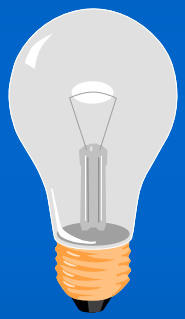
Benefits & Applications of Electric Submeters in the "Green Facility" Environment

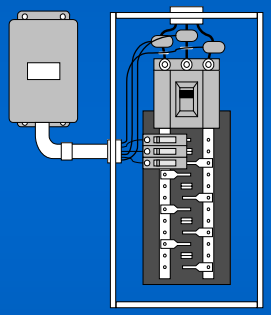
- NC AEE Meeting
- March 25, 2019
  Raleigh, NC

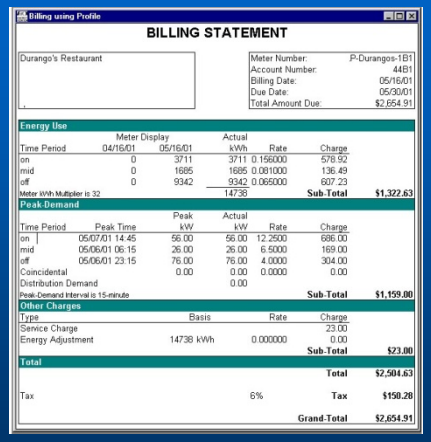
- Steve Kearney, CEM DSMP LEED
  Regional Manager , Honeywell/E-Mon

Energy Management and Conservation
Takes Energy Measurement

Advanced Metering software and hardware is the solution for all your energy measurement needs






Billing using Profile

BILLING STATEMENT

Durango's Restaurant

Meter Number: P-Durangos-1B1
Account Number: 44B1
Billing Date: 05/16/01
Due Date: 05/30/01
Total Amount Due: $2,654.91

Energy Use

Time Period	Meter Display 04/16/01	05/16/01	Actual kWh	Rate	Charge
on	0	3711	3711	0.156000	578.92
mid	0	1685	1685	0.081000	136.49
off	0	9342	9342	0.065000	607.23
Meter kWh Multiplier is 32			14736		Sub-Total $1,322.63

Peak-Demand

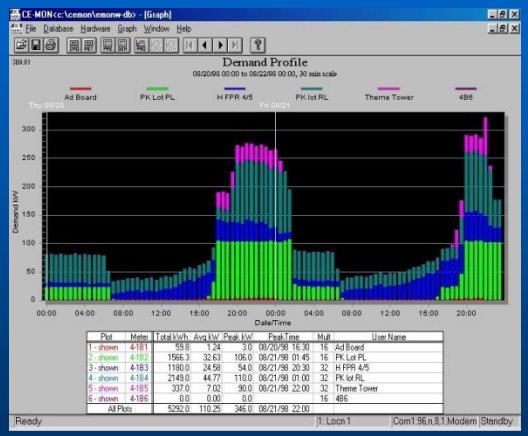
Time Period	Peak Time	Peak kW	Actual kW	Rate	Charge
on	05/07/01 14:45	56.00	56.00	12.2500	686.00
mid	05/06/01 06:15	26.00	26.00	6.5000	169.00
off	05/06/01 23:15	76.00	76.00	4.0000	304.00
Coincidental		0.00	0.00	0.0000	0.00
Distribution Demand			0.00		
Peak-Demand Interval is 15-minute					Sub-Total $1,159.00

Other Charges

Type	Basis	Rate	Charge
Service Charge			23.00
Energy Adjustment	14736 kWh	0.000000	0.00
			Sub-Total $23.00
Total			
			Total $2,504.63
Tax		6%	Tax $150.28
			Grand-Total $2,654.91

Utility bill

PC
or
Internet


CE-MON c:\cemon\emonw-db - [Graph]

File Database Hardware Graph Window Help

Demand Profile

09/20/98 00:00 to 09/22/98 00:00, 30 min scale

Ad Board | PK Lot PL | H FPR 4/5 | PK lot RL | Theme Tower | 4B5

Demand kW

Date/Time

Plot	Meter	Total kWh	Avg kW	Peak kW	Peak Time	Mult	User Name
1 - shown	4-1B1	59.8	1.24	3.0	08/20/98 16:30	16	Ad Board
2 - shown	4-1B2	1566.3	32.63	106.0	08/21/98 01:45	16	PK Lot PL
3 - shown	4-1B3	1180.0	24.58	54.0	08/21/98 20:30	32	H FPR 4/5
4 - shown	4-1B4	2149.0	44.77	110.0	08/21/98 01:00	32	PK lot RL
5 - shown	4-1B5	337.0	7.02	30.0	08/21/98 22:00	32	Theme Tower
6 - shown	4-1B6	0.0	0.00	0.0		16	4B6
All Plots		5292.0	110.25	346.0	08/21/98 22:00		

