Economics of Electric Real-time Metering

Sonny K. Oh, P.E.
Christopher P. Werle, P.E., R.E.M.
Logistics Management Institute
McLean, VA 22102

LMI®

Economics of Electric Real-time Metering

Electric Metering/Pricing Alternatives

- Category 1: Residential and small commercial users
  - Metering typically tracks total consumption measured in Kwh over the billing period (e.g., 27-32 days)
  - Pricing based primarily on specified rate per Kwh consumed

$$\text{Cost} = \text{Kwh} \times \$/\text{Kwh}$$

LMI®

Economics of Electric Real-time Metering

Electric Metering/Pricing Alternatives (cont)

- Category 2: Large commercial and industrial users
  - Metering tracks total consumption *and* demand data on a real time basis
  - Pricing based primarily on
    - Consumption at a specified rate per Kwh consumed
    - Demand charges (KW_{max})

Economics of Electric Real-time Metering

Electric Metering/Pricing Alternatives (cont)

- In addition to consumption and demand, other pricing factors may include
  - Energy surcharges
  - Power adjustment factors
  - Charges for transformer and line losses
  - Size of power line feed
  - Noncompliance penalties for failing to meet emergency curtailment requirements
- State public utility commissions regulate pricing formulas and approve rate structures for $/Kwh, rules for determining peak periods, combined Kwh and KW_{max} pricing rate schedules, etc.

LMI®

Economics of Electric Real-time Metering

Establishing Demand and Associated Charges

- Demand charges typically vary by season (summer/winter) and time of day – e.g., for summer season
  - *On peak* (e.g., M-F, 1200-1800)
  - *Partial peak* (e.g., M-F, 0800-1200 & 1800-2200)
  - *Off peak* (e.g., M-F, 2200-0800, S/S/H anytime)
  - Add-on all season charge
- Demand typically established by calculating moving average of the highest demand (KW_{max}) during a specified time interval (1-60 minutes) over the billing period

Economics of Electric Real-time Metering

Establishing Demand and Associated Charges

- Demand charges are cumulative during billing period – e.g., for summer season
  - Summer *on peak* demand charge (KW_{max})
  - Summer *partial peak* demand charge (KW_{max})
  - Summer *off peak* demand charge (KW_{max})
  - Add-on all season charge (KW_{max})
- Example for Category 2 user during summer billing cycle

Cost = Kwh x $/Kwh (consumption)
+ KW_{max} x $A/KW (peak demand for on peak period)
+ KW_{max} x $B/KW (peak demand for partial peak period)
+ KW_{max} x $C/KW (peak demand for off peak period)
+ KW_{max} x $D/KW (add-on demand factor)

Economics of Electric Real-time Metering

Why pursue electric real-time metering?

LMI®

Economics of Electric Real-time Metering

Potential Congressional Mandates on Real-time Metering

- Section 543 of National Energy Conservation Policy Act (42 U.S.C. 8253) to be amended as
  - All federal buildings shall, for the purposes efficient use of energy and reduction in the cost of electricity used in such building, be metered or sub-metered.
  - Each agency shall use, the maximum extent applicable, advance meters or advance metering devices that provide data at least daily and that measure at least hourly consumption of electricity at the federal buildings.
  - Deadline: 1 October 2010

LMI®

Economics of Electric Real-time Metering

Potential Management Benefits

- Provides accurate data on electricity use and cost on real time basis
- Allows facility managers to make informed decisions on electricity use patterns
- Helps avoid energy use during peak period when electricity is more expensive
- Helps avoid high power demand charges
- Helps avoid demand curtailment penalties

Economics of Electric Real-time Metering

Examples of how real-time electric metering might be used at a facility……

LMI®

Economics of Electric Real-time Metering

Pacific Gas and Electric E-20 Rate Schedule (excerpt)

