FEMP Metering Training Course
Session 3: Metering Planning, Financing, Uses for Data and Case Studies
April 4, 2007

Course Introduction – slide 3

- Help Federal agencies meet EPAct 2005 metering requirements
- Three-part program
  - Metering Overview (2/28/2007)
  - Metering Technologies, Communications, and Data Storage (3/14/2007)
  - Metering Planning, Financing, Data Usage, and Case Studies (4/4/2007)

Previous Sessions – slide 4

- Videos available at http://eere.pnl.gov/femp/metering_webcast.stm

Session #3 Objectives – slide 5

- As related to EPAct 2005, presentation focused on:
  - Metering planning steps
  - Options on metering financing
  - Examples of data uses
  - Relevant Federal sector case studies

Other FEMP Metering Support – slide 6

- FEMP metering website:
  http://www.eere.energy.gov/femp/technologies/om_advmetering.cfm
- Energy 2007 – August 5-8, 2007
  http://www.govenergy.com
- Metering Best Practices Guide – summer 2007:
  - Methods and approaches
  - Technologies and applications
  - Communications and data storage
  - Program planning
  - Data applications
  - Case studies

Session #3 Topics – slide 7

- ❑ Sessions 1 and 2 Highlights
- ❑ Metering Planning
- ❑ Financing
- ❑ Uses of Data
- ❑ Case Studies

Sessions 1 and 2 Highlights – slide 8

- Session 1:
  - Overview of EPAct requirements
  - Technology descriptions and economic considerations
  - High level discussion of planning, financing, uses of data
- Session 2:
  - Metering technologies
  - Communications and data storage

Session #3 Topics – slide 9

- ✓ Sessions 1 and 2 Highlights
- ❑ Metering Planning
- ❑ Financing
- ❑ Uses of Data
- ❑ Case Studies

Metering Planning – Plan Considerations – slide 10

- Consider metering plans on a site-by-site basis
  - One size does not fit all
- Economies of scale apply
  - Build for the future
- Plan becomes guidance road map
  - Suggest get buy-in/approval from management
    - Get management to review/participate in development

Metering Planning – Objective/Goal Development – slide 11

- Think about the questions you want to answer…
  - **How much does it cost you to operate a facility?**
  - What operational actions can help reduce costs?
  - **Where is the poorly designed/operating equipment?**
  - Which of these should be replaced, and when?
  - **Do like facilities/buildings use similar amounts of energy?**
  - Are your energy savings strategies/projects producing results?
  - **By facility, how much energy do you use daily, weekly, yearly?**
  - What utility rate opportunities can you take advantage of?

Metering Planning – Program Structure – slide 12

- Determine data needs…
  - What data are necessary to achieve designed goals?
  - How are these data collected and stored?
- Determine equipment needs…
  - Level of sophistication
  - Level of compatibility

    - Communication needs
- Develop criteria for equipment decisions
    - Metering costs
    - Metering benefits
    - Metering impact

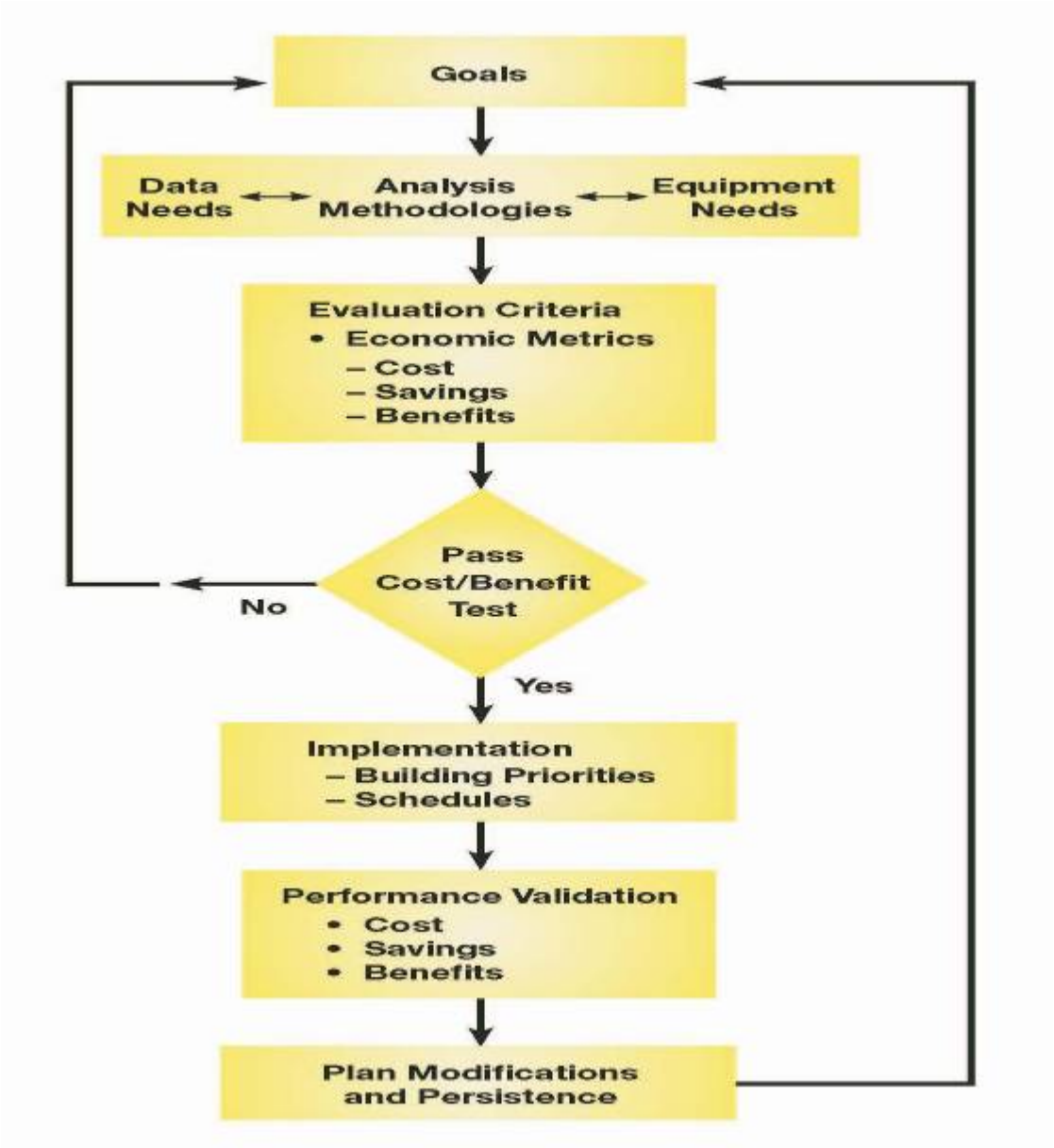
Metering Planning – Program Structure cont'd – slide 13

- Develop criteria for facility decisions
    - Which buildings to meter
        - How to "formally document" those ***not*** metered
- Future activities
    - Steps to implement plan
    - Steps to sustain plan
    - Growth of system
    - Persistence

Metering Planning – slide 14

In summary – major plan sections:
1. Introduction
2. Objective/goals
3. Needs identification
4. Evaluation criteria
5. Implementation actions
6. Persistence and modifications

Metering Planning – slide 15



Session #3 Topics – slide 16

- ✓ Sessions 1 and 2 Highlights
- ✓ Metering Planning
- ❑ Financing
- ❑ Uses of Data
- ❑ Case Studies

Financing – slide 17

- Financing hierarchy
- Financing approaches

Financing Hierarchy – slide 18

- "No cost"
  - Inclusion in construction projects
  - Tenant fees
  - Retained savings reinvestment
  - Utility provided
- Appropriations
  - Line item
  - Local authority
- Alternative Financing
  - Utility company financed
  - Energy savings performance contract (ESPC)