Ready | 1: Locn 1 | Com1:96,n,8,1,Modem | Standby

Load Profile

Electric Submetering

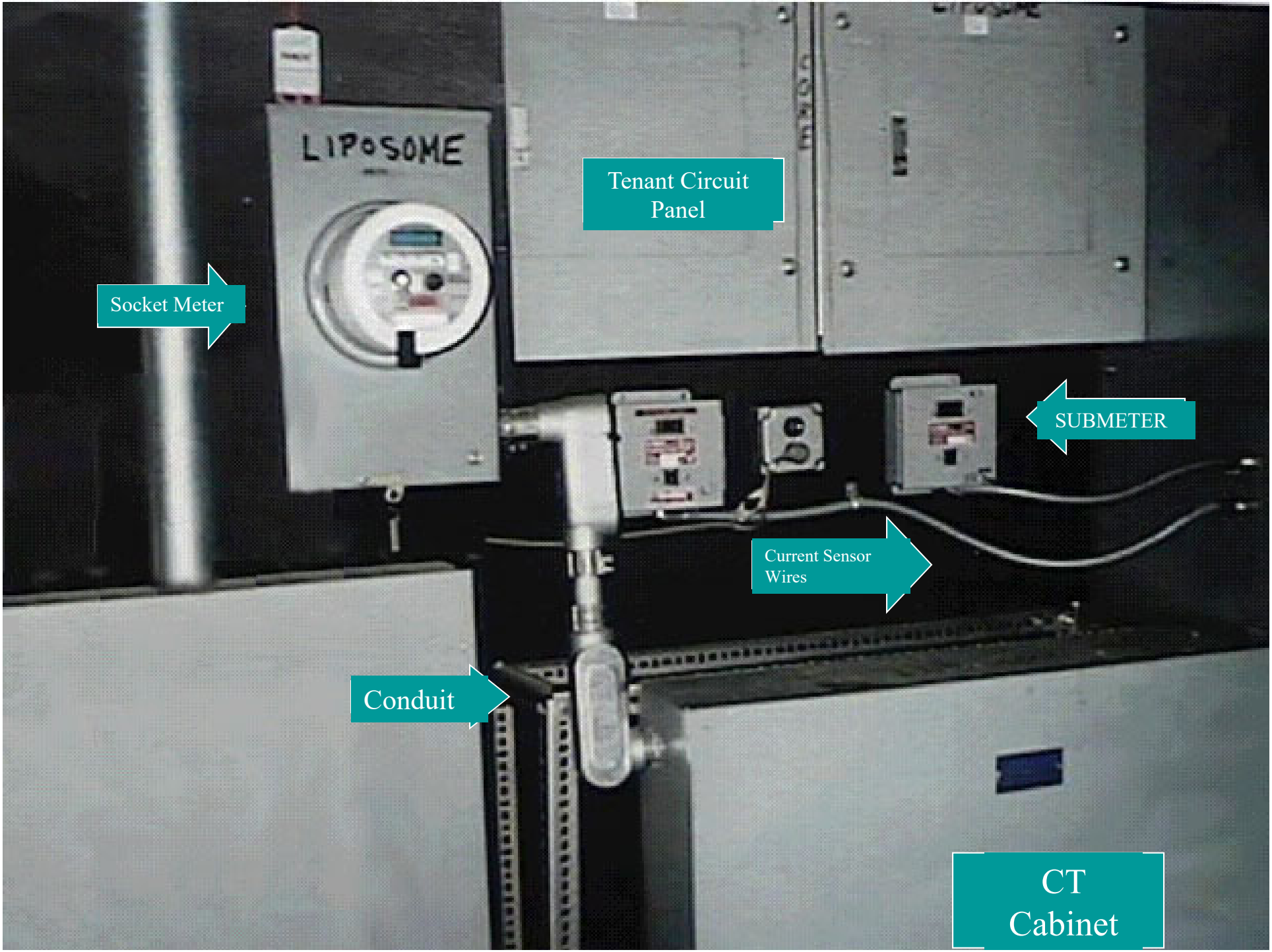
- What is electric submetering
- Technology for electric Submetering
- Metering in Green Facilities
- Case studies from Various Industries

Why Meter?

- Record Electrical Consumption
- Cash register for electricity
- Analytical tool for allocating cost
- Analytical tool for energy management
- Compliance with Green Building Initiatives

