



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.

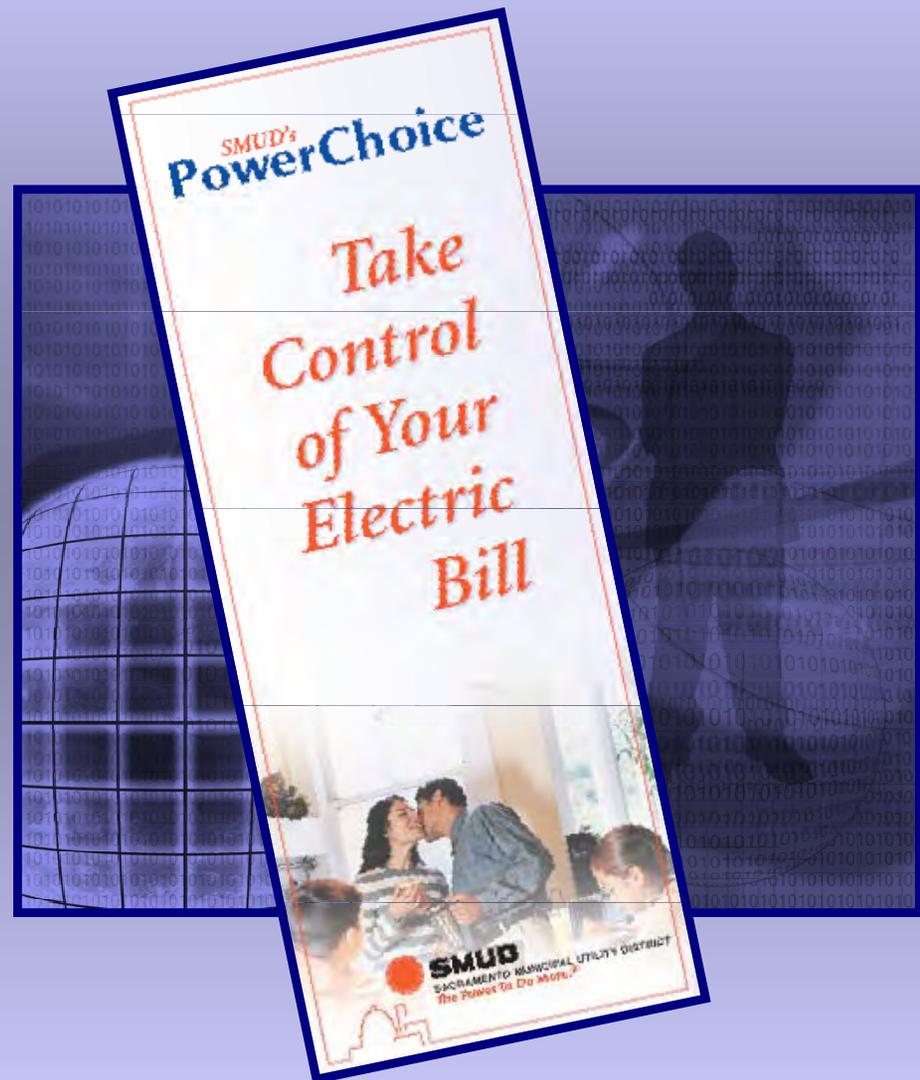
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SMUD PowerChoice TOU Program

PROJECT OVERVIEW



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The Research Team



→ RIA

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- James Woods
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→ SMUD

- Vikki Wood
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→ 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)

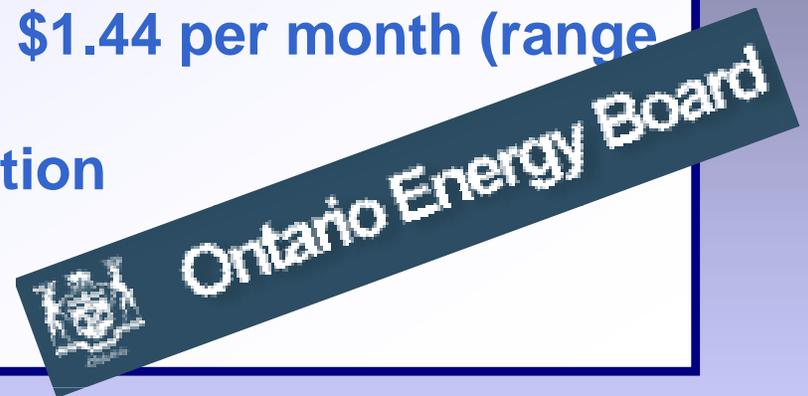


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Other Residential TOU Studies

