Designing and Implementing an Advanced Metering Program at the U.S. Postal Service

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Origins – the USPS California Advanced Metering Pilot

- Electricity restructuring in CA
- CA energy crisis 2000/2001
  - Rolling blackouts
  - High/volatile energy prices
- California Energy Commission (CEC) grant program to develop demand response capabilities among large electricity users (funded meters, demand controls, etc based on demonstrated kW reduction)
- New energy data management products available (web-based, near real time, flexible reporting capabilities, etc)

- USPS recognized increased need for data for:
  - Energy commodity purchases in deregulated market
  - Energy efficiency project design

- Originally, motivated by business needs and desire to cooperate with needs of the State (reduce peak demand)
- Now, EPACT requirements also

Key Features of California Advanced Metering Pilot

- 24 large USPS processing facilities in CA
- Project included:
  - Facility level interval electric meters
  - HVAC and other equipment controls
  - Web-based data access, including standard and custom analysis and graphics
  - Two one-day training sessions
- Shortcoming
  - Access to USPS network denied (no real time data)
  - Phone line access only (once a day polling)
- Partnered with Viron (now Chevron Energy Solutions) who provided UtilityVision energy data management platform
- Demonstrated 4.7MW of demand response potential (non-coincident) across all 24 sites
- Completely funded by $1.2M CEC grant
- In addition, FEMP funded: *Using Energy Information Systems (EIS):`A Guidebook for the U.S. Postal Service*

Potential Sources of Benefits from Advanced Metering

- Based on pilot success, LBNL was asked by USPS National Energy Program Committee to identify potential sources of benefits and develop business case for national advanced metering program
- More effective electricity and gas commodity procurements
  - Detailed usage history helps reduce risk for suppliers
- Improve facility operations & maintenance (O&M)
  - Establish consumption benchmarks (with sub-metering)
  - Identify equipment problems through changes in consumption patterns
  - Prevent equipment damage (with sub-metering)
- Improve energy efficiency retrofit project design
  - Detailed equipment usage (with sub-metering)
  - Verify projected savings
- Reduce demand charges
- Reduce unnecessary energy consumption

Potential Sources of Benefits from Advanced Metering (cont.)

- Emergency management system
  - Controls and automation facilitate quick response
  - Prevent equipment damage (with sub-metering and controls)
- Tariff analysis
  - Evaluate alternative rates and supply options
- Reduce utility billing errors
  - Estimate bills, identify errors
- Evaluate potential benefits from economic (price response) and reliability (grid emergency) demand response programs
  - Identify load reduction opportunities
  - Monitor reductions