Inclusion in Construction Projects – slide 19

- Include meters on new buildings and with major renovations
- Cost absorbed as part of the project
- Use policy approach: DoD Instruction 4170.11
  - Required on
    - All new construction projects
    - Renovations exceeding $200,000
  - Electric, water, natural gas, and steam (central plants)
- Caution
  - Limited new construction and major renovations
  - "Value engineering"

http://www.dtic.mil/whs/directives/corres/pdf/i417011_112205/i417011p.pdf
http://www.acq.osd.mil/ie/irm/irm_library/DoD%20Energy%20Manager%20Handbook%20Aug%202005.doc

Tenant Fees – slide 20

- Bill costs to tenants for meters on their assigned buildings
- Applicable where tenants pay rent and/or utilities
- Tenants benefit from
  - Accurate cost allocation
  - Improved ability to manage energy use
- Caution
  - Tenants may protest additional costs

Retained Savings Reinvestment – slide 21

- Retention of Savings – Section 546 of National Energy Conservation Policy Act (NECPA)
- Must reinvest for
  - Energy efficiency
  - Water efficiency
  - Renewable resources projects
- Very limited availability

Utility Time-Based Rate Customers – slide 22

- States to determine requiring time-based rate offerings per EPAct 2005, Section 1252
- Utility provides meter to customers requesting time-based rates
- Limited availability by state – check local electric utility
- Caution
  - Load disaggregation at multi-building sites

Line Item Appropriations –slide 23

- Request funding in budget submittal
- "Traditional" approach
- Specific to agencies (e.g., GSA and Army)
- Caution
  - Limited funding environment
  - Competition for funds
  - Budget process may take several years

Local Funding – slide 24

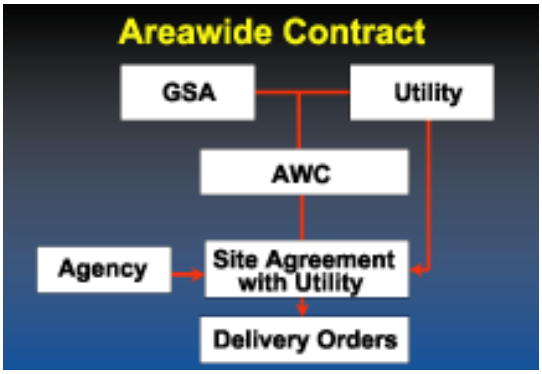
- Appropriated funds managed locally
- Use when
  - Agency policy directs
  - Local funds are available
  - Anticipated system cost is "low"
- Caution
  - Limited funding at local level

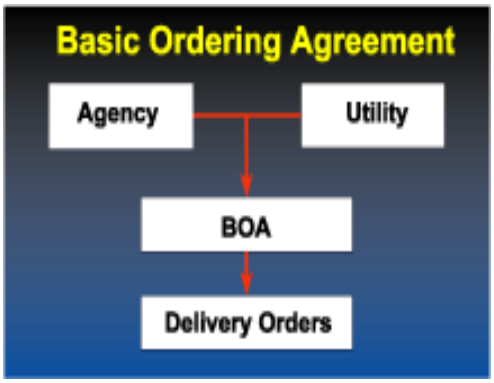
Utility Company Financed – slide 25

- Utility finances internally or through 3rd party
- Use financing for
  - Engineering services
  - Purchase and installation
  - Monthly services
- Repayment
  - Part of monthly utility bill

- Directly to financier

Utility Company Financed – slide 26





- Multiple approaches
  - Areawide contracts
  - Basic ordering agreements
  - Rebates
- Availability

Utility Company Financed – cont'd – slide 27

- Can be used to install variety of energy conservation measures (ECMs)
- Widely used in Federal sector
- Caution
  - Savings should exceed repayment
  - Interest fees increase total costs
- Consider when
  - Rebates are available
  - "No-cost" or appropriations are not available

ESPCs – Basics – slide 28

- Savings must be greater than repayment
- Savings verified annually
- Typical projects:
  - Multiple ECMs
  - "Large" investment contracts

ESPCs – Metering and ESPC Approaches – slide 29

- Stipulated savings
- Measured savings
  - Metering supports ECMs such as
    - On-going retro-commissioning
    - Real-time purchasing

        - Peak load management
        - Equipment diagnostics
    - Include requirements for
        - Annual verification of savings
        - Analysis of data
        - ESCO to initiate corrective actions

ESPCs – slide 30

- Use to install variety of ECMs
- Available throughout the Federal sector
- Caution
    - Ensure an energy savings mechanism
    - Interest fees increase total costs
- Consider when
    - "No-cost" or appropriations are not available
    - Other ECMs are available
    - Potential to contract all metering program aspects

Utility and ESPC Financing Comparison – slide 31

	Utility	**ESPC**
Investment Amounts	Any size project	Large projects
Cost Savings	Recommend savings > repayment	Require savings > repayment
Repayment	Utility cost savings or other	Annual verification Utility cost savings

Selecting a Financing Approach – slide 32

Choice based on
- Agency policy
- Estimated funding requirements
- Availability of funds
- Servicing electric utility offerings
- Other energy management opportunities

Session #3 Topics – slide 33

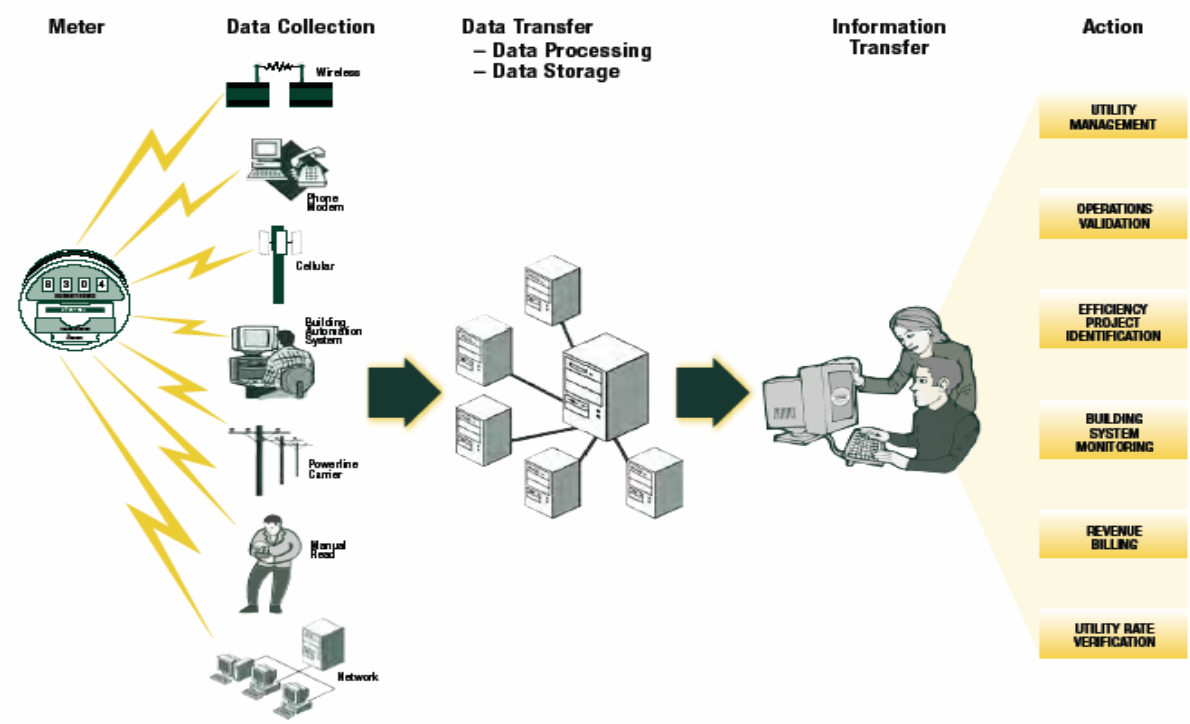
- ✓ Sessions 1 and 2 Highlights
- ✓ Metering Planning
- ✓ Financing

- ❑ Uses of Data
- ❑ Case Studies

Uses of Data – slide 34

- Interval Data - A Paradigm Shift
- Data Realities - Need for Management
- Graphical Data Representations
- Efficiency Opportunity Identification

