



# 2007-2008 SMUD PowerChoice Time of Use Program: DRRC Research Project

*Prepared for:*

**California Energy Commission**

**Load Management Standards Efficiency Committee:  
Customer Education and Needs Workshop**

*Presented by:*

**Mithra Moezzi, Ph.D.**

**July 10, 2008**

<b>DOCKET</b> <b>08-DR-1</b>
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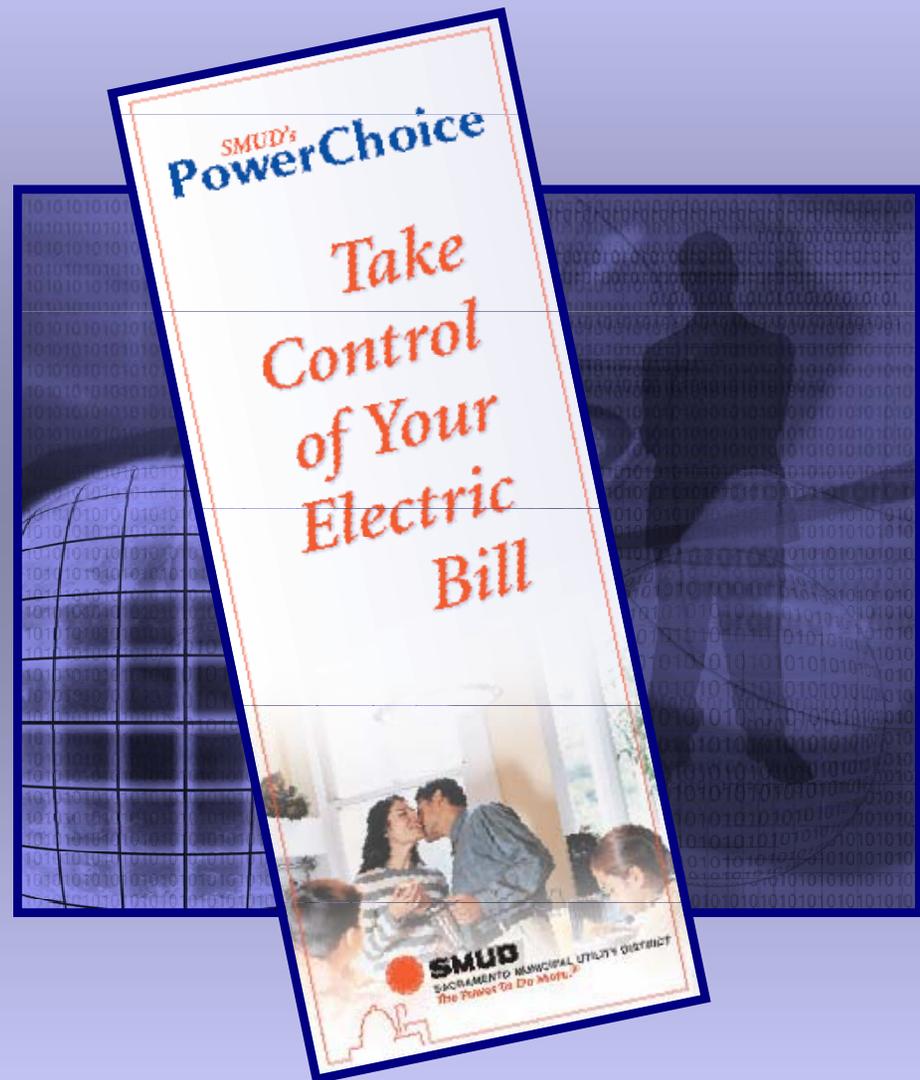
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# SMUD PowerChoice TOU Program

## PROJECT OVERVIEW



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# The Research Team



## → RIA

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- James Woods
- Linda Dethman
- Rick Kunkle

## → SMUD

- Vikki Wood
- Carol Novak
- Ralph Carlson
- Steve Van Horssen

## → Advisory Group

- Loren Lutzenhiser
- David Hungerford
- Iris Sulyma

## → Project Funding

- LBNL's Demand Response Research Center Study – Ron-3
- May 2007 to Dec 2008



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# Residential TOU

- Promoted by engineers from 1890-1910, to fade away until a 1970s-1980s revival
- Residential TOU rates are commonly offered:
  - U.S. (148\*)
  - Internationally: Canada, France, Israel ...
- But when voluntary, TOU is not popularly subscribed
  - 1.4% of all residential customers nationally have TOU rate\*