Nationwide Large Facility Statistics: P&DCs, BMCs, and AMC/AMFs

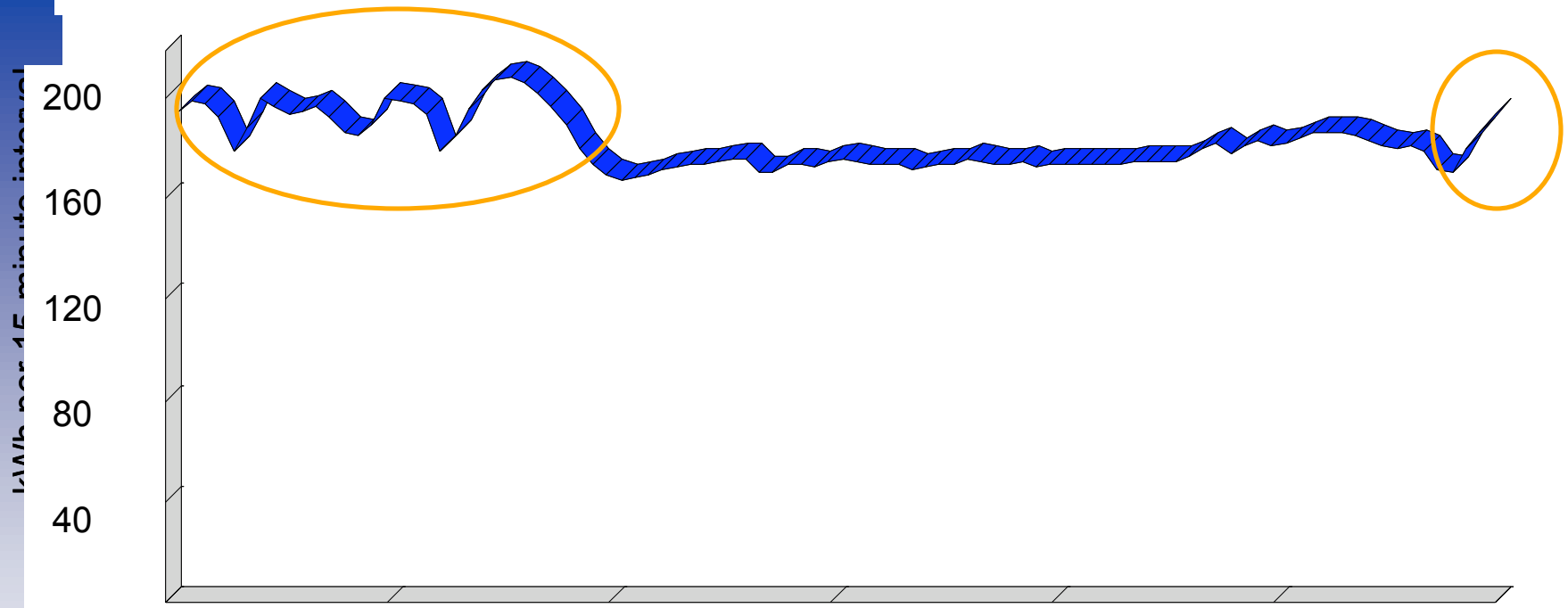
Category	Size	P&DC count	P&DC Avg. Sq. Ft.	BMC count	BMC Avg. Sq. Ft.	AMC/AMF Count	AMC/AMF Avg. Sq. Ft.
Small	Under 200K sq. ft.	132	106,818 (min. 21K sq. ft.)	0	n/a	n/a	106,818 (min. 800 sq. ft.)
Medium	>200K and >600K sq. ft.	118	330,833	18	531,022 (min. 336K sq. ft.)	5	268,192 (max. 380K sq. ft.)
Large	>600K sq. ft.	30	901,935 (max. 1.5M sq. ft.)	2	1,129,415 (max. 1.5M sq. ft.)	1	638,000
	Totals	280		20		6	

Representative P&DC sites*

Category	Location	Int. Sq. Ft.
Small	Pasadena, CA	152,895
Medium	San Jose, CA	394,442
Large	Oakland, CA	827,587

Representative sites selected based on average size and availability of 15-minute interval data from UtilityVision system.

Avg. Profile – July 2003
Pasadena, CA (small)

