not behavior change
- Tailored assessment historically costly and risky (e.g., home performance testing)
- Feedback crude and not real-time
- Decline in sub-metering and other forms of household-level analysis (mass of new data on the way)

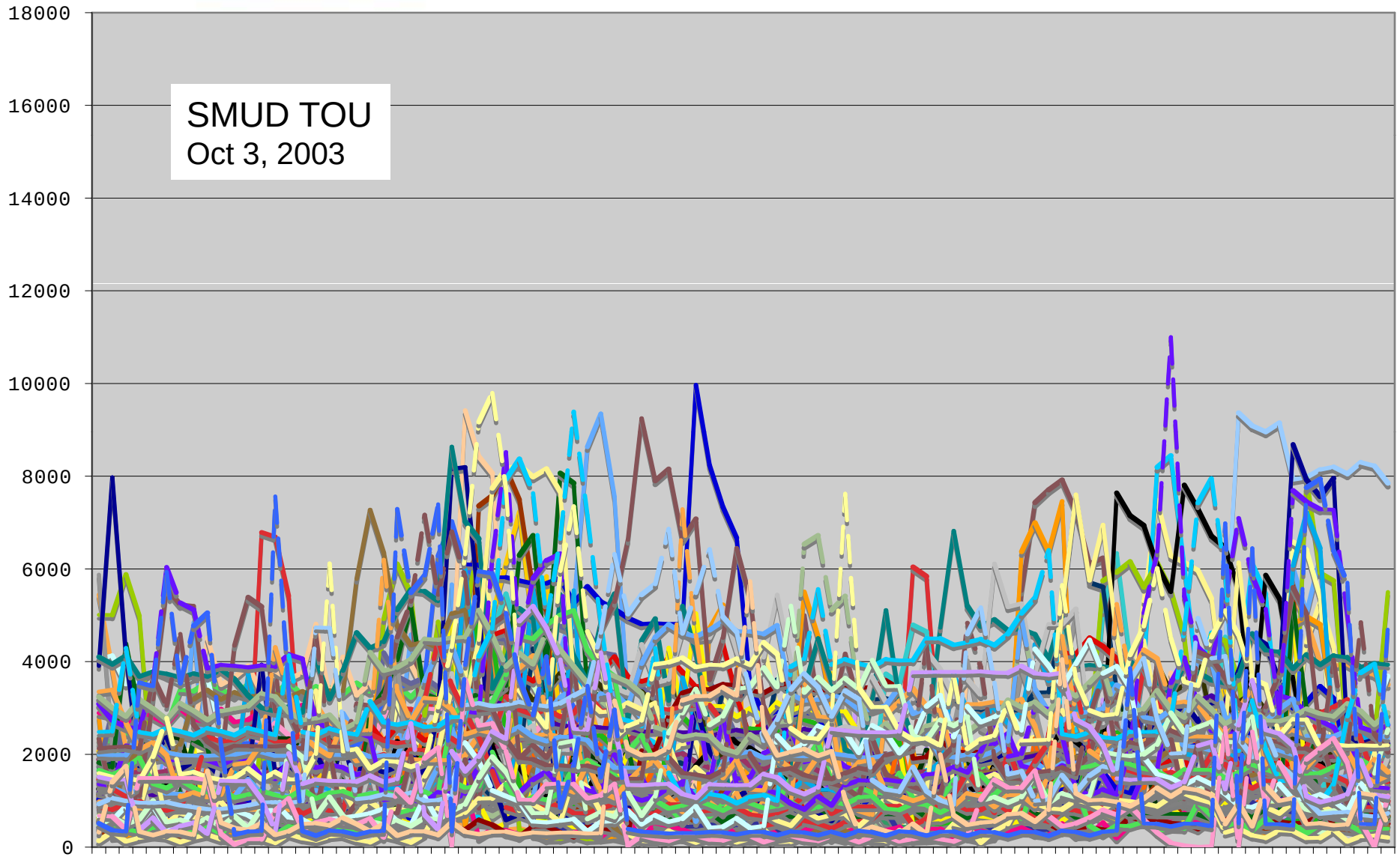


Reality bites: Real loads

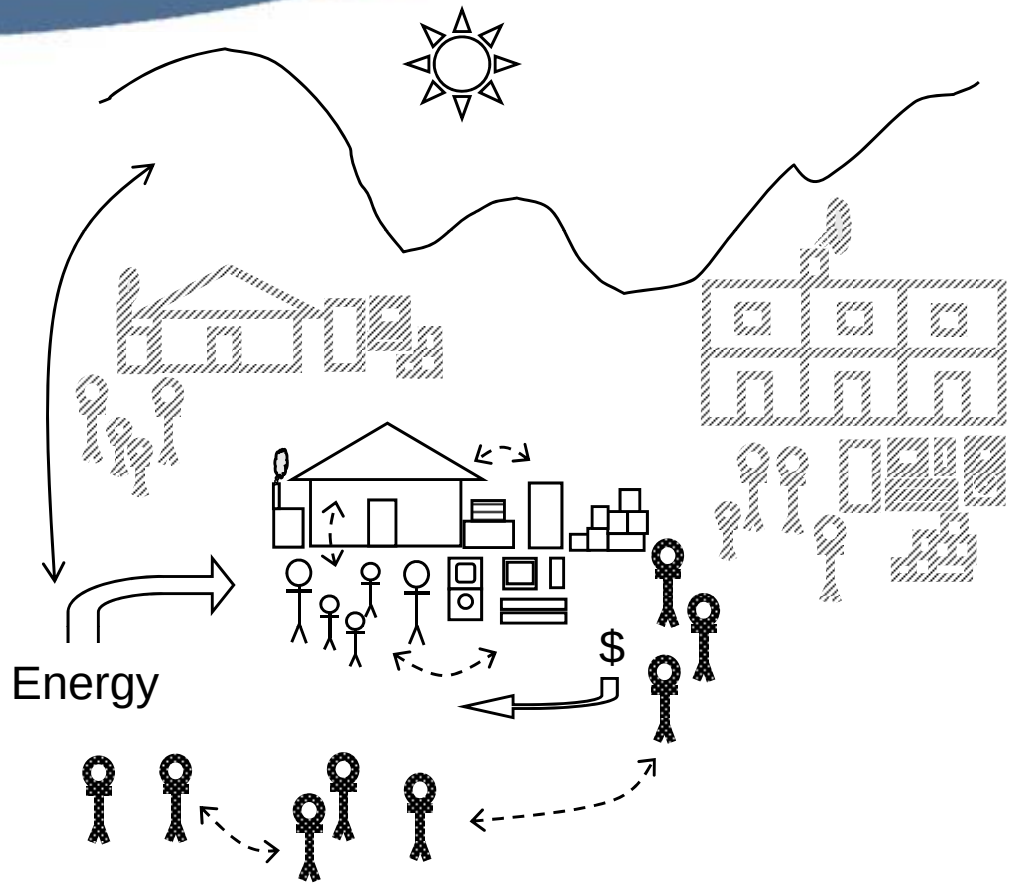
70 households



Even in mild weather



Household energy use is a complex system



- Interacting elements – internal and external to HH
- Not easily reduced to simple explanations & models

Demand shaped by a diversity of factors

Complex relationships and interactions among . . .

- Environment/climate/weather effects
- Building characteristics and thermal performance
- Technologies/systems and appliances
- Behaviors – associated with:
  - Household composition (numbers and ages)
  - Social characteristics (income, ownership, ethnicity, etc.)

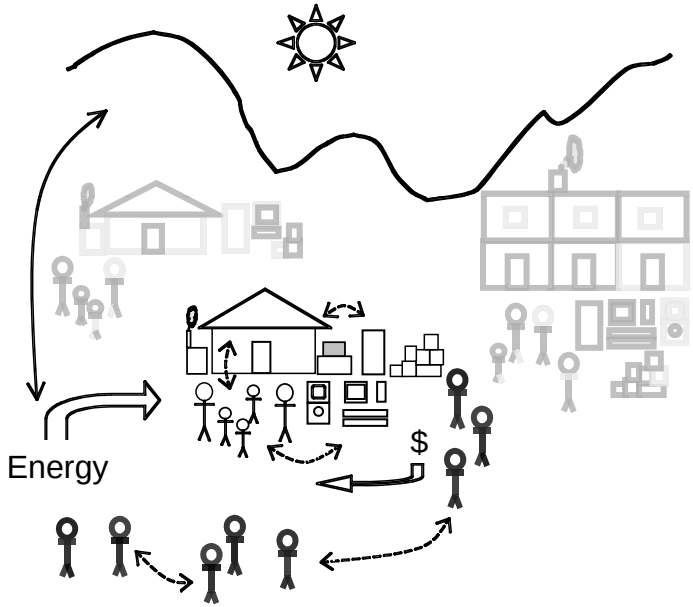
Model of annual kWh
(Northern California, 2006)

	B	Sig.
CDD (100s)	-27.70	.53