\* FERC 2006, *Demand Response & Advanced Metering* (AD-06-2-000)

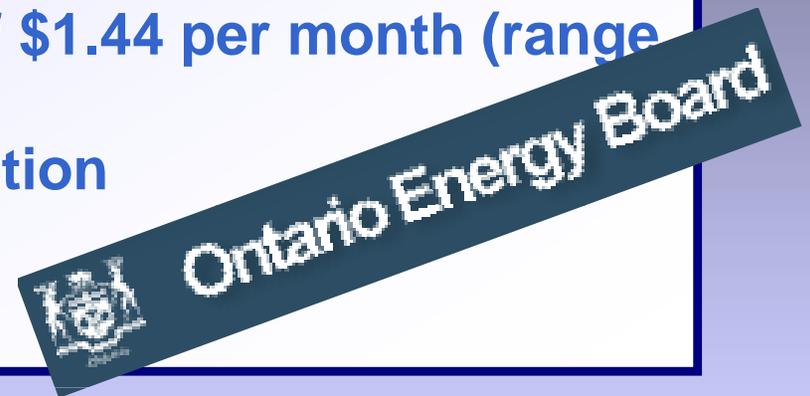


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# Other Residential TOU Studies

## → Recent studies attend to behavior under TOU:

- **BC Hydro Power Smart**
  - Detailed look at actions
- **Ontario Energy Board Smart Price**
  - *Pre Roll-Out*: precedes mandatory smart metering – high customer interest
  - *Customer*: average savings of \$1.44 per month (range about +/- \$10 at extremes)
  - *Utility*: 6% summer peak reduction average customer



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# Research Approach

## PURPOSE

- To explore behavioral responses associated with demand-shifting related to PowerChoice (PC) TOU pricing

## METHODOLOGY

- Survey customers in three waves
- Collect consumption data (PC & control groups)
- Test effects of:
  - Enhanced Information Intervention
  - In-home Feedback Intervention
  - Price – TOU rate



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# SMUD TOU Pilot Population

## SELECTION

- Self-selected, unavoidably
- At first, random sample stratified by customer usage groups (e.g., low, medium, high)
- Low initial response lead to more relaxed recruitment process

## OUTCOME

- **March 2006:**
  - 330 enrolled
  - 2/3: Received *Centron SmartSynch* interval meter
  - 1/3: Meter installation postponed
    - Alternatives considered
    - *Itron Sentinel* meters installed beginning November 2007
- **Opt-Outs:**
  - 39 households (18% of those with meters) moved/dropped by February 2008



# SMUD PowerChoice TOU Program

## RESEARCH IMPLEMENTATION



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# Status of Research



- Two types of interventions underway
- Two of three surveys completed
- Collection of billing data ongoing
- Initial analyses of survey and consumption data
- Findings to date and evolution of questions



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# Two Types of Interventions

## ENHANCED INFORMATION

- **Technical information beyond the usual**
- **Community-Based Social Marketing principles:**
  - **Increase normative nature of demand response behavior**
  - **Share stories**
  - **Encourage sense of community**

## FEEDBACK

- **Real-time consumption monitors**
- **Literature suggests dynamic feedback improves ability to reduce consumption**
  - **Typical estimate is a 5% to 15% kWh reduction**
    - Which customers, for how long?
  - **Less is known about shifting kW (TOU pricing + feedback)**



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# Enhanced Information Examples

## Letter Example

*Note the use of survey information sent by SMUD program manager*

### A “Whole Lotta Changes Going On”

In a recent survey, 77% of you told us that after joining PowerChoice you did some new things, including:

- Changing how you do laundry (44%) – like shifting to off-peak hours and doing fuller loads
- Changing how you stayed cool (37%) – like increasing the A/C temperature and closing curtains
- Changing how and when you cook (19%)