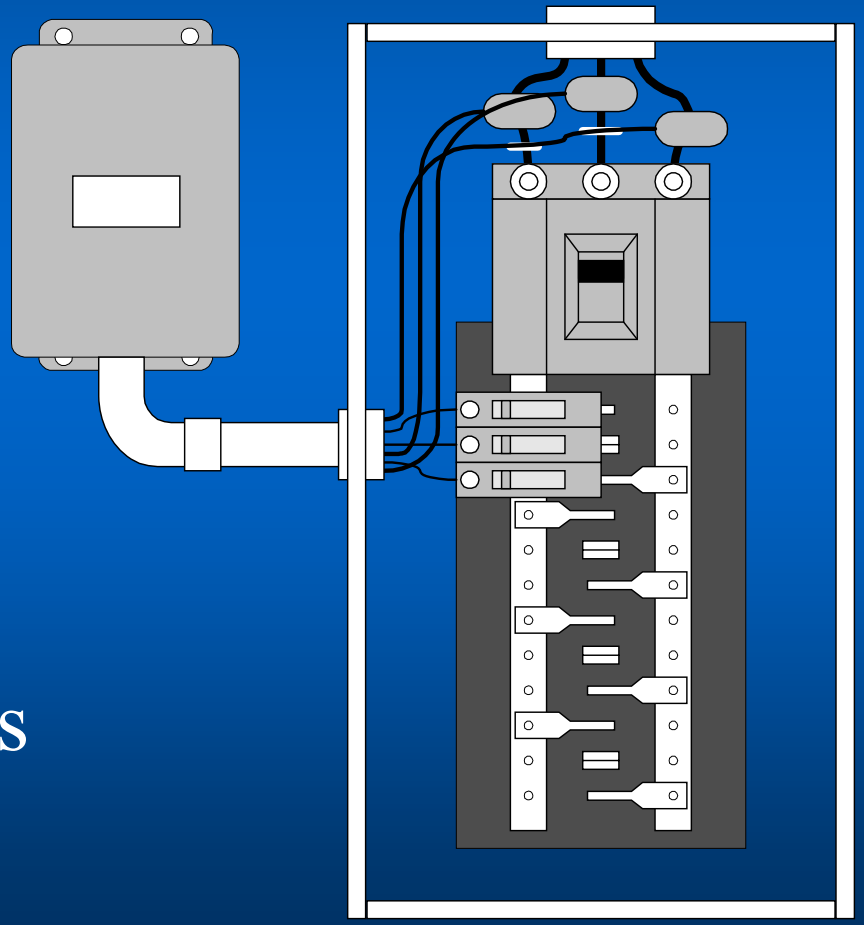
Definition of Submetering

- Metering of electricity beyond the main utility meter
- Meter electrical consumption from individual lighting circuit to HVAC panel to tenant to entire building


LIPOSOME
Tenant Circuit Panel
Socket Meter
SUBMETER
Current Sensor Wires
Conduit
CT Cabinet

SUBMETERING APPLICATIONS

- Tenant Billing
- Load Profiling
- Cost Allocation
- Energy Management
- Green Buildings
- Aggregation Analysis
- Power Quality



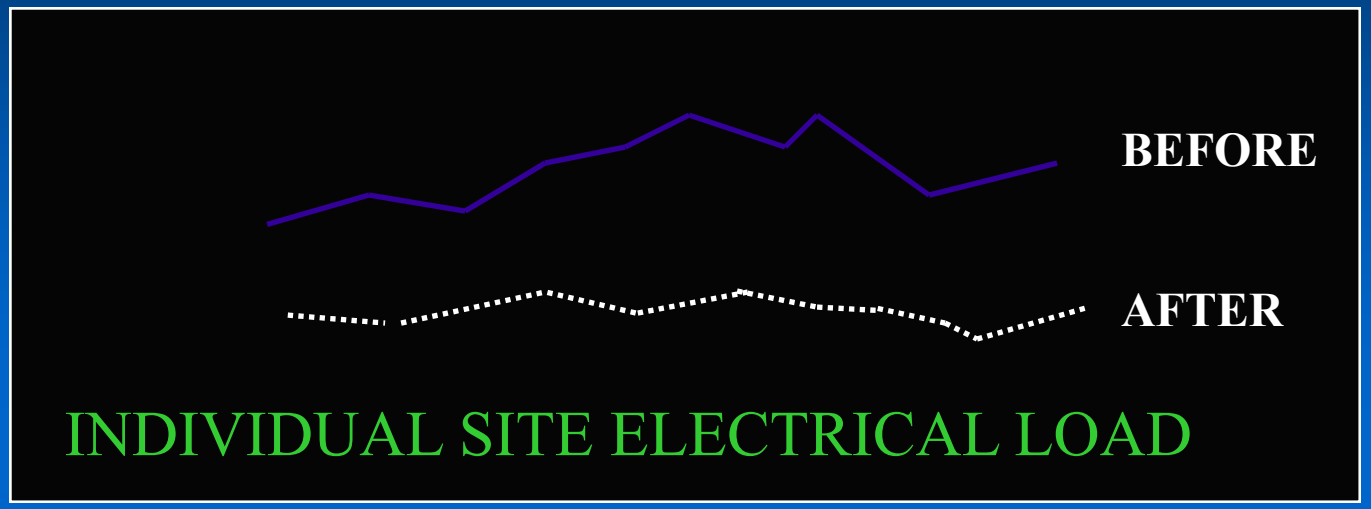
Tenant Billing & Cost Allocation

- New York State Energy Research and Development Authority Residential Electrical Submetering Manual (October 1997, revised October 2001)
  - "the change from master-metering to submetering typically reduces the consumption of electricity in apartments by 10-26 percent."
- U.S. Environmental Protection Agency, in a 2002 paper "Submetering Energy Use in Colleges and Universities: Incentives and Challenges,"
  - reduce electric demand by 10 percent through demand aggregation.
  - 10 percent reduction in electricity use was realized

Peak Shaving

- Each site provides individual energy profile
- Submeters provide enhanced details
- Informed decisions clip demand peaks
- Lower demand peaks lower energy costs

Load Reduction



- Each site provides coincidental usage profile
- Submeters provide detailed (individual) usage data by department, equipment, etc.
- Proactive energy users curtail unnecessary usage and lower energy (kWh) costs.