Metering System Path to Action – slide 35



Interval Data – Old Paradigm – slide 36

- Standard meter (if metered)
  - Monthly meter reads
  - Wait for bill/process bill
  - Utility owns process
  - One data point per month

Interval Data – New Paradigm – slide 37

- Interval meter (EPAct compliant)
  - Data available daily (hourly resolution)
  - Near-real time data access
    - Next day "served" data

    - Organization owns process
    - At least 700 data points per month
        - Hourly data – 30 days per month = 720 points per month

Interval Data – Near-Term Benefits – slide 38

- Accessible "information" every day
- Understand energy use today – not 4 weeks from now
- Verify utility billing
- Identify efficiency opportunities

Interval Data – Long-Term Benefits – slide 39

- Ability to track and trend
- Utility negotiations/renegotiations
- Cost allocation
- System monitoring and continued efficiency project identification

Data Realities – slide 40

- Transition from "data" to "information"
- What was "one" can now be "thousands"…
- Management options:
    - In-house data maintenance/processing
    - Contracted/purchased services
        - Application service providers (ASP)
        - Energy information systems (EIS)
        - Local utility
        - Metering equipment vendors

Data Realities – slide 41

- EIS/ASP/Utility considerations:
    - Automated collection, processing, storage
    - Analytic capabilities for data validation, manipulation, and presentation

Data Realities – slide 42

- EIS/ASP/Utility selection criteria:
    - Technical capabilities:
        - Meters and communications
        - Data transfer protocols
    - Data management/presentation
        - Storage structure – transferable?
        - Presentation offerings
            - Data validation
            - Daily profiles
            - Profile aggregation/dis-aggregation

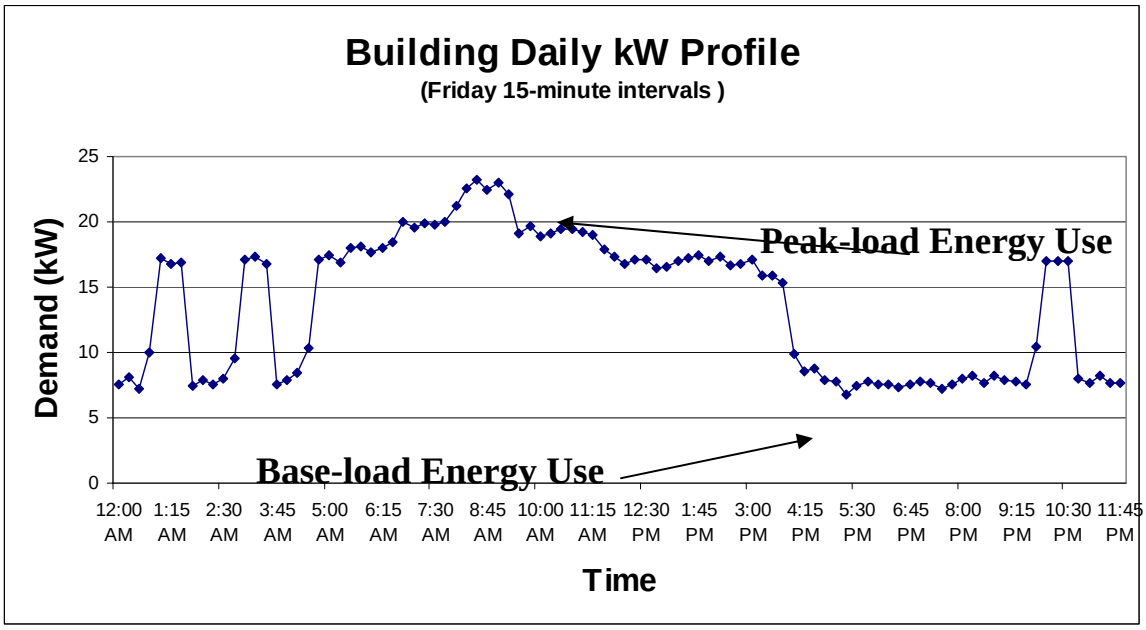
- Normalization

Data Realities – slide 43

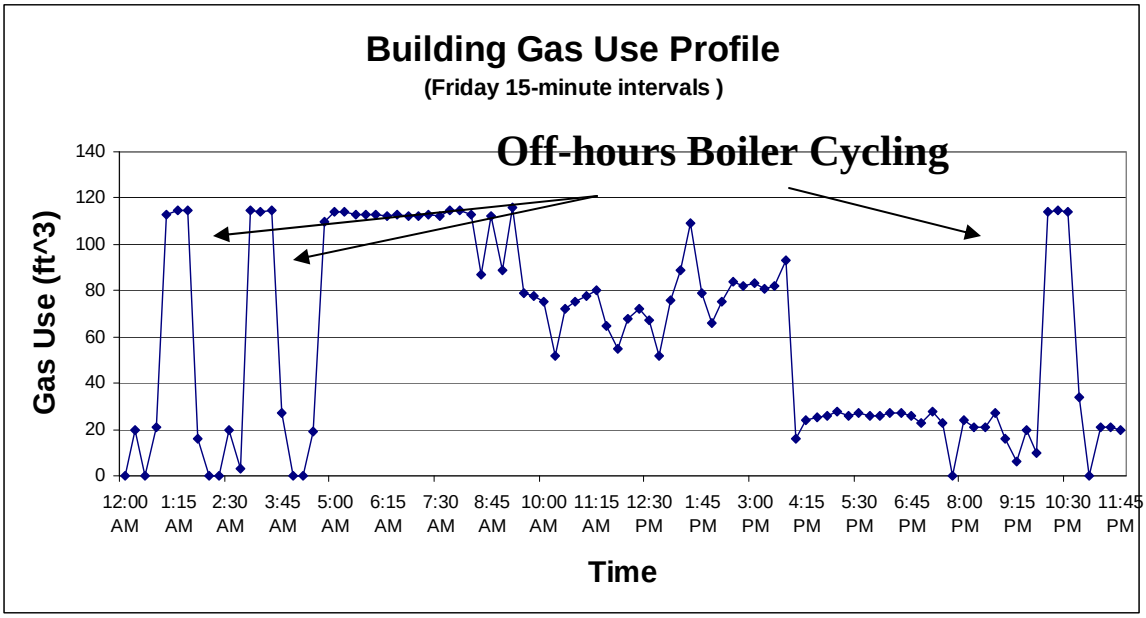
- EIS/ASP selection criteria:
  - Data presentation
    - Standard reporting formats – transferable
    - Web-based viewing/downloading
- EIS/ASP/Utility selection resources:
  - Local utility
  - Metering equipment vendors
  - Report: Web-based Energy Information Systems for Large Commercial Buildings http://buildings.lbl.gov/CEC/pubs/E5P22T1b4_LBNL-49977.pdf
  - Energy Information System Vendors