SMUD's PowerChoice			
Power Choice Rates			
Day of Week	Time Period	Time of Use	¢/kWh
■ SUMMER SEASON (JULY & AUGUST) ■			
WEEKDAYS	10pm – Noon	Off-Peak	9.05¢
	Noon–5pm	On-Peak	17.79¢
	5pm – 8pm	Super-Peak	23.02¢
	8pm–10pm	On-Peak	17.79¢
WEEKENDS & HOLIDAYS	10pm – Noon	Off-Peak	9.05¢
	Noon – 10pm	On-Peak	17.79¢
■ SWING SEASON (JUNE & SEPTEMBER) ■			
WEEKDAYS	10pm – Noon	Off-Peak	8.32¢
	Noon–5pm	On-Peak	12.98¢
	5pm – 8pm	Super-Peak	15.64¢
	8pm–10pm	On-Peak	12.98¢
WEEKENDS & HOLIDAYS	10pm – Noon	Off-Peak	8.32¢
	Noon – 10pm	On-Peak	12.98¢
■ WINTER SEASON (OCTOBER–MAY) ■			
WEEKDAYS	10pm – Noon	Off-Peak	7.61¢
	Noon–5pm	On-Peak	9.74¢
	5pm – 8pm	Super-Peak	10.73¢
	8pm–10pm	On-Peak	9.74¢
WEEKENDS & HOLIDAYS	10pm – 6am	Off-Peak	7.61¢
	6am – 10pm	On-Peak	9.74¢
<p><b>IMPORTANT:</b>            Your monthly bill will include a discount or premium called a “Consumption Adjustment” depending on your monthly usage.            If you use less than 1000 kWh of electricity per month, your bill will show a discount of up to 15%.            If you use more than 1000 kWh of electricity per month, your bill will show a surcharge of 20%-50% depending on the total monthly usage.</p>			
GAF 1220-07		1-888-742-SMUD (7683)	
 <b>SMUD</b> SACRAMENTO MUNICIPAL UTILITY DISTRICT The Power To Do More.®		Effective January 1, 2008	



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# Feedback Monitor Intervention



## → PowerCost Monitor

- Sends load data from meter to a wireless device in the home
- Displays:
  - KW
  - Cumulative kWh
  - Price
  - Time
  - Temperature

## → Training booklet prepared by RIA

- Included tips and exercises for using the monitor



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# SMUD PowerChoice TOU Program

## SURVEY FINDINGS TO DATE



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# Survey Status

## → Two telephone surveys completed

- **Aug 2007 (123 of 210):**

- Baseline data
- Motivations
- Expectations and concerns
- Initial actions

- **Dec 2007 (91 of the 123):**

- Reflection on summer and winter actions
- Assessment of Enhanced Information

## → Self-reported and a subset of PowerChoice participants



# Survey Demographics

- 90% own dwelling (most are single-family)
- Compared to Sacramento County:
  - Head of household is typically older
    - Most usually have someone home in daytime (72%)
    - Fewer kids at home
  - 68% are one- or two-person households (vs. 51% for County)
  - Dwelling age and size broadly matches
  - HH income broadly matches
  - Are more highly educated
  - Are more white



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# Reasons for Joining PowerChoice

## → Strongest interest is in saving money: 67%+

- “Your government has put me at poverty level”
- “Saving money while doing something good”

## → Other responses included:

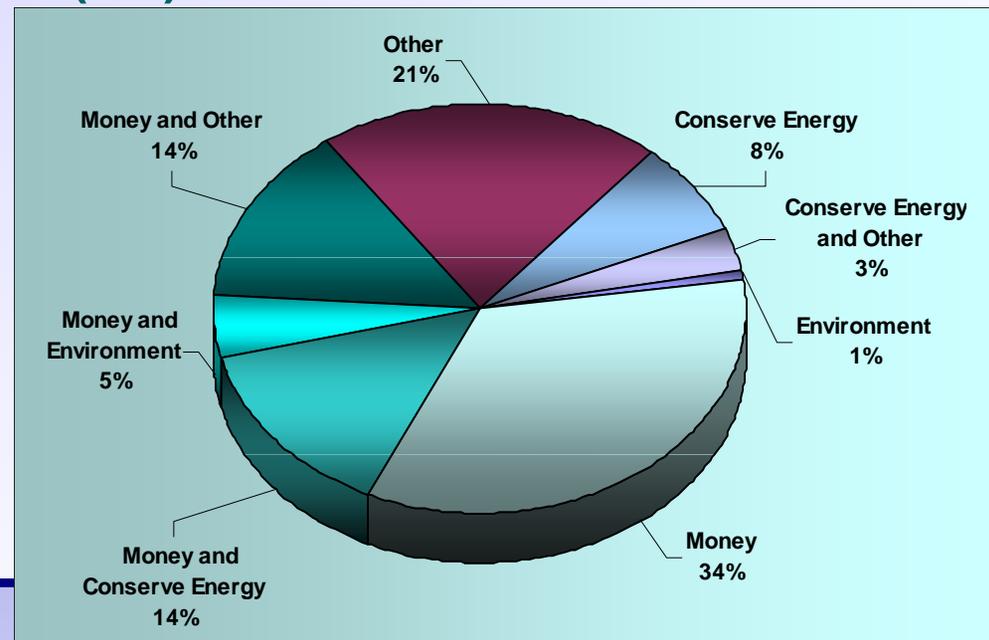
- Help SMUD (7%)
- Good idea for the future (8%)