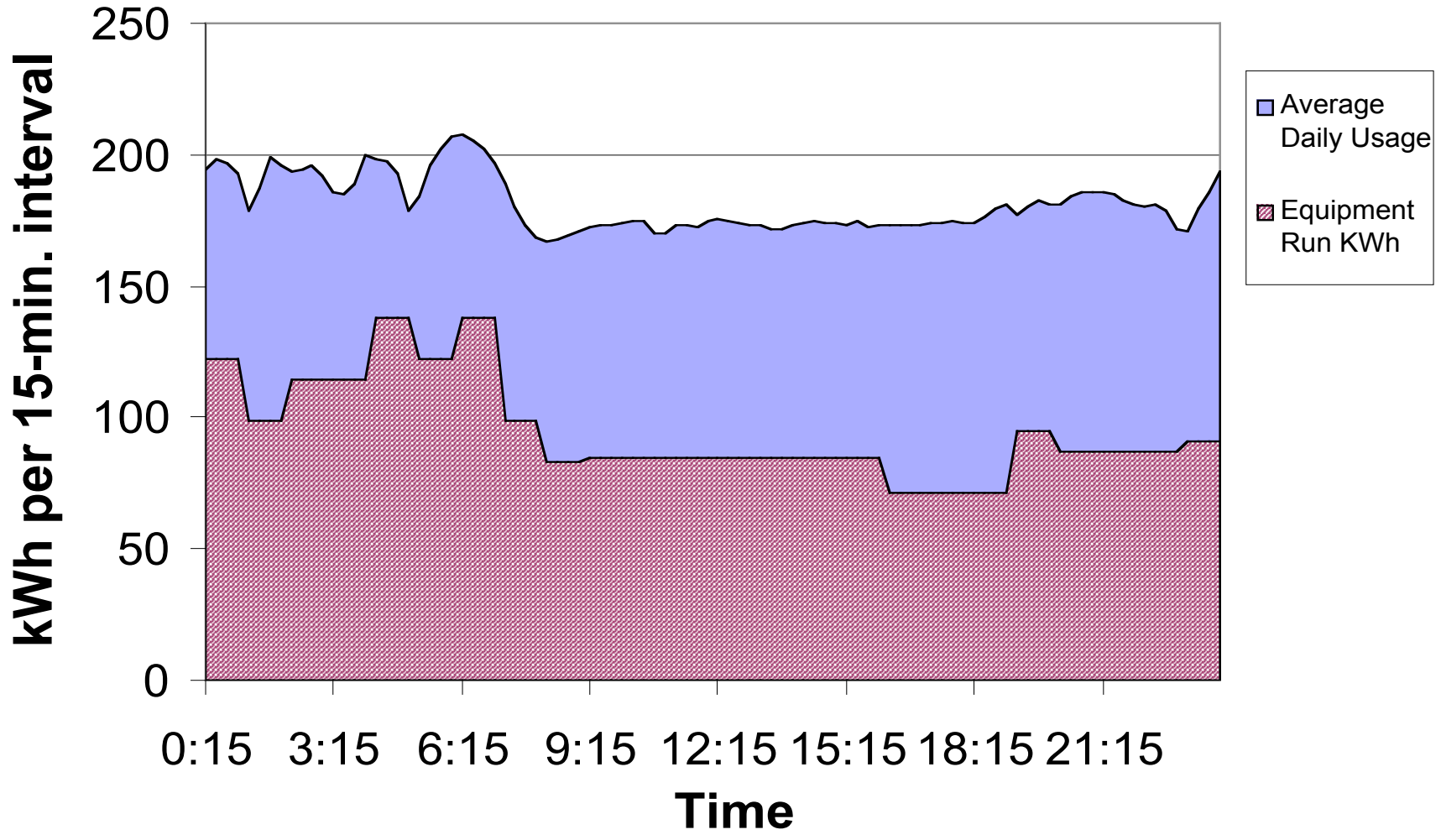


Highest Use Period : 11:00 p.m. – 8:00 a.m.