→ 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



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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>IMPORTANT: 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>			
 SMUD SACRAMENTO MUNICIPAL UTILITY DISTRICT The Power To Do More.®		1-888-742-SMUD (7683)	
 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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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



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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:

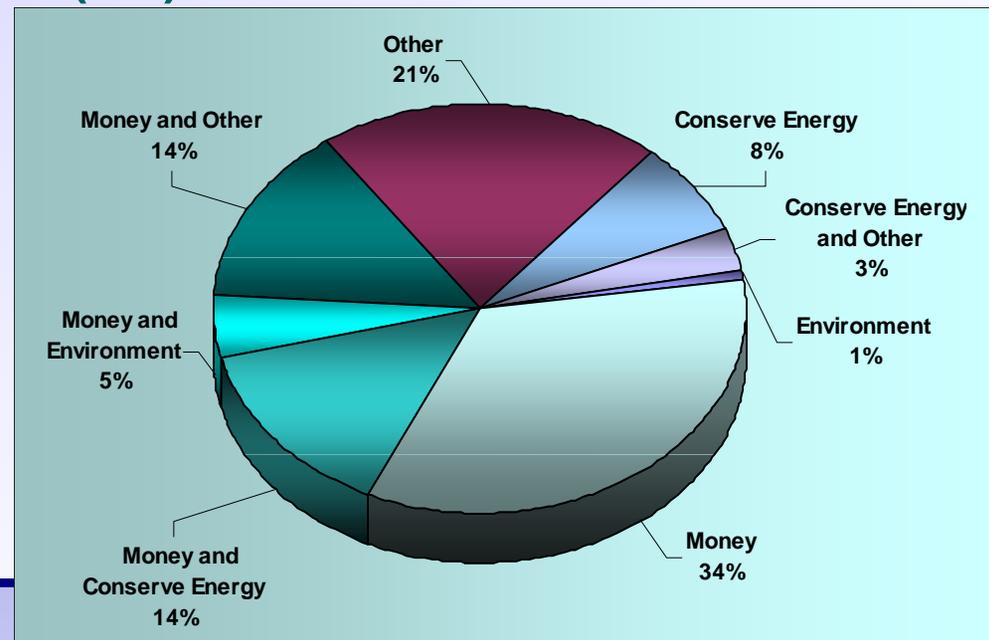
- Help SMUD (7%)
- Good idea for the future (8%)

→ How easily?

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

→ Few early reservations

- Higher bills
- Lifestyle changes

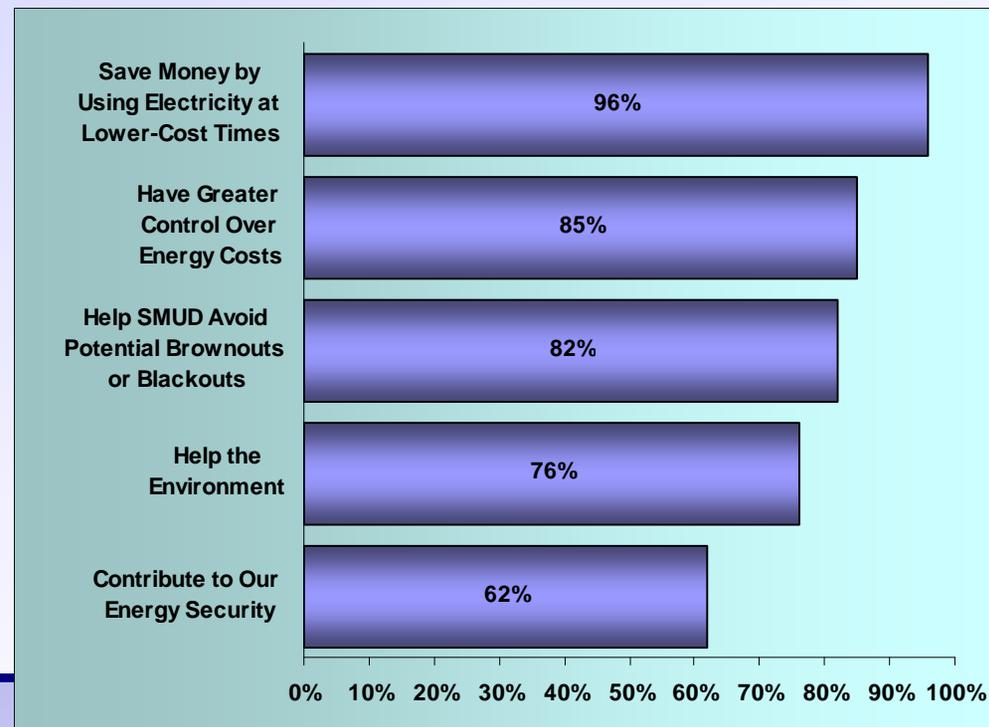


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Reasons for Joining PowerChoice