## → How easily?

- No changes: 15%
- Lots of changes: 15%

## → Few early reservations

- Higher bills
- Lifestyle changes



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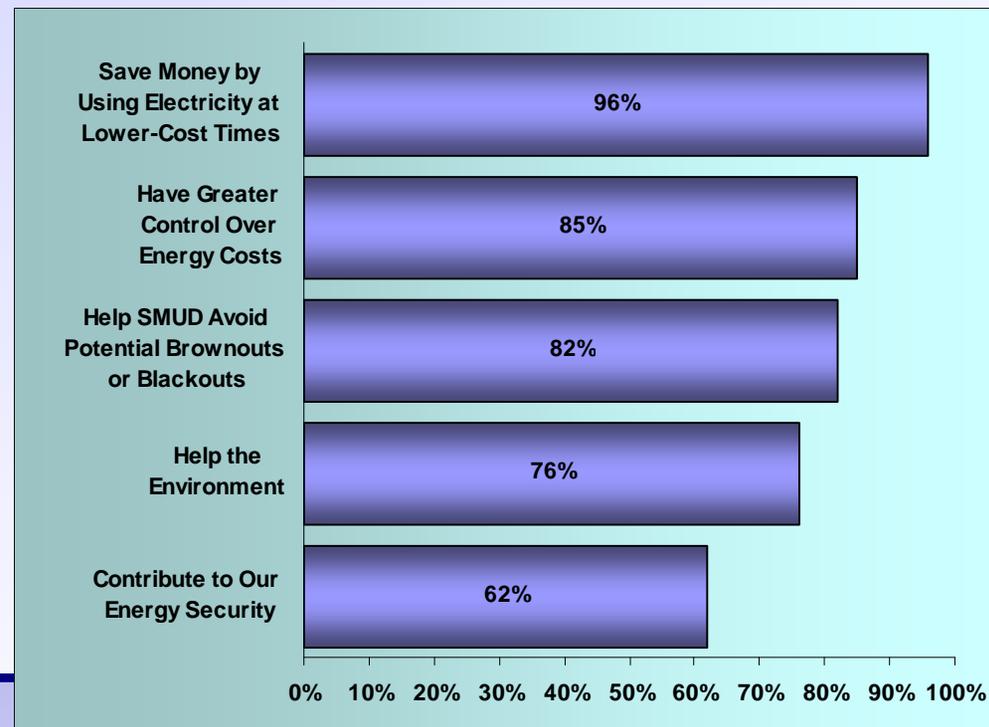
# Reasons for Joining PowerChoice

→ Closed-ended follow-up listed 5 reasons for joining (multiple responses allowed)

- Nearly one-half selected all five

- Saving money appears to be a primary motivation for joining

- Other reasons play supporting role



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# Rate Basics

## → Rate details

- Time periods
  - Four seasons
  - Weekday vs. weekend/holiday
  - Two and three times of use
- Very high awareness claimed
  - Some want aide-memoire
  - Some say it's too complicated



## → “Consumption adjustment”

- Rewards conservation
- Noted in the recruitment material
  - Half said they didn't know about it when joining
- About half received a charge at least once



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# Learning by Survey

## → Challenge in identifying new behaviors and changing degrees

- 85% “already conserved”
- 77% “did something new”

## → Questions

- Open-ended
- Closed-ended



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# What Did Households Report Doing?