www.energy.ca.gov/enhancedautomation/documents/EA_Vendor_List.PDF

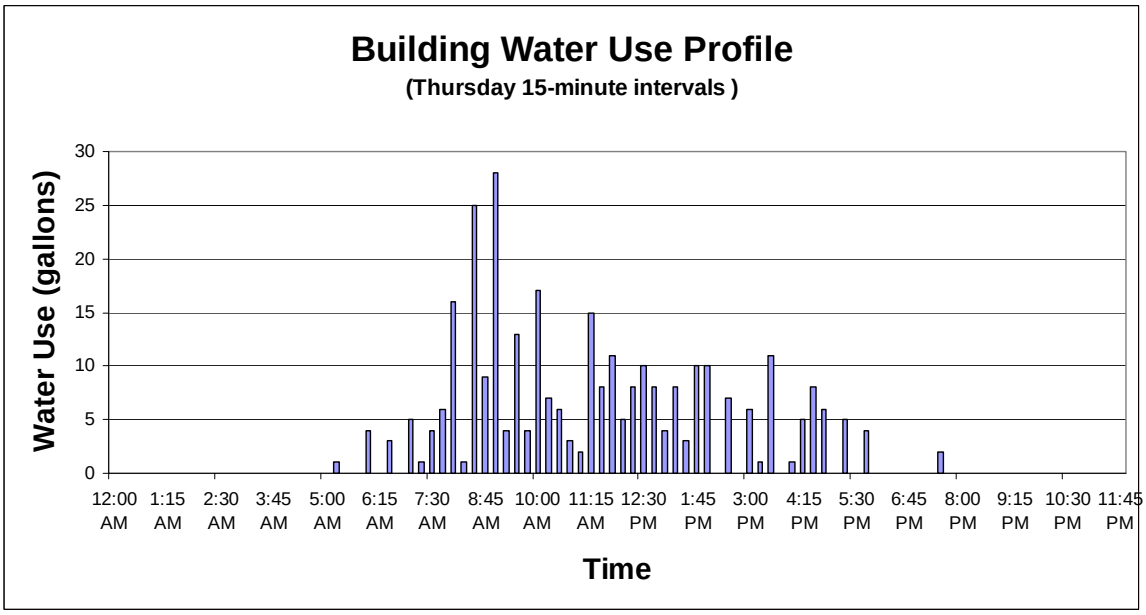
Daily Electrical Demand – slide 44



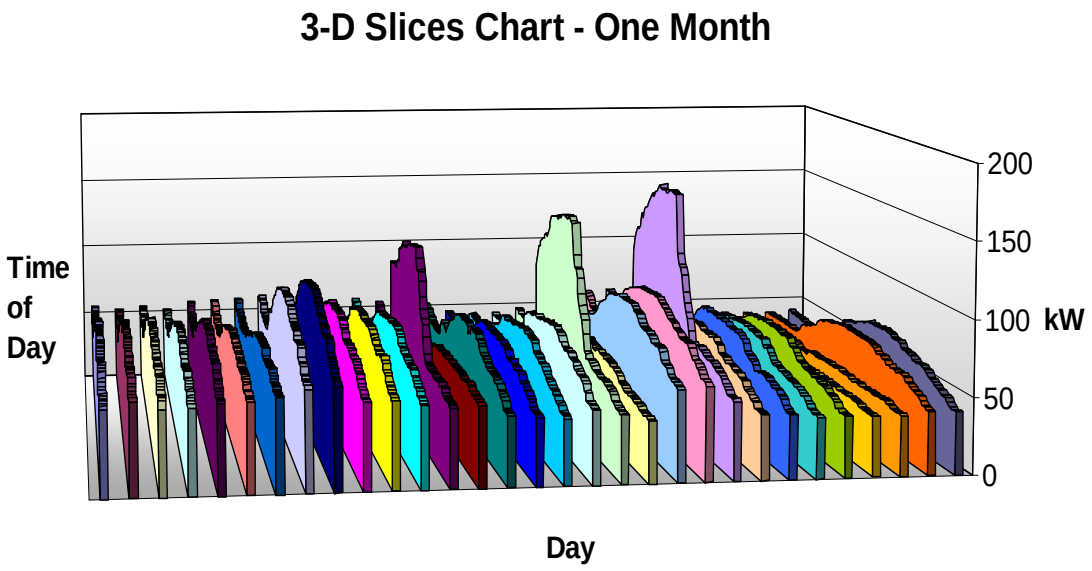
Daily Gas Use – slide 45



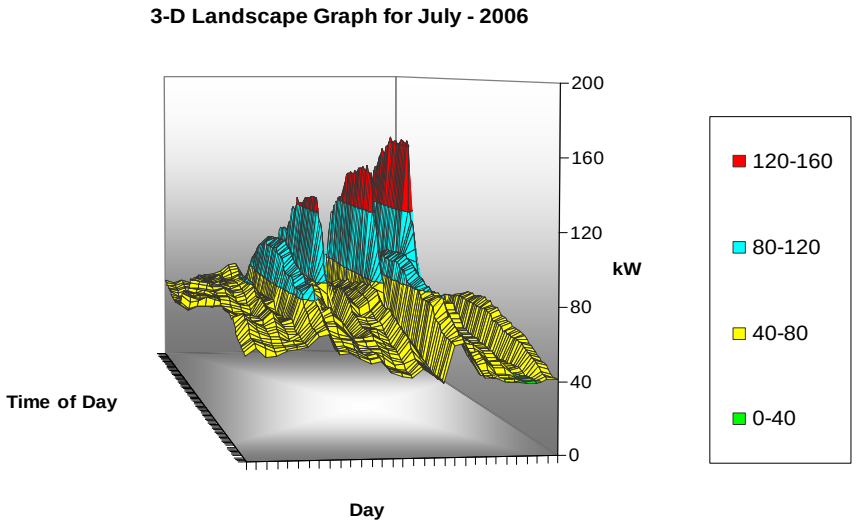
Daily Water Use – slide 46



Monthly Electrical Demand "Slices" – slide 47



Monthly Electrical Demand "3-D Landscape" – slide 48



Efficiency Opportunity Identification – Some Questions – slide 49

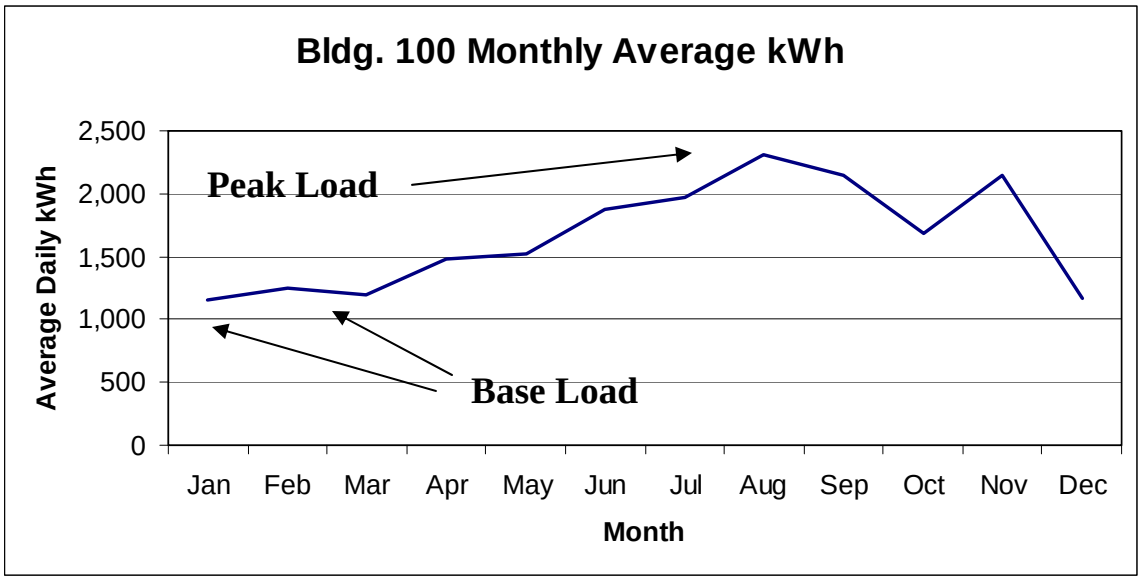
- How much energy does your facility use …?
- How does your energy use change … occupied, unoccupied, weekday, weekend, etc.?
- What is your facility base-load energy use?
- What is your facility peak-load energy use?
- How does your facility energy use compare with similar facilities?