Season	Time of Use Period	$/KW	$/Kwh
Summer On Peak (5/1-10/30)	12:00 – 18:00, M-F, ex holidays	$13.35	$0.18407
Summer Partial Peak (5/1-10/30)	08:30-12:00 & 18:00-21:30, M-F, ex holidays	$3.70	$0.09814
Summer Off Peak (5/1-10/30)	21:30-08:30, M-F, Sat Sun, & holidays	-	$0.09069
Winter Partial Peak (11/1-4/30)	08:30-21:30, M-F, ex holidays	$3.65	$0.10391
Winter Off Peak (11/1-4/30)	21:30-08:30, M-F & All weekends and holidays	-	$0.09048
All seasons	Maximum demand	$2.55	-

Note: Demand interval is 30 minutes per billing cycle

LMI®

Economics of Electric Real-time Metering

Example Charges: Fresno, CA Facility (6/21/2002 – 7/24/2002)

Demand Charge Category	(a) Peak Demand (KW_{max})	(b) Peak Demand Rate ($/KW)	(c) Total Usage (Kwh)	(d) Usage Rate ($/Kwh)	(e) Cost (a*b)+(c*d)
On Peak (12:00-18:00)	887	$13.35	106,188	$0.18407	$31,387
Partial Peak (08:30 -12:00 & 18:00 -21:30)	900	$3.70	120,419	$0.09814	$15,148
Off Peak (21:30 - 08:30)	870	0	362,541	$0.09069	$32,879
Maximum Demand	900	$2.55	NA	NA	$ 2,295
Total Charges					$81,709

LMI®

Economics of Electric Real-time Metering

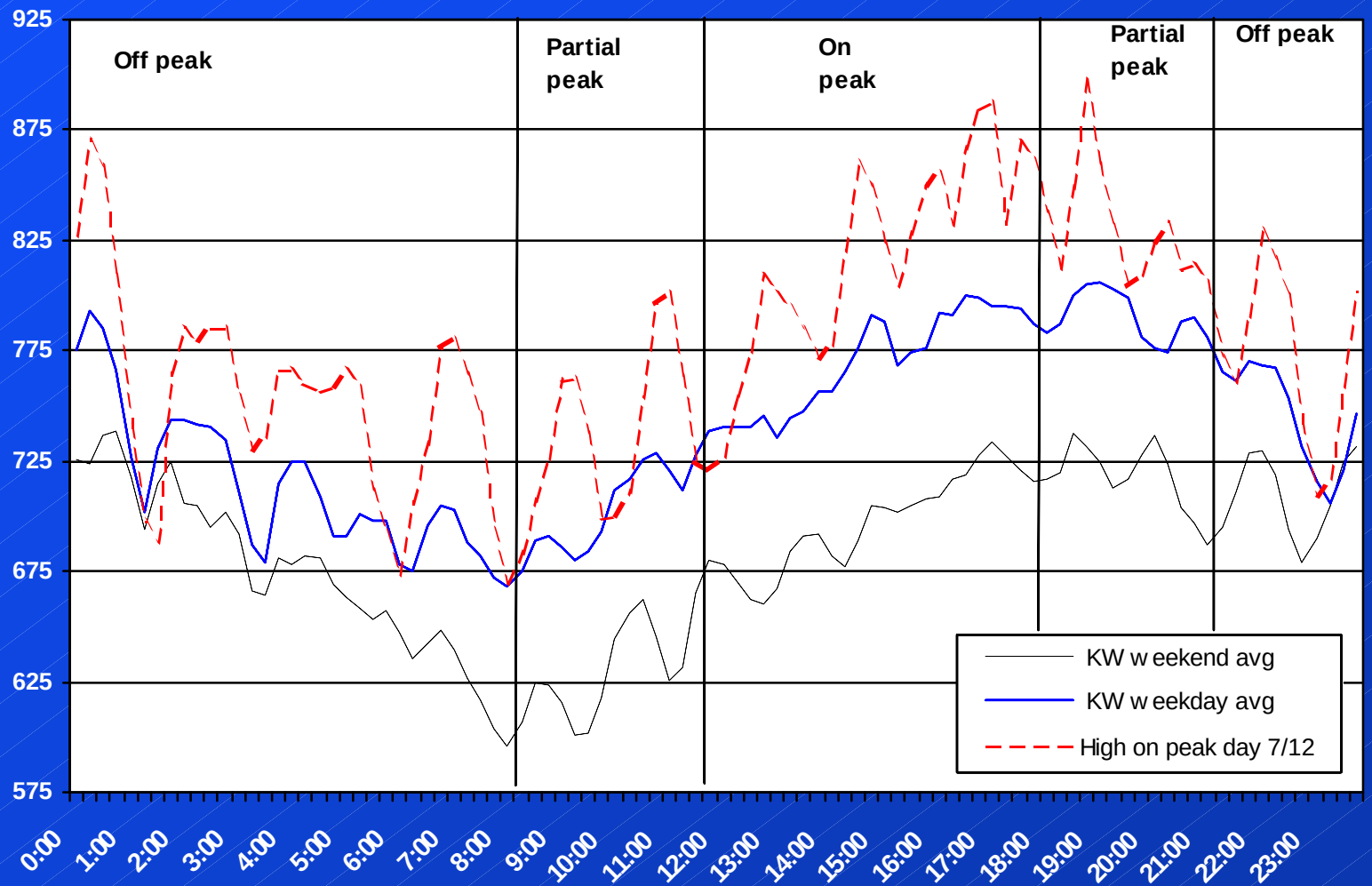
PGE E-20 Rate Schedule – Cost Savings Differentials