POWER QUALITY ANALYSIS

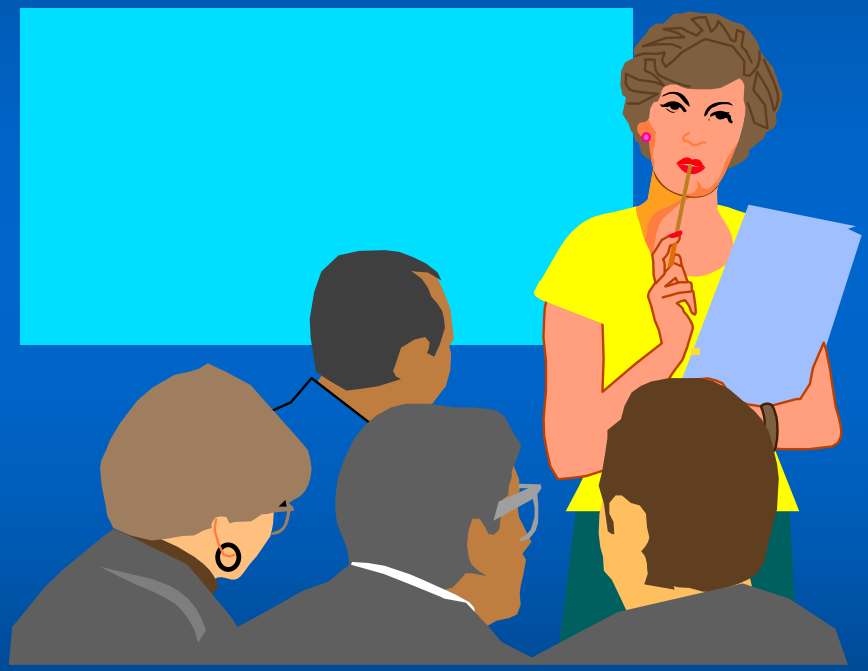
- Meter entire building and specific loads for power quality information and issues:
  - Power Factor Analysis
  - Per Phase Volts and Amps
  - Per Phase PF, Vars, Va
  - Total Harmonic Distortion
  - Momentary Voltage Sags

Benefits of Power Quality Monitoring

- Increase energy efficiency of a facility
- Increase life time of electrical distribution equipment
- Increase life time of electrical equipment such as motors and generators

Types of Meters

- Electro-Mechanical socket meters
- Electronic socket meters
- Non-Socket Meters
- Electronic submeters



Electro-Mechanical Meters

- Typical Utility type Meter
- Available in various amperages
- Power passes through meter, then to distribution panel
- Requires substantial physical space for installation

Electronic Socket Meters

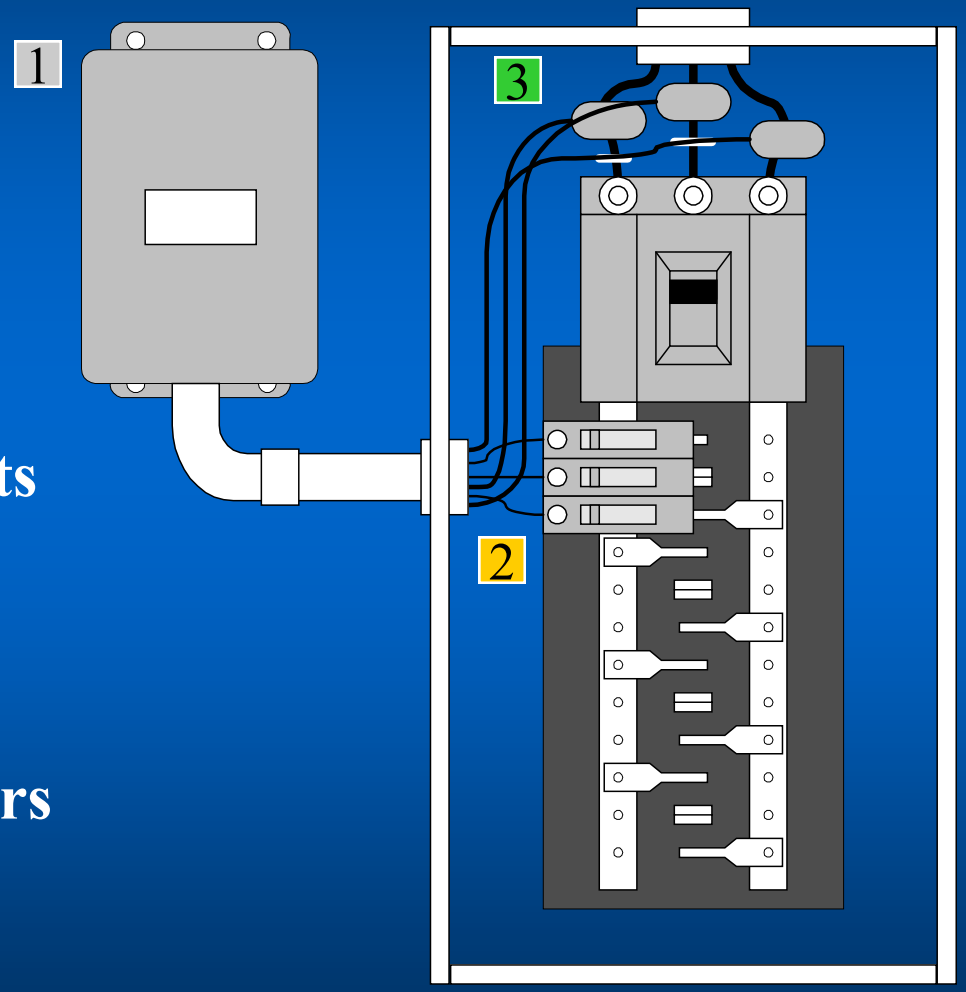
- Standard or CT type configuration
- Typically applied over 200 amps
- Used in application where customer requires information beyond Kwh:
  - Demand
  - Load Profiling
  - Power Quality