Summer Stats (May – Oct): Max 15-min. kWh: **226**

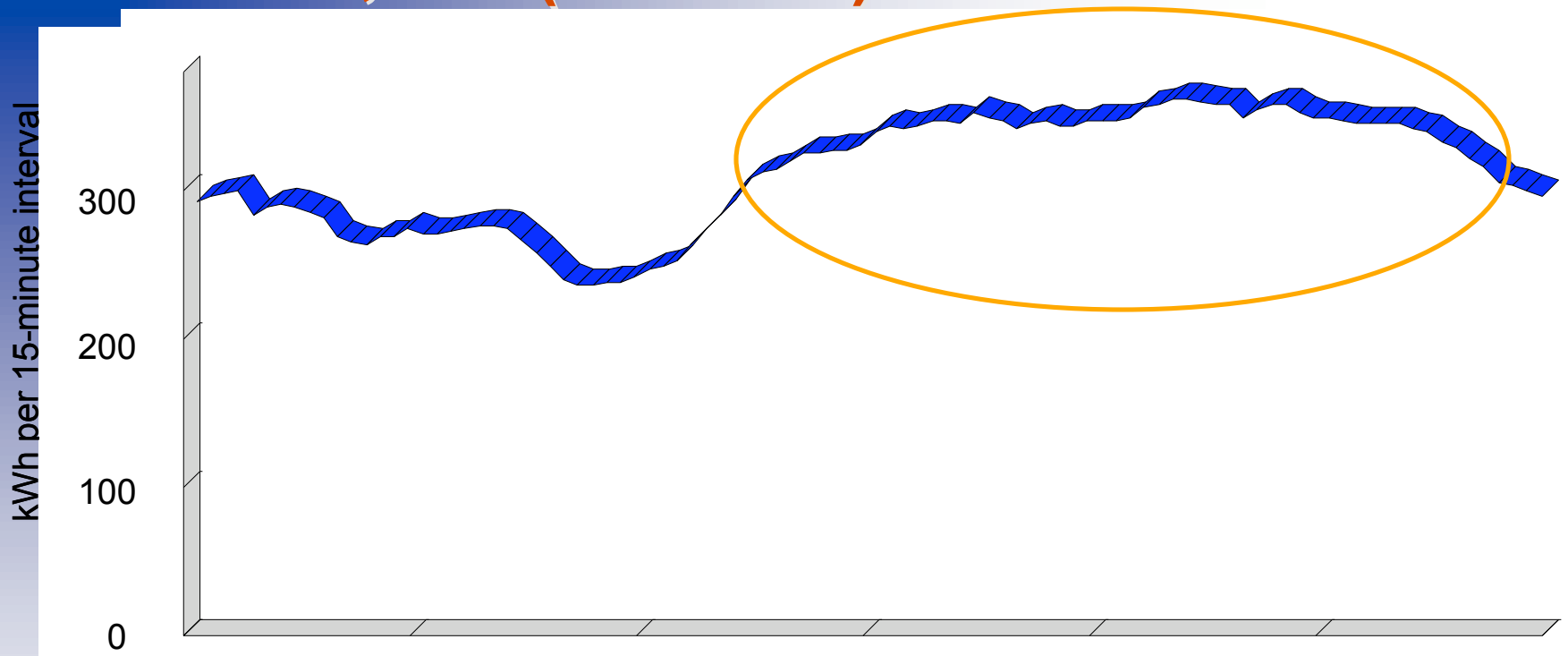
Min 15-min kWh: **116**

Average Load with Estimate* of Process Equipment Use – Pasadena, CA



**Some equipment run information not available*

Avg. Profile – July 2003
San Jose, CA (medium)