→ 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



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New Actions Taken – Most Well-Informed

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



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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



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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

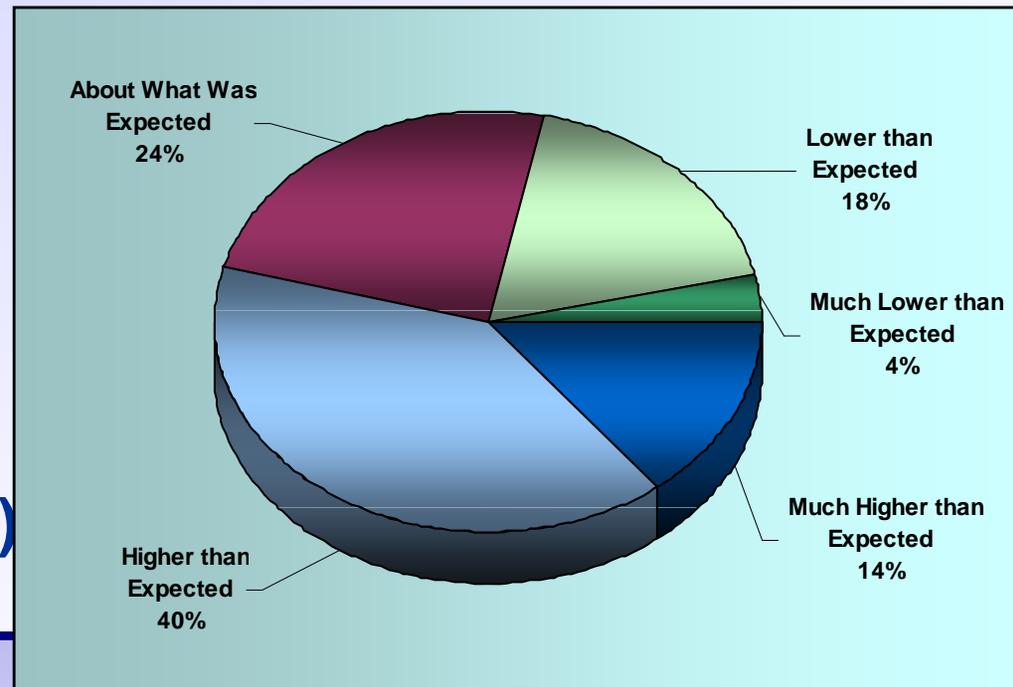
- Few said the actions they undertook were **onerous**
 - Burdens of domestic energy action studied in Sweden (hardest on women)
- **Between the lines, some family strife**



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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**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 times the most by shifting use from the off-peak to the on-peak periods.

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

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 activate the **Consumption History Indicator** in Section 2 and use it as described in Section 3
- Press the **1** button (when held for a few seconds) to activate the **Signal Strength** indicator in Section 2
- Press the **2** button (when held for a few seconds) to activate the **Battery Charge** indicator in Section 2
- Press the **3** button (when held for a few seconds) to activate the **Day & Time** indicator in Section 2
- Press the **4** button (when held for a few seconds) to activate the **Outdoor Temperature** indicator in Section 2
- Press the **5** button (when held for a few seconds) to activate the **Day & Time** indicator in Section 2
- Press the **6** button (when held for a few seconds) to activate the **Outdoor Temperature** indicator in Section 2
- Press the **7** button (when held for a few seconds) to activate the **Day & Time** indicator in Section 2
- Press the **8** button (when held for a few seconds) to activate the **Outdoor Temperature** indicator in Section 2
- Press the **9** button (when held for a few seconds) to activate the **Day & Time** indicator in Section 2
- Press the **0** button (when held for a few seconds) to activate the **Outdoor Temperature** indicator in Section 2

→ **\$ and KW** – Buttons that 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)



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