Efficiency Opportunity Identification – slide 50

- Search for variability in…
  - "total usage"
    - Magnitude changes by period
  - "time of usage"
    - Duration changes over period
  - "demand for usage"
    - Instantaneous changes

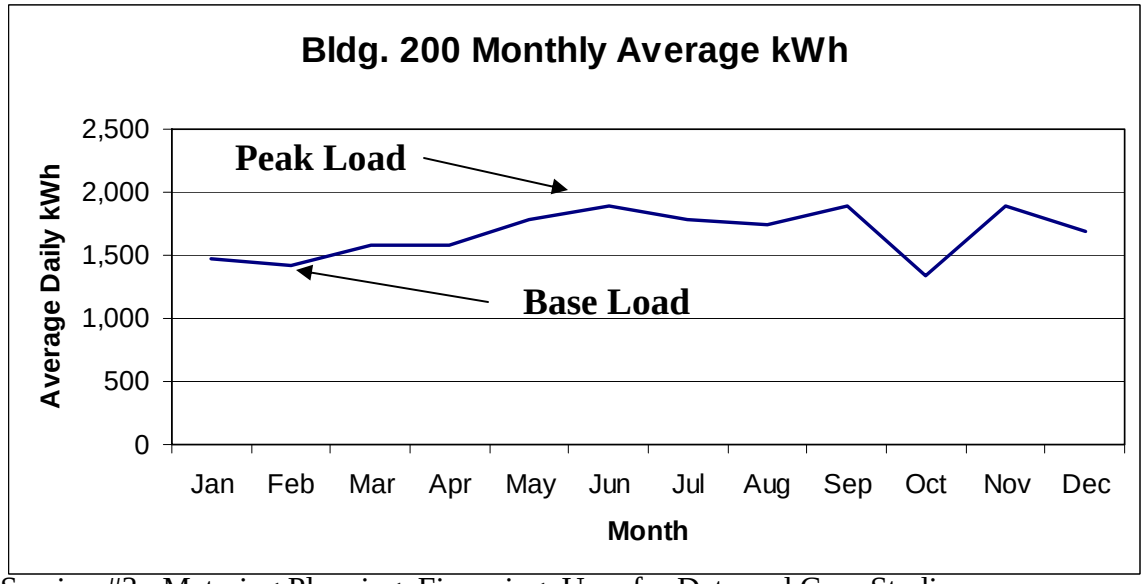
Efficiency Opportunity Identification – slide 51

Month-to-Month variability



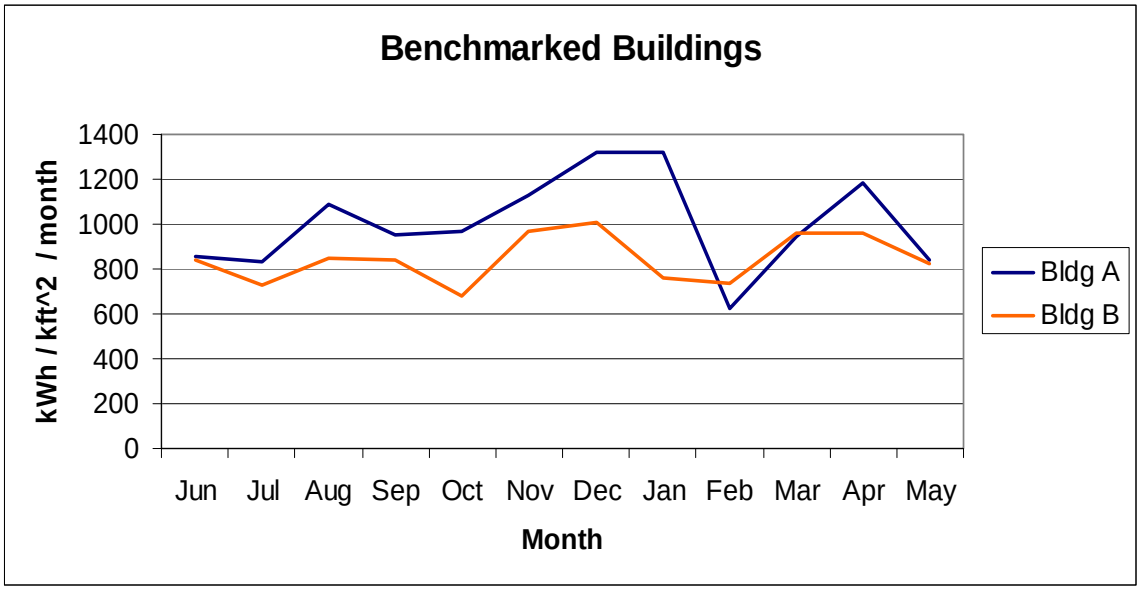
Efficiency Opportunity Identification – slide 52

Month-to-month variability



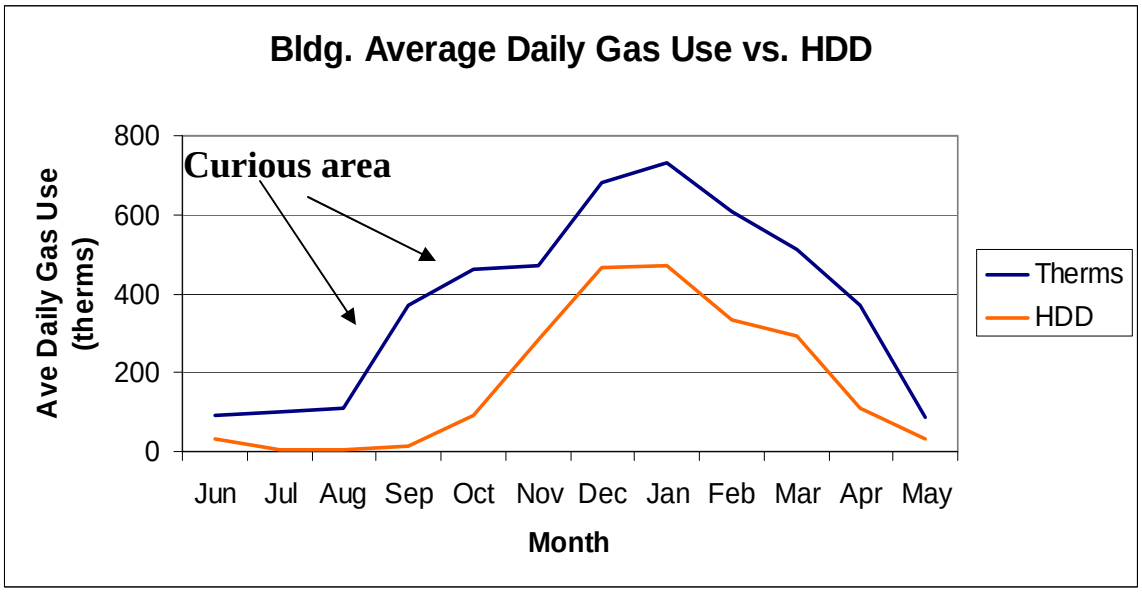
Efficiency Opportunity Identification – slide 53

Month-to-month variability



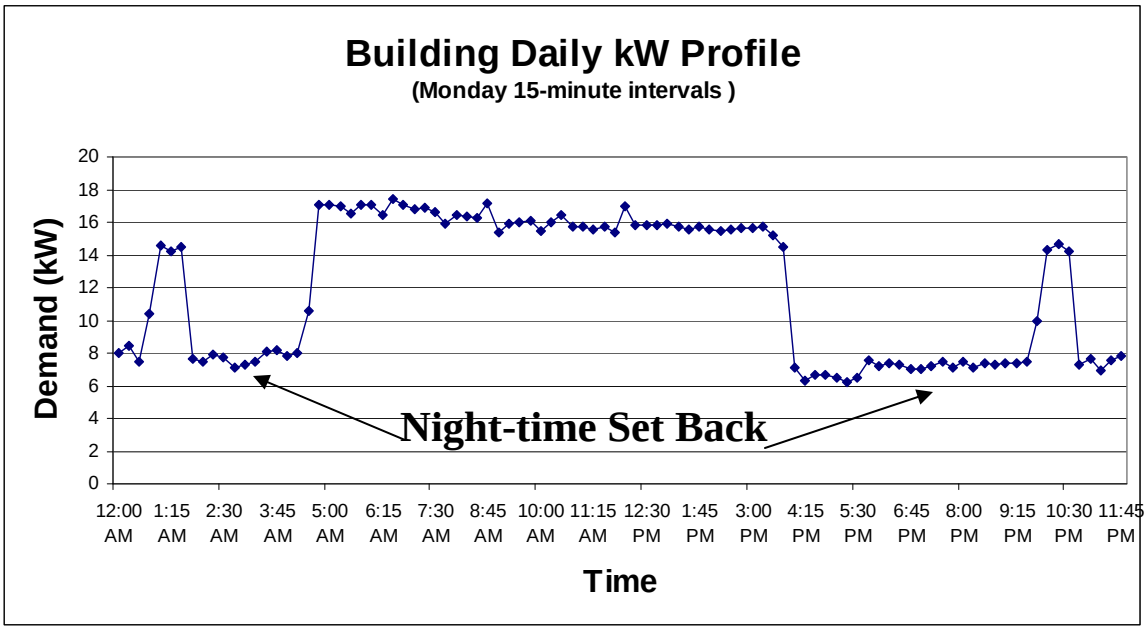
Efficiency Opportunity Identification – slide 54