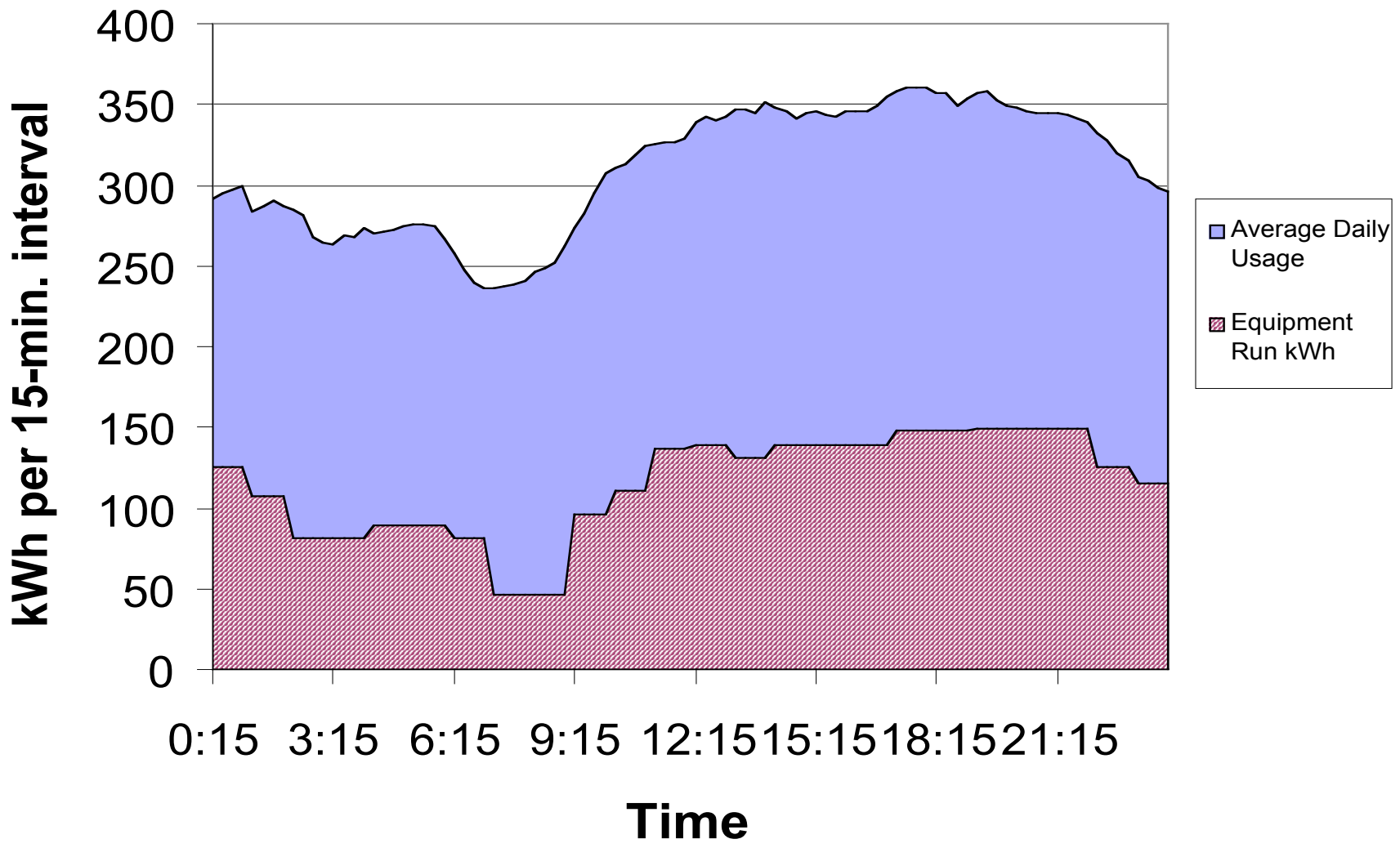


Highest Use Period: 8:00 a.m. – 11:00 p.m.