kWh Meter Installation

❶ (1) Mount meter

❷ (2) Connect voltage inputs

❸ (3) Install Current Sensors



Non-socket, current sensor based technology

- Limited or no Power interruption
- Lower installed cost
  - No CT Cabinets
  - No Meter Socket
  - Reduced cabling and conduit
- 1/10 the time to install
- Space saving and flexibility in location

kWh/demand Meter

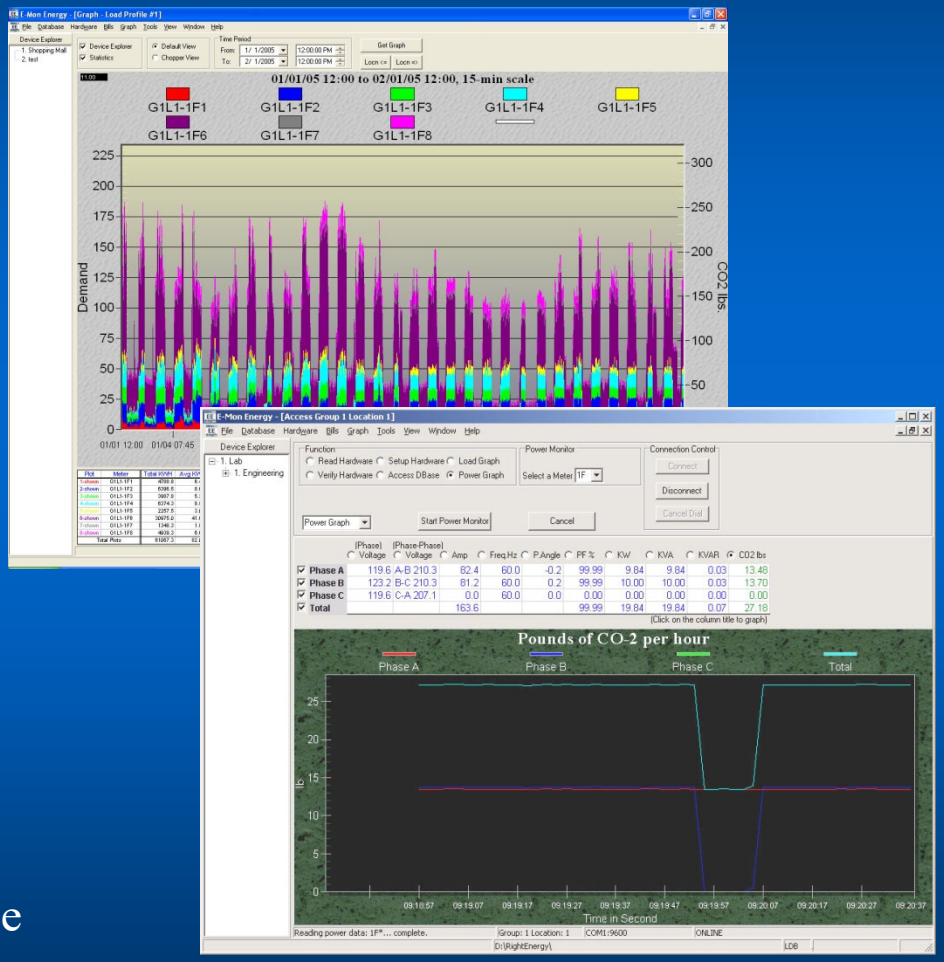
- 120/208; 277/480; 600 Volts
  * *other voltages available*
- Sized from 25 to 3200 Amps
- Split or solid core low voltage output Current Sensors
- AMR interface
- BAS interface

Multiple Meter Units - MMU

- MMU Configuration in 8,16 & 24
- Ideal for electrical closets and basement configurations
- Tremendous space and time saver