Month-to-month variability



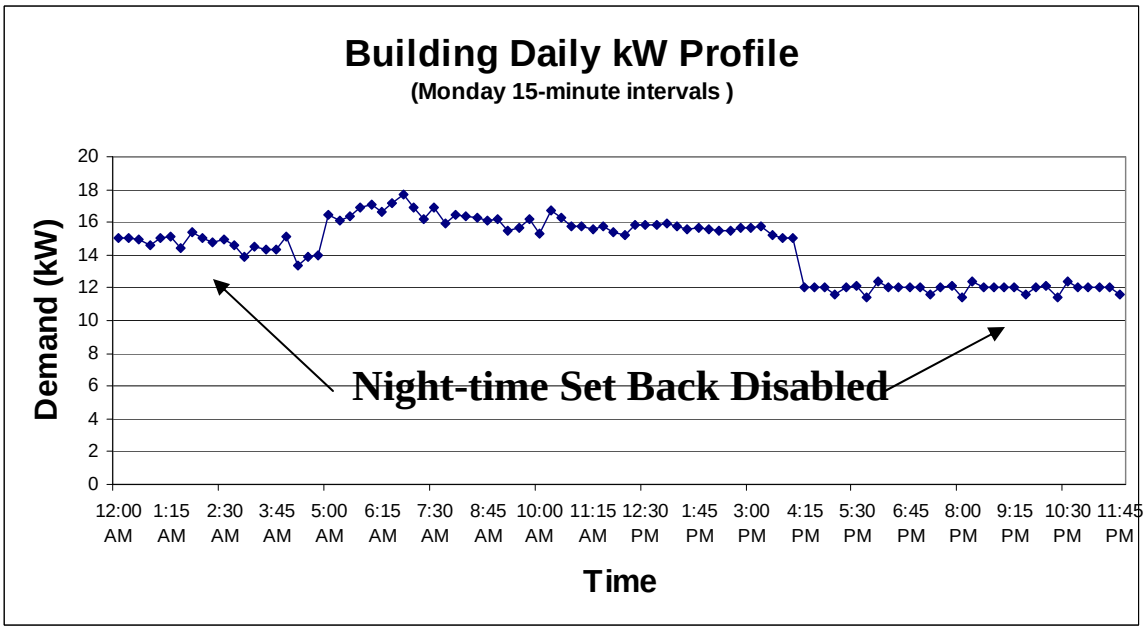
Efficiency Opportunity Identification – slide 55

Month-to-month variability



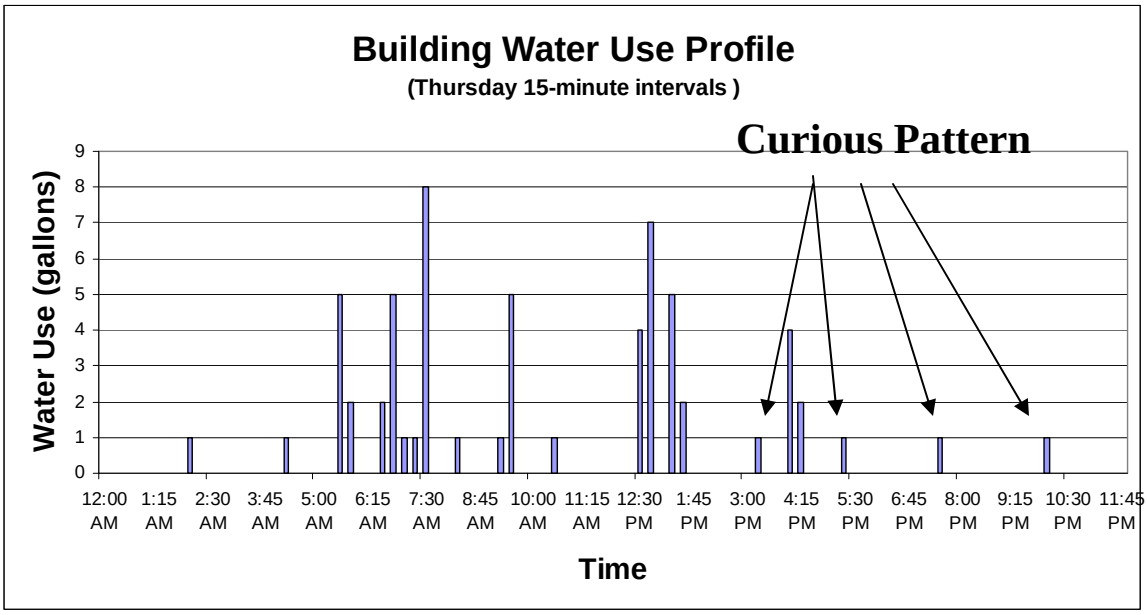
Efficiency Opportunity Identification – slide 56

Daily Demand Profile – Setback Disabled



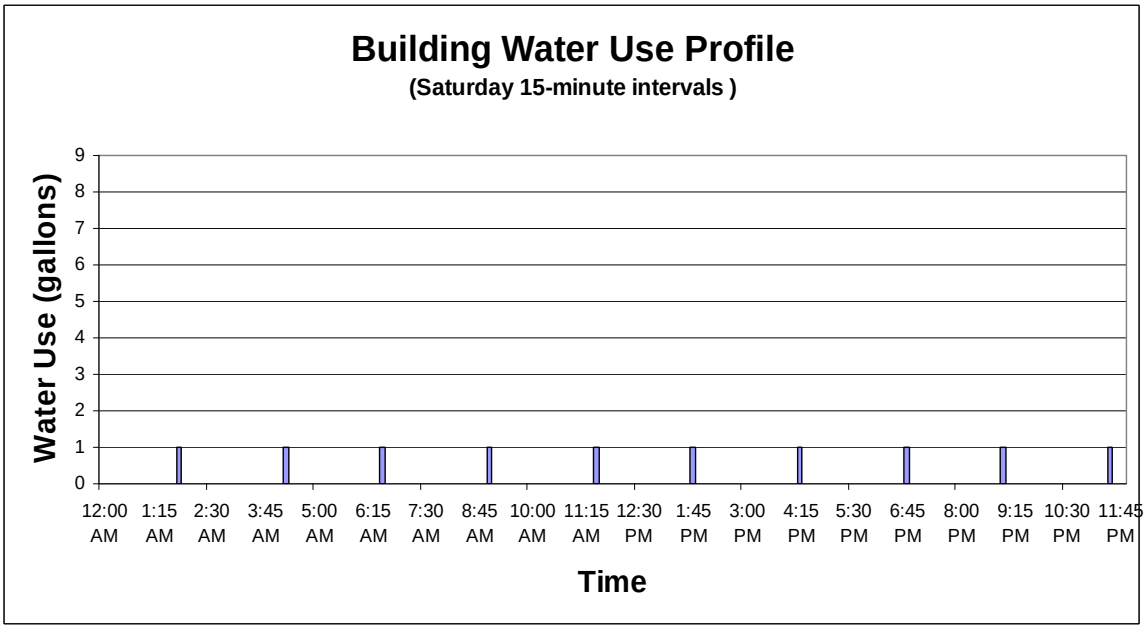
Efficiency Opportunity Identification – slide 57