Summer Stats (May – Oct): Max 15-min. kWh: **406**

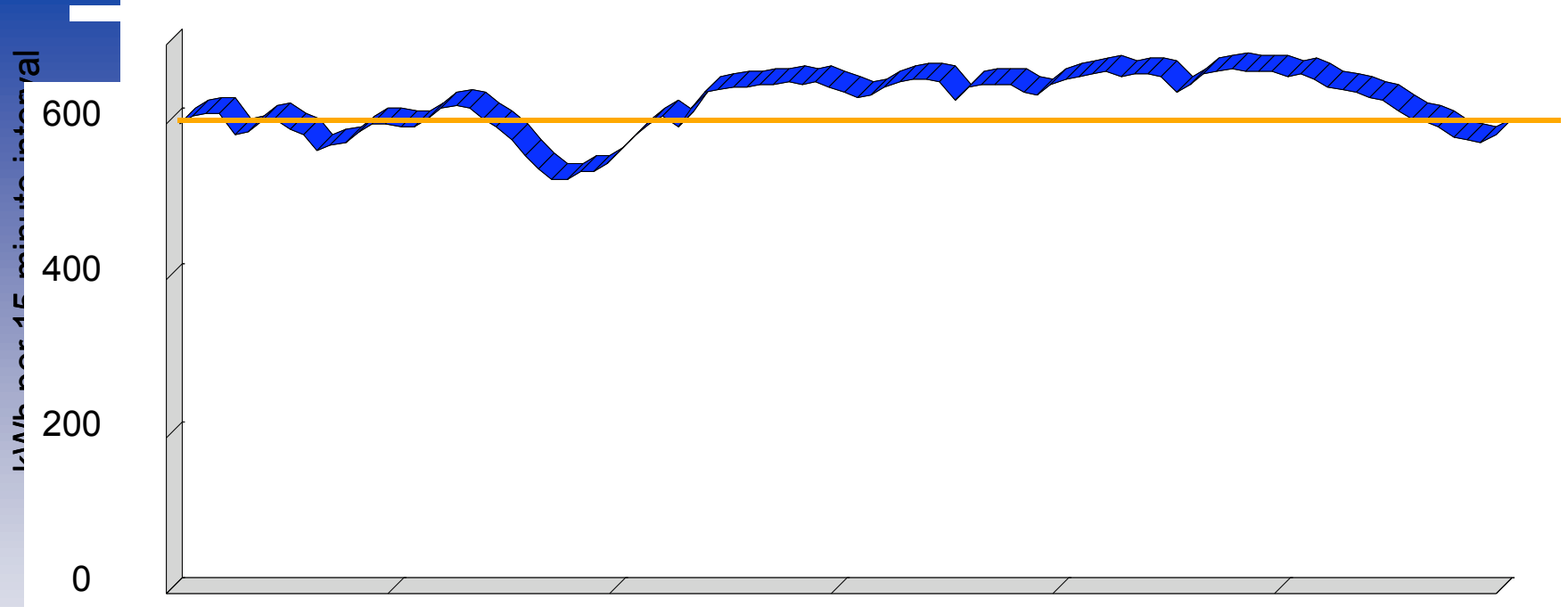
Min 15-min kWh: **148**

Average Load with Estimate* of Process Equipment Use – San Jose, CA



**Some equipment run information not available*

Avg. Profile – July 2003 Oakland, CA (large)