Communication Options

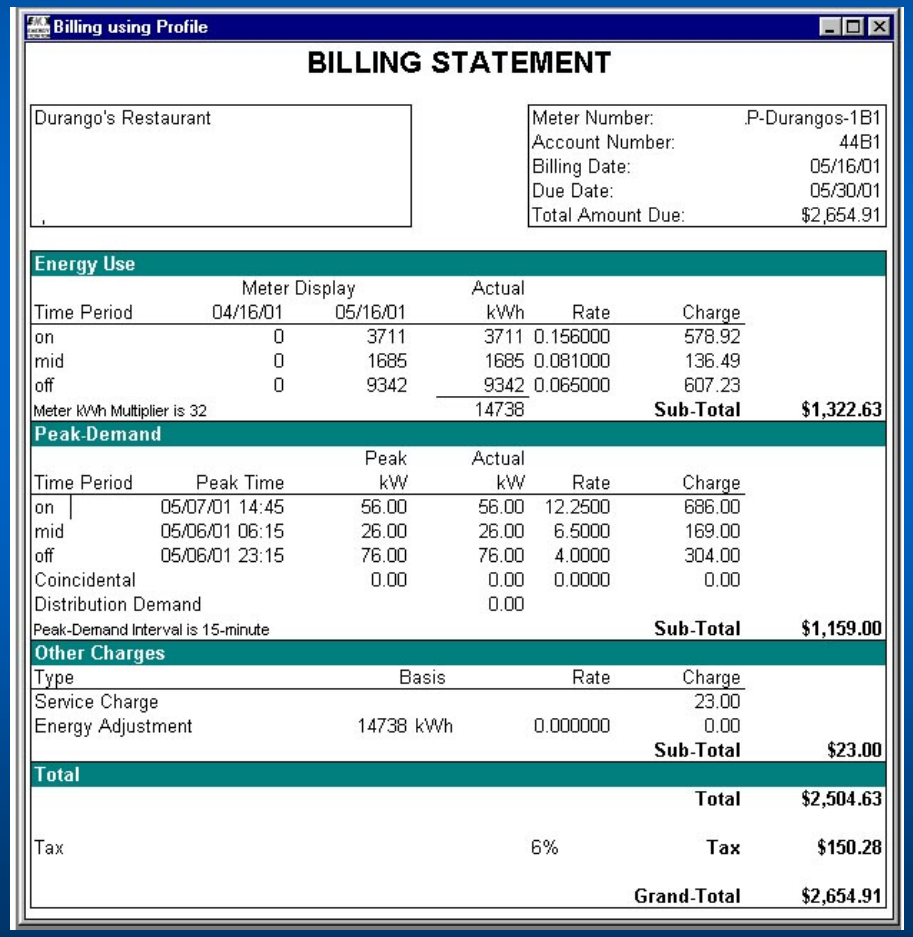
- Sneaker Reads
- Hardwired RS-485
- Modbus RTU
- Telephone Modem
- Wireless 900 Mhz
- Wireless CDMA/GSM
- Ethernet
- BACNET/Lonworks, etc
- Satellite
- Data Collection Option
  - Company Read
  - 3rd-party meter reading service
  - Web-server



Energy Management in the Information Age

- PC based Energy Data Software
- Internet Data Presentation Services
- Internet-Based Energy Controls

Energy Monitoring Software
"Customer" Automatic Meter Reading



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Total

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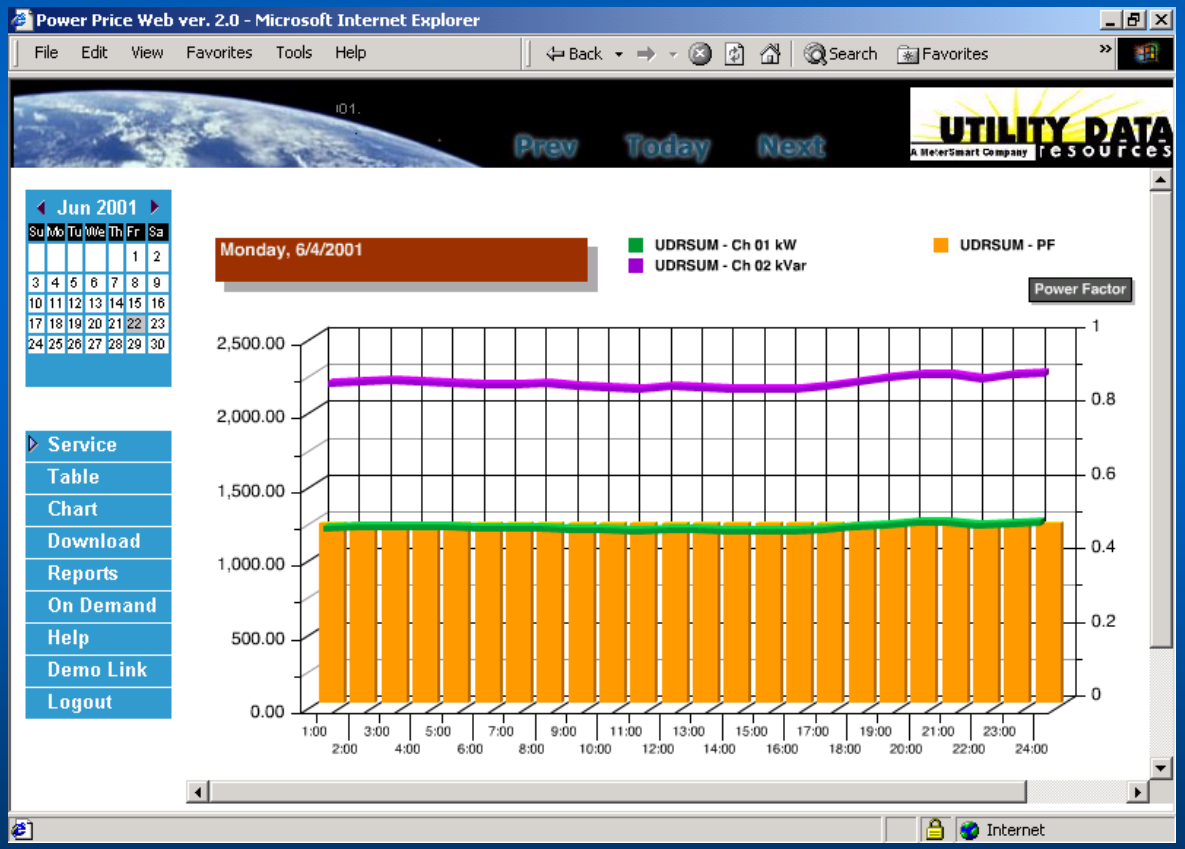
		Grand-Total	**$2,654.91**