Suspicion of Water Leak



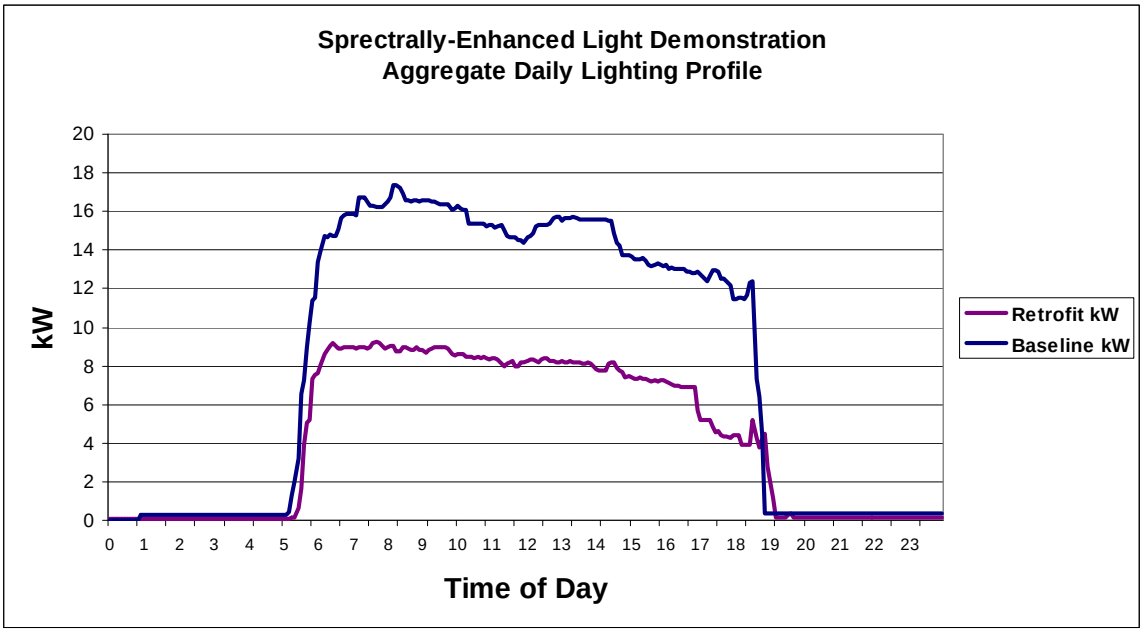
Efficiency Opportunity Identification – slide 58

Verification of Water Leak



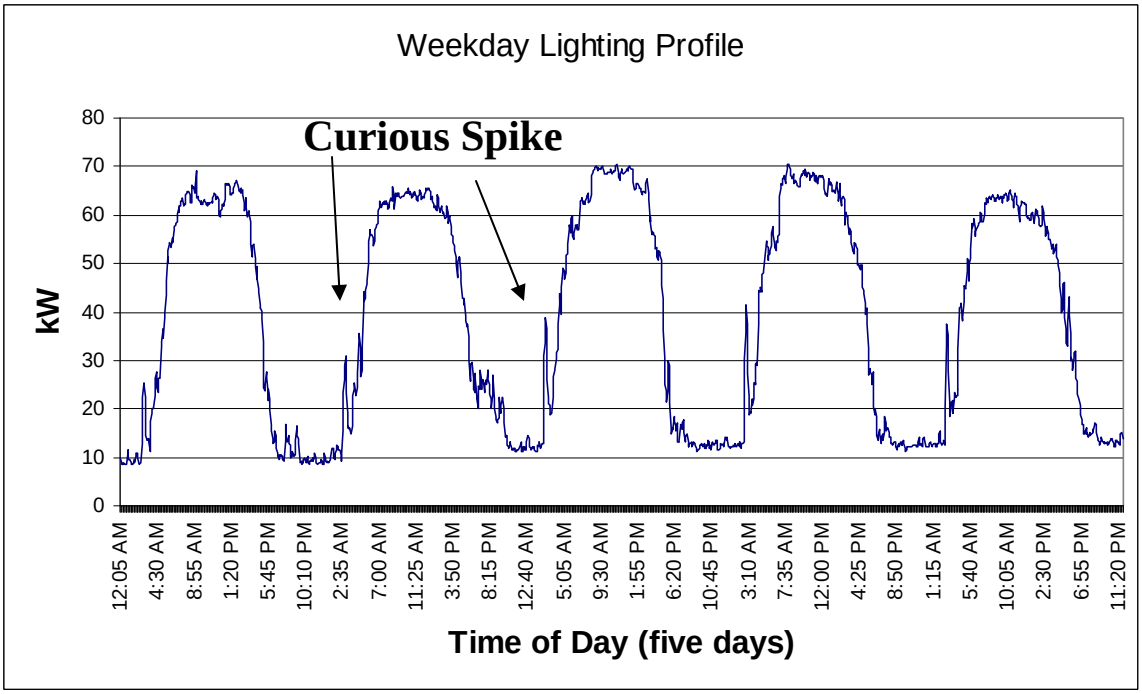
Efficiency Opportunity Identification – slide 59

Verification of Lighting Demonstration



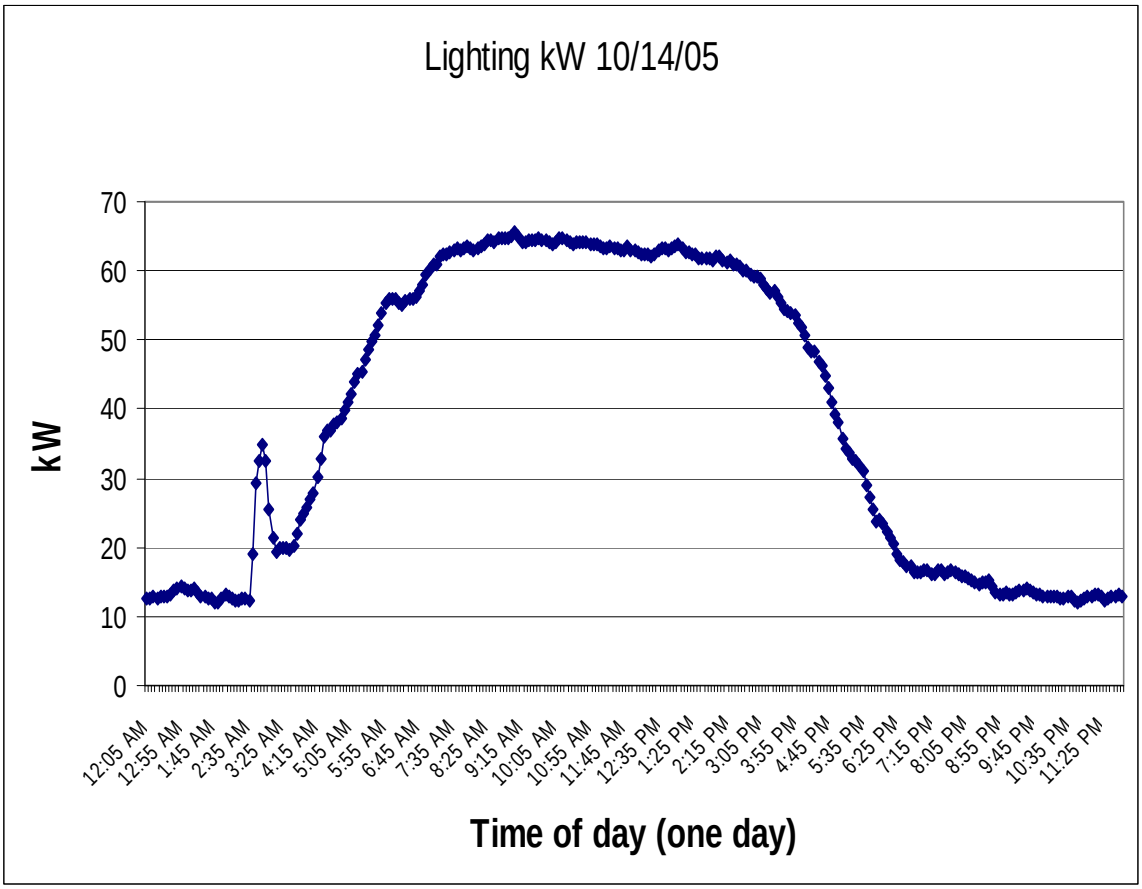
Efficiency Opportunity Identification – slide 60

Interesting Uses for Data



Efficiency Opportunity Identification – slide 61

Interesting Uses for Data



Session #3 Topics – slide 62

- ✓ Sessions 1 and 2 Highlights
- ✓ Metering Planning
- ✓ Financing
- ✓ Uses of Data
- ❑ Case Studies