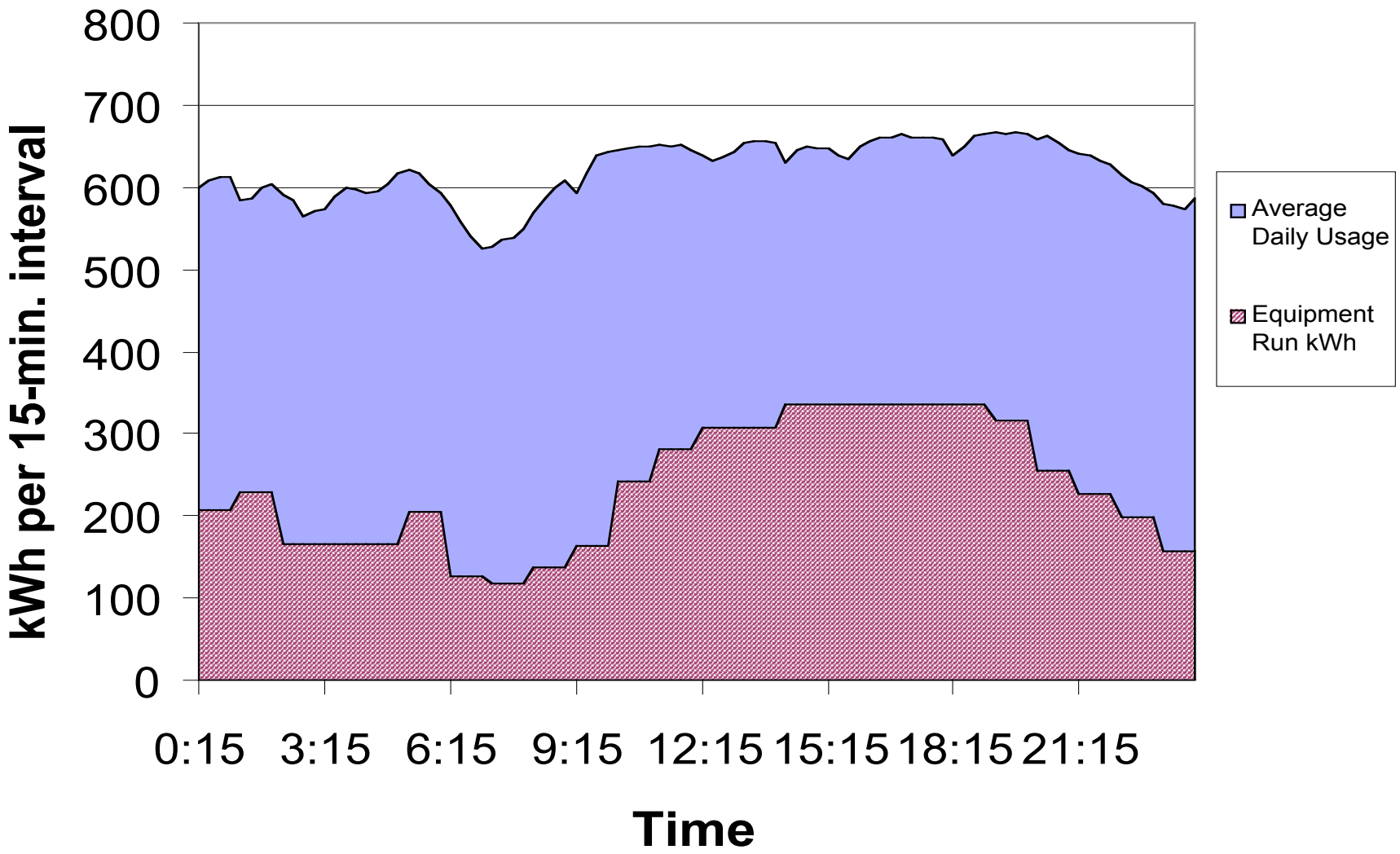


Fairly consistent all day, slightly higher in afternoon

Summer Stats (May – Oct): Max 15-min. kWh: **742**

Min 15-min. kWh: **392**

Average Load with Estimate* of Process Equipment Use – Oakland, CA



Some equipment run information not available

Calculating Benefits – O&M and Procurement Savings

- Average utility bill costs by facility size
  - Small: $500K
  - Medium: $1.0M
  - Large: $1.5M
- Estimated annual savings of 1%, 2% and 3%
- Estimated costs for low-, medium- and high-tech metering solutions
- Applied to facilities likely to install telemetering:
  - P&DCs
  - BMCs
  - Medium and large AMC/AMFs
- NPV at 5% over 5 years, installation costs in year 0

Calculating Benefits – Energy Efficiency Retrofit Designs

- National scenarios based on potential annual estimated savings from EE opportunities
  - Low: $10M
  - Medium: $30M
  - High: $50M
- Estimated annual savings of 1%, 5% and 10%
- Applied to facilities likely to install telemetering:
  - P&DCs
  - BMCs
  - Medium and large AMC/AMFs

National Advanced Metering Pilot – Objectives

Based on success in first pilot, selected Chevron Energy Solutions to install advanced meters and UtilityVision at six sites:

- Establish full access to USPS network
- Validate findings from California pilot
- Provide interval data for commodity purchases
- Provide interval data for energy efficiency retrofit project design
- Better understand components of demand
    - Process loads
    - HVAC
    - Compressed air
    - Lighting
    - Plug loads
    - Other
- Improve overall facility O&M
- Improve chiller O&M (alarms, etc)
- More effective participation in demand response programs
- Better understand performance of on-site generation

National Advanced Metering Pilot – Sub-metering Protocol Design

- One key question to be addressed in pilot: how to design a cost-effective sub-metering plan
- Two sites of six in pilot receive sub-meters
- 18 sub-metering points funded
- Accomplish different goals at different facilities
  - Chiller O&M
  - On-site generation
  - Process load

Financial Analysis of National Advanced Metering Program

Business Case: Net Present Value of Advanced Metering Program

Discount Rate =	5.00%					
Facilities Benefitting (%) - Comm =	50%					
Facilities Benefitting (%) - O&M =	50%					
Facilities Benefitting (%) - EE =	50%					
Year	0	1	2	3	4	5
Commodity Procurements		$256,500	$513,000	$769,500	$1,026,000	$1,282,500
O&M Improvements		$513,000	$1,026,000	$1,539,000	$2,052,000	$2,565,000
EE Project Design		$150,000	$300,000	$450,000	$600,000	$750,000
Telemetering Investment	($7,000,000)					
Telemetering Costs		($345,600)	($345,600)	($345,600)	($345,600)	($345,600)
Annual Cash Flow	($7,000,000)	$573,900	$1,493,400	$2,412,900	$3,332,400	$4,251,900
Discounted Cash Flow	($7,000,000)	$546,571	$1,354,558	$2,084,354	$2,741,574	$3,331,475
Net Present Value	$3,058,532					

Conclusions

- An well-designed advanced metering program makes business sense for the USPS, even absent EPAct 2005 requirements
- (Near) real time access to data is key to maximizing benefits
- No obvious rule of thumb for designing sub-metering protocols, although effective sub-metering likely to add significant value
- Metering is just a start
  - Proper analysis necessary
  - Effective use must be made of data