## SHIFTING

- Understood shifting as key (Wave-2 results)
  - Reduced AC use: 80%
  - Changed laundry time: 72%
  - Reset pool filter timer: 15 of 18 who didn't already do so
  - Other:
    - Dishwasher timing
    - Meal & cooking schedule
    - "Tried not to use anything during peak"

## CONSERVING

- Almost all already conserved, but most tried harder
  - Reduced AC use
  - Lights
  - General conservation
  - Other
    - Full loads
    - Hang clothes to dry
    - Bought something new



# New Actions Taken – Most Well-Informed

<b>ACTIONS (Wave-1)</b>	<b>FREQUENCY</b>
<b>Air Conditioning (use less, avoid use, open windows, add fans)</b>	<b>48</b>
<b>General Conservation (non-specific shifting or conserving)</b>	<b>35</b>
<b>Laundry (shift, line-dry, new gas dryer, full loads)</b>	<b>33</b>
<b>Lighting (turn off, change to CFLs)</b>	<b>25</b>
<b>Pool / Hot Tub / Shower (shift, turn off, low-flow)</b>	<b>11</b>
<b>TV / Appliances / Computers (turn off, reduce use, shift)</b>	<b>9</b>
<b>Dishwashing (shift, reduce dishwasher use, hand wash)</b>	<b>9</b>
<b>Cooking (outdoors, shift, microwave, use gas stove)</b>	<b>6</b>
<b>TOTAL (multiple responses – 88 respondents )</b>	<b>176</b>



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# How Much Effort?

## → Some extreme

- Wake up at 4:00 am
- Leave the house
- Bake after 10 pm, change how they cook (BBQ, crock pot ...)
- Energy audit
- No AC (10%: 86° or more)

## → Many moderate

- “Make it fun”
- General conservation
- Temperature a little higher
- One-time actions

## → Some minimal

- Turn off the lights

## → Some say “nothing”: 23%



# To What Effect?

- AC & pools understood as big-ticket items
- Actions are not always well-targeted to money or power
  - Some likely don't save or shift – e.g., wash dishes by hand
  - Or at least not much – e.g., nuking the coffee, reducing computer use, even clothes washing
  - Is “consciousness” enough?

- Hard for consumers to tell
  - Bills easily vary 25% one month to next
  - Want more informative bills
- Preliminary price effect analysis supports initial reduction in super-peak use



# What Didn't They Do?

- **The quarter who said they did nothing**
  - Judged their usage already matched TOU rate
  - Didn't know what to do
  - Most who didn't mention money as a motivator changed nothing
- **What didn't others do – some state limits**
  - **Didn't give up AC**
    - Like it cool
  - **Line dry clothes**
    - 30% said “always” or “usually” – but most had done so before starting on PowerChoice
    - No: “We are going forward not backward,” “too frail,” “not allowed,” “I want fluffy,” “My dryer is high-efficiency”



# Other constraints

## → Limiters

- Preferences of spouse
- Habits of kids
- Health problems
  - Where to stop?
- General protection of family

## → Effect on the household

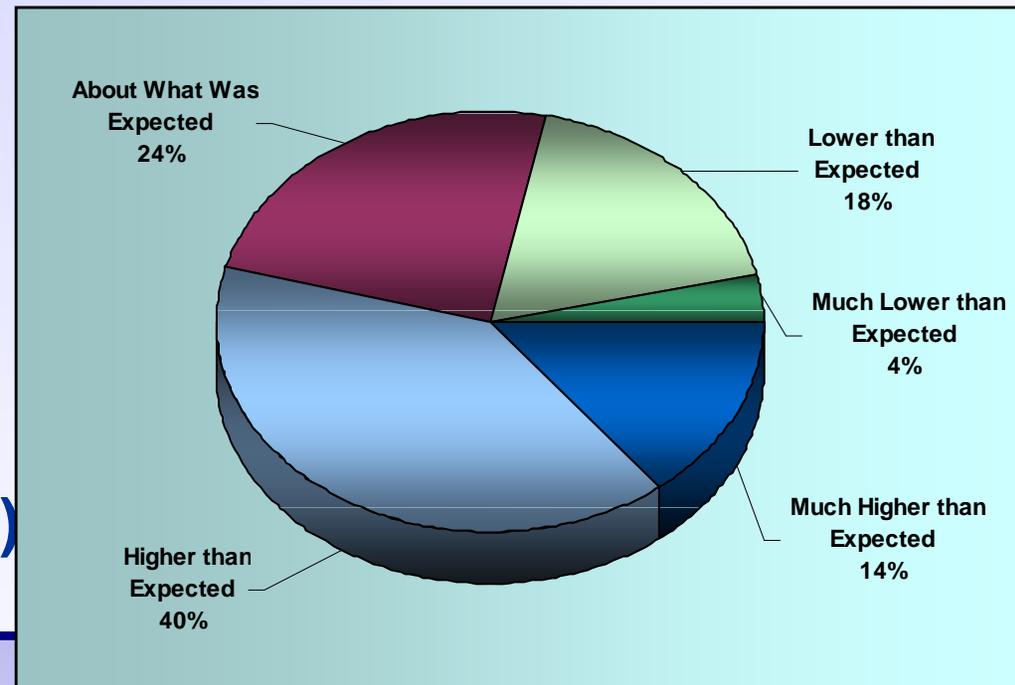
- Few said the actions they undertook were onerous
  - Burdens of domestic energy action studied in Sweden (hardest on women)
- Between the lines, some family strife