Shifting From	To	Savings $/KW	Savings $/Kwh
Summer On Peak (max)	Summer Partial Peak (max)	$ 9.65	$0.08693
Summer On Peak (max)	Summer Partial Peak	$13.10	$0.00745
Summer On Peak	Summer Off Peak	$13.35	$0.09438
Winter Partial Peak	Winter Off Peak	$ 3.65	$0.01343

Economics of Electric Real-time Metering

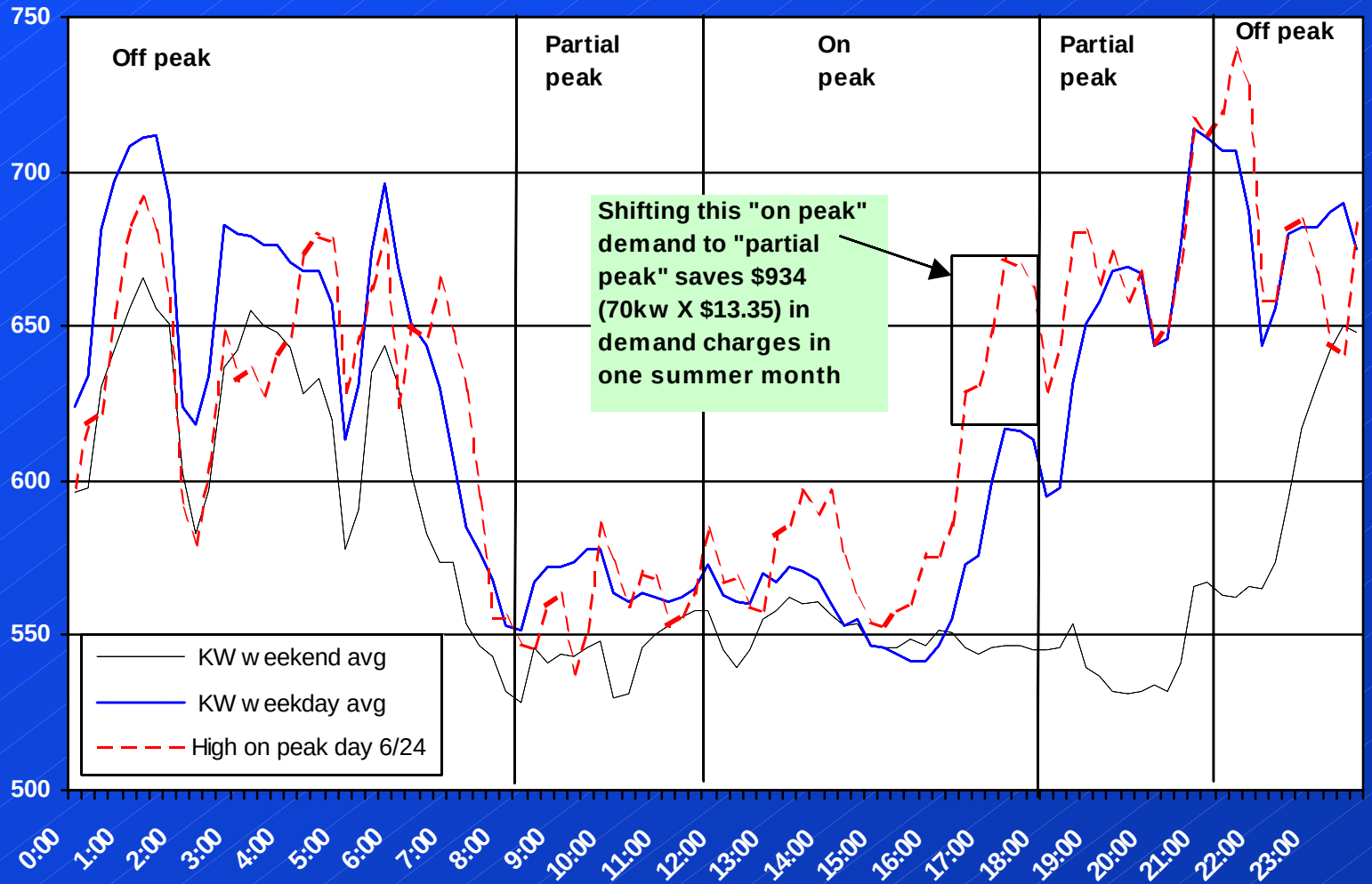
Fresno Facility – Demand (KW) History

(15-min. interval averages 6/21/02 – 7/24/02)



Economics of Electric Real-time Metering

Stockton Facility – Demand (KW) History
(15-min. interval averages 6/20/02 – 7/20/02)



Economics of Electric Real-time Metering

Demand Profile Analyses - Inventory Major Components

Energy Systems	Components
Lighting	Lamps, Ballasts
Heating	Electric heaters, heat pumps
Air Conditioning	Chillers, pump motors
Ventilation	Fan motors
Industrial process	Motors, special equipment
Plug Ins	PC, vending, kitchen appliances, etc

Economics of Electric Real-time Metering

Common Demand Shedding/Shifting Techniques

- Turn off portions of lights
- Pre-cool building before on-peak period
- Shift work schedule or equipment use hours
- Fuel substitution – gas absorption chiller
- Use of adjustable speed drives
- Install thermal storage capabilities

Economics of Electric Real-time Metering

There are clearly advantages to knowing how much electricity your facility is using from hour to hour……..

…… so how can you establish a real-time metering capability?

Economics of Electric Real-time Metering