Case Studies – slide 63

- Robins Air Force Base, Georgia
- U.S. Coast Guard
- National Institutes of Health
- Website for product information: http://www.dramcoalition.org/

Robins Air Force Base (RAFB) – slide 64

- Site missions
- Buildings
  - 1,100 buildings
  - 14 million square feet
- Annual utilities
  - Electric:
    - $17 million (M)
    - 60 MW peak
  - Natural gas: $12M

RAFB – Program Description – slide 65

- Program objectives:
  - Allocate costs
  - Contain costs
- Current system
  - More than 500 meters, ~380 electric
  - Manual and automated readings with dial-up communications
  - Dedicated server with limited availability
- System financing and costs
  - Year-end funds
  - $1.8M invested to date
  - $4,000 monthly O&M by GA Power

RAFB – Data Analysis and Results – slide 66

- Data Analysis
  - On-going reviews by program
  - Customers review bills
  - Software for significant deviations
- Key result: Level electric costs since 1999

U.S. Coast Guard – slide 67

- Three sites:
  - Air Station Cape Cod, Massachusetts
  - Training Center Cape May, New Jersey
  - Coast Guard Yard, Baltimore, Maryland
- Buildings support local missions
- Site specific needs

Coast Guard – Program Description – slide 68

- Program objectives: Identify waste/cost containment
- Started in 2004
- Approach

    - Pilot at 3 of 13 sites
    - Site designed and installed
    - Non-proprietary
    - Phased approach

Coast Guard – Program Description – slide 69

- Metering systems
    - Meters:
        - Pulse meters and adaptors for electric
        - Pulse adaptor retrofits to gas
    - Communications: Modbus and RF mesh network
    - Data storage: Central at $10/month/site
- Meter counts
    - 10 at Cape Cod
    - 60 at Cape May
    - 21 at Coast Guard Yard
- System financing
    - Appropriations
    - Approximately $20,000 per pilot site

Coast Guard – Program Description – slide 70

- Data Analysis
    - HQ level for general analysis
    - Site level for site-specific analysis
- Key results
    - Identify 300 HP compressor operating schedule problem
    - Baseline Cape May water use and identify problems

National Institutes of Health – slide 71

- Mission: Medical research
- Buildings:
    - 10,000,000 square feet
    - Diverse functions
- Utility expenses: $75M in fiscal year 2005

NIH – Program Description – slide 72

- Program objectives: Manage utility costs
- Approach
    - Meter all major buildings
    - Meter main utilities
    - Designed and installed by ESPC

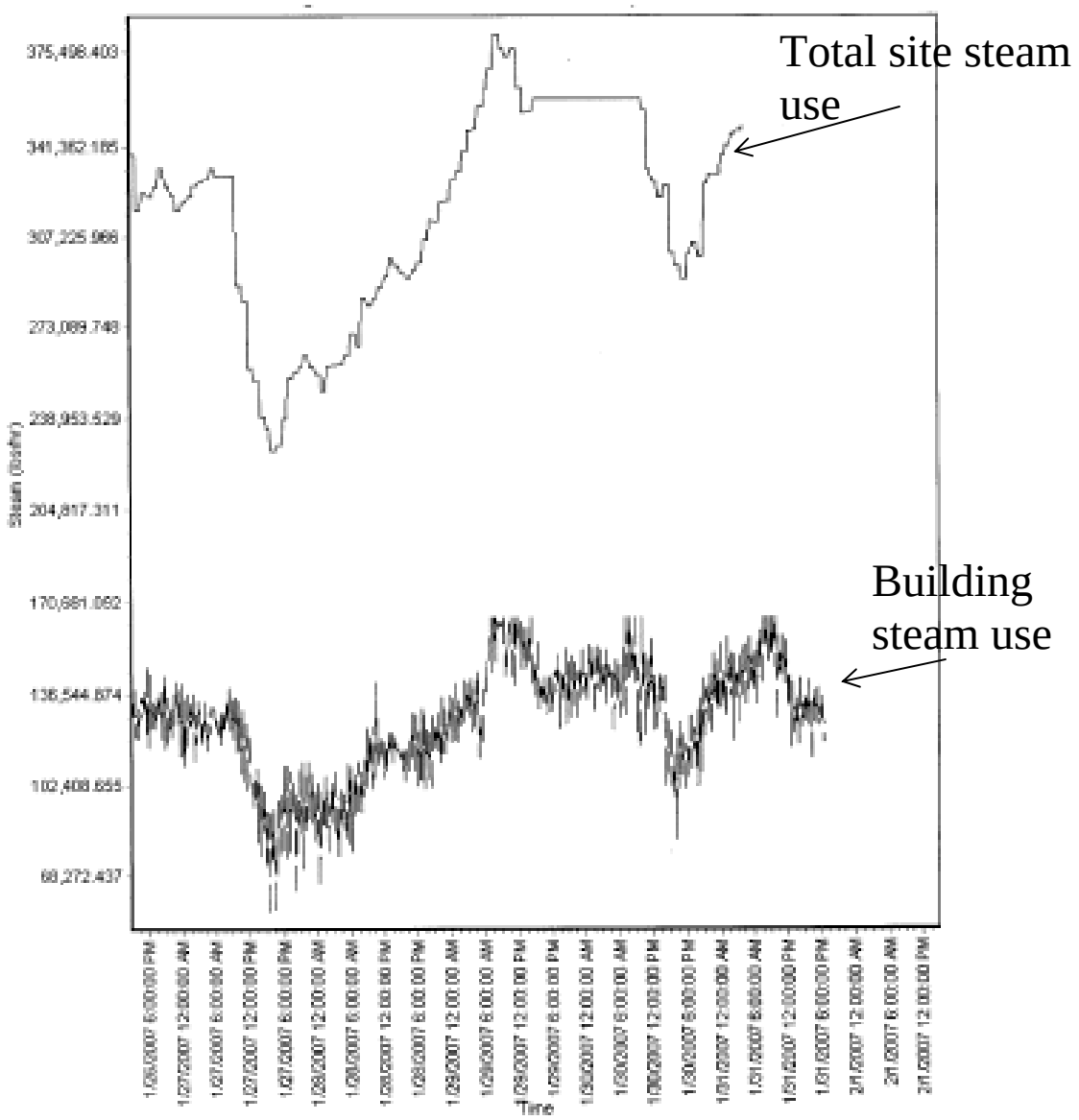
NIH – Program Description – slide 73

- Metering systems
  - Meters: Advanced
    - Over 200 electric meters
    - Over 150 non-electric meters
  - Communications:
    - Separate LAN for electric
    - Building automation system for non-electric
  - Data storage: On-site
- Financing: ESPC with stipulated savings

NIH – Findings and Results – slide 74

- Costs per meter
  - Electric: $1.5K to $5K
  - Power quality: ~ $5K
  - Steam and chilled water: $21K to $24K
  - Compressed air: $10K to $12K
  - Domestic water: ~$10K
- Results
  - Installation not yet complete
  - Single building high steam use identified

NIH – Steam Use Chart – slide 75



Case Studies Conclusions – slide 76

- Variety of approaches have been used
  - In-house and contracted design
  - Retrofit existing and installation of new meters
  - Varying system architecture
  - Electric and other utilities
  - Appropriated funds and ESPC financing
- Savings/improvement opportunities identified

Metering Training Series Summary – slide 77

- Objective: Address EPAct 2005 Federal-sector metering needs for compliance
- Training Part 1
  - EPAct requirements
  - Metering technology introduction
  - Metering program planning
- Training Part 2
  - Metering technologies
  - Communications options
  - Data storage
- Training Part 3:
  - Metering planning
  - Financing
  - Uses of data
  - Federal site case studies

Additional Training and Resources – slide 78

- FEMP metering website:
  http://www.eere.energy.gov/femp/technologies/om_advmetering.cfm
- Energy 2007 – August 5-8, 2007
  http://www.govenergy.com
- Metering Best Practices Guide

Live Q&A