# Did Summer Bills Meet Expectations?

→ 83 of 94 who had received summer bill(s) by Wave-1 survey reported that the bills were...

- Higher than expected (54%)
- Lower than expected (22%)
- About as expected (24%)
- Results were similar for households doing new DR actions or not
- 2/3 satisfied (Wave-2)



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# Summary

- **Self-selected sample**
- **Behavioral focus – who, what, why – with supporting consumption data**
- **75% of interviewees claim they reacted**
  - **Are they getting what they want and need?**
    - Concerns
  - **Will they continue to react?**
    - Capacity, Conditions
    - Short term vs. long term
  - **Did they deliver DR?**



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# SMUD PowerChoice TOU Program

**NEXT  
STEPS**



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# Extra Tips Bulletin

## TRAINING MANUAL

**EXERCISE: USING YOUR MONITOR TO SHIFT USE TO LOWER COST PERIODS**

You can save money by reducing how fast you use electricity during super-peak and on-peak periods when you are paying up to 10¢ per kWh. You can use the monitor to help you shift your use to off-peak periods when you pay only 5¢ per kWh.

**SMUD PowerChoice**

**Take Control of Your Electric Bill**

**Blue Line PowerCost Monitor™**

**Extra Tips Bulletin #1**

**In this bulletin:**

- Extra Help for installing Your Blue Line PowerCost Monitor™
- How To Read Your Monitor Display
- How To Use Your Monitor To Help You Shift Your Electricity Use To A Cheaper Time

**Hello from the Research Into Action Team!**

Our goal is to help you make the most out of your new Blue Line PowerCost Monitor. This is the first in a series of bulletins we will send you with tips. We'll be checking in with you later, but if you need us in the meantime, please call 1-800-452-3333, free to call.

Susan J. ...

**HOW TO READ YOUR MONITOR DISPLAY**

Your monitor display screen has four sections:

**SECTION 1** – Shows how fast you are using electricity

**SECTION 2** – Gives you meter and monitor feedback, including a consumption history indicator, an image of the disk rotating, the strength of the signal from your monitor, and the strength of the battery charge

**SECTION 3** – Shows the total of electricity you've used

**SECTION 4** – Gives the time and outdoor temperature



your monitor do these things:

- Press the **0** button (when held for a few seconds) to turn on the **Consumption History Indicator** in Section 2 and use it as described in Section 3.
- Press the **1** button **only** during setup to set the monitor for (PowerChoice summer or winter) and the **2** button **only** during setup to synchronize the monitor with the sensor on your meter.
- Press the **\$** and **KW** buttons to let you switch back and forth between displaying electricity use in dollars (\$) or in kilowatts (kW).



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# Next Steps

## → Conduct Wave-3 survey

- Gauge reactions to Interventions (Spring and Summer 2008)
  - How will monitor be used?
  - For how long?
  - To what effect?
- 50 monitors accepted out of 191 offered
- To what effect?
  - So far 20 installed
  - 20 having trouble
  - 10 haven't responded

## → Assess actions taken in Summer 2008

## → Analyze Wave-3 survey (Fall 2008)

## → Complete analyses of consumption data

## → Submit final report (Winter 2008/09)



# Contact Information



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