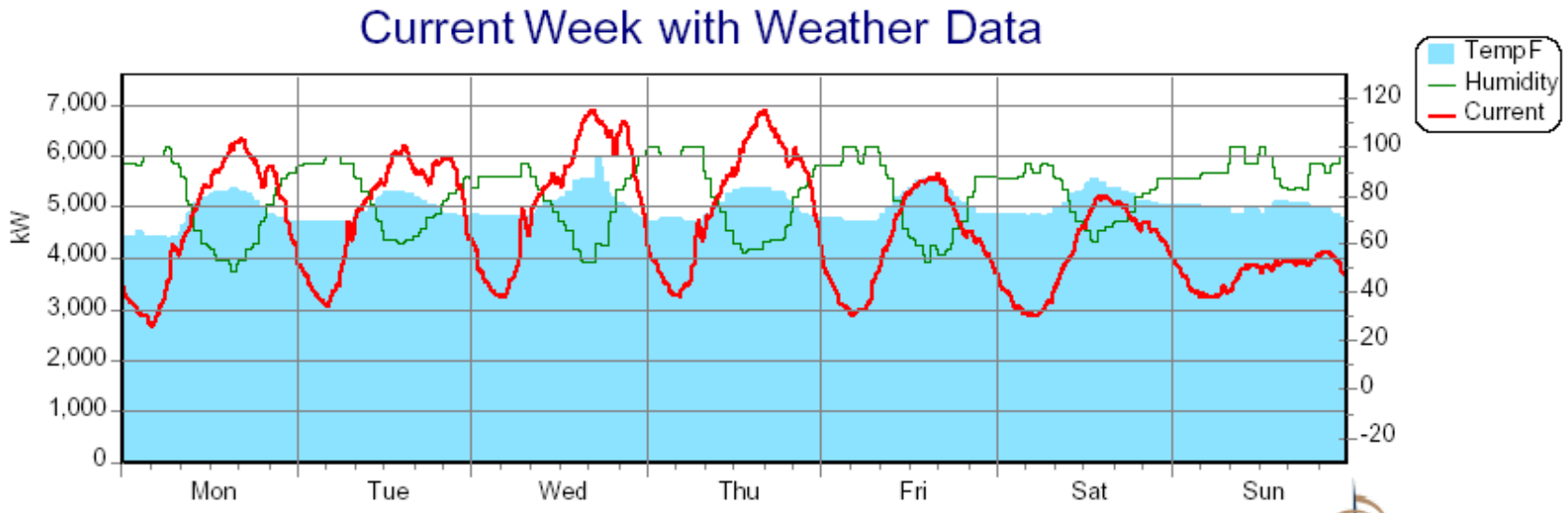
- Total Package
  - Cost Allocation
  - Statistical Analysis
  - Measurement & Verification
- Time of Use
- Real time billing
- Multiple utilities, gas, water, steam, btu, etc.
- Energy Management

Internet Access to Data

- kWh Usage Presentation
- Pricing Presentation
- Near Real Time Refresh Available
- Secure Site



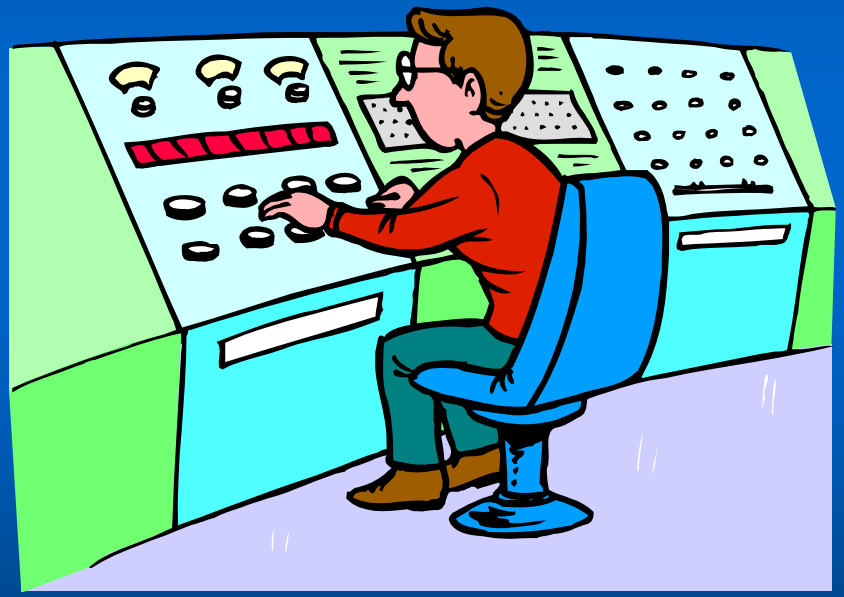
Energy & Weather Reporting



*Prior year start day adjusted to nearest Monday.

MeterSmart
A Division of Hunt Power, L.P.

Load Control



- Critical Event Alarming
- Utility Penalty Alarming
- Simple Load Control Solutions
- Demand Response Programs

Why Go Green?

- Reduce energy usage
  - Buildings consume more than 30% of energy in US annually
  - Buildings consume more than 60% of electricity in US annually
- Reduce CO2
  - Climate changes from greenhouse gases are no longer a subject for debate. Reductions will benefit us all.
- Good Corporate Citizen
  - To ‘Go Green’ not only improves our future, it improves a company’s image.

United States Green Building Council

USGBC

The U.S. Green Building Council (USGBC) is a non-profit organization composed of every sector of the building industry working to promote buildings that are environmentally responsible, profitable and healthy places to live and work.

11,000 member organizations
75 regional chapters
39,000 LEED Accredited Engineers

The Leadership in Energy and Environmental Design (LEED) Green Building Rating System ™ is the nationally accepted benchmark for the design, construction and operation of high performance green buildings developed by the USGBC and its members.

LEED

- Leadership
- Energy
- Environmental
- Design

Leadership in Energy & Environmental Design

The LEED Rating System

Leadership in Energy & Environmental Design:

- Sustainable Sites
- Water Efficiency
- Energy & Atmosphere
- Material & Resource
- Indoor Environmental Quality
- Innovation & Design Process

LEED Certification Levels:

- Certified
- Silver
- Gold
- Platinum

LEED Certification by Building Type & Lifecycle

- New Building Construction & Major Renovation
- Commercial Interiors
- Existing Buildings
- Core & Shell
- Schools

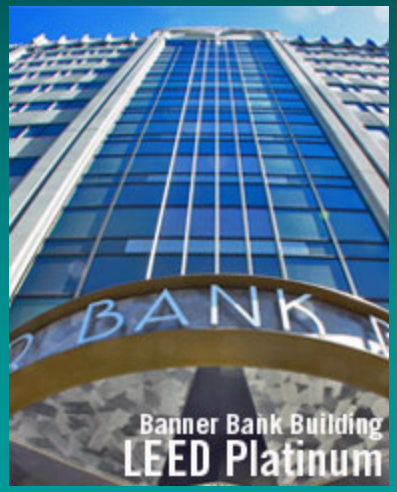
Metering Credits

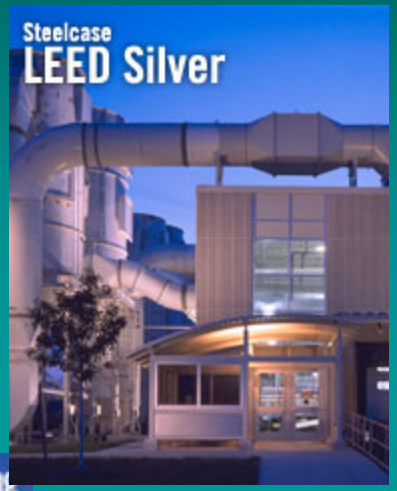
- Measurement & Verification – EA Credit 5
  - use meters for base building, tenant submetering and energy system performance
- Building Operations & Maintenance – EA Credit 3.3
  - use meters and software system to educate staff, continuously track performance and optimize systems
- Performance Measurement – EA Credit 5.1 - 5.3
  - enhanced metering-use electric, water and gas meters and software system for ongoing accountability and optimization of building energy performance over time

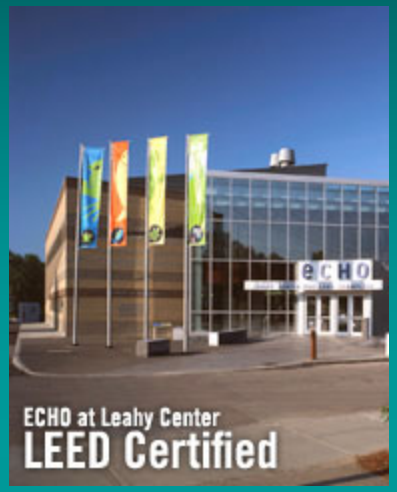
Metering Credits

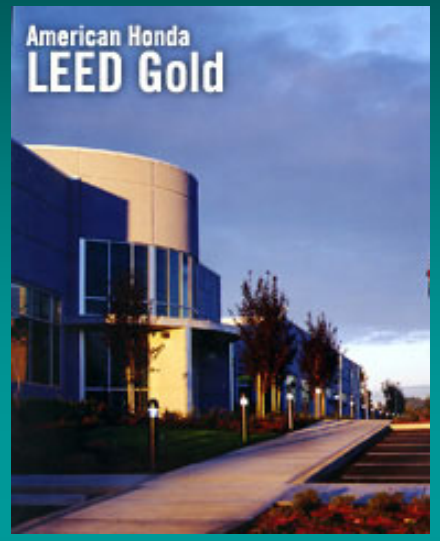
- Documenting Sustainable Building Cost – EA Credit 6
  - Use Submetering Software to document overall build operating costs to identify any positive impacts relative to sustainable performance improvements
- Optimize Energy Performance – EA Credit 1
  - Verify that energy efficiency equipment and system are operating at peak performance and as specified in the building design
- Energy Use, Measurement & Payment Accountability – EA Credit 3
  - Provide for the ongoing accountability and optimization of tenant energy and water