HDD (100s)	-43.00	.25
Zone 2	-1,162.24	.31
Zone 3	-212.02	.85
Zone 4	-2,592.61	.02
Zone 5	-3,216.19	.00
Single Family	2,648.55	.00
Duplex/Tri, Town/Row	1,619.58	.04
Apartment or Condo	1,860.78	.01
Bldg Sqft (1000s)	642.21	.04
Built 1984-96	319.29	.32
Built 1997-04	308.42	.48
Income ($10,000s)	134.43	.00
Owner	773.72	.01
Latino	-1,296.16	.00
African American	631.40	.19
Asian	-1,005.11	.07
N of adults 18+	857.97	.00
N 13-17 yrs	1,326.28	.00
N 6-12 yrs	421.94	.02
N Infant - 5 yrs	16.90	.94
(Intercept)	3,384.01	.08
	R-sq = .40	

Lutzenhiser & Bender (ACEEE 2008)

Before detailed feedback and advice: Research required

- Residential consumption patterns & load profiles
- Basic elements & structure of loads & peaks (what's producing the patterns?)
- Dynamics of stability & change (internal & external to HH system)



- More precise targets for *electricity and natural gas* efficiency, conservation and carbon reductions
- Comparing/evaluating policy strategies and outcomes

Which brings us to . . .