Gaining Access to Facility Real-time Meters

- Utility companies often install telemeters that record and transmit real time consumption data; may also be manual read
- Utilities own the meters, but may allow customers to tap into data through some form of sharing arrangement
- Utilities may convert conventional meters at larger facilities to real-time meters at either no, partial, or full cost to customer

LMI®

Economics of Electric Real-time Metering

Costs Associated with Real-time Metering

- Metering equipment installation: $500 - $3,000 per meter
- Communication line: initial installation cost and monthly fee (e.g., phone lines, wireless, intranet, Ethernet, etc.)
- User interface: initial hardware/software development cost, incremental cost of upgrade or ESCO contract fee, staff training

Economics of Electric Real-time Metering

Conclusion

- Potential cost savings will depend on many variables
  - Rate schedule (penalty clause, competitive purchase)
  - Demand profile based on energy systems and operational characteristics
  - Capability to shift demand
- Real time metering is first step
- Training and retrofit projects are needed to establish demand management capability

Economics of Electric Real-time Metering

LMI Contacts for Additional Information

Sonny K. Oh, P.E.
Energy and Environment Group
(703) 917-7304
soh@lmi.org

Christopher P. Werle, P.E., R.E.M.
Energy and Environment Group
(703) 917-7442
cwerle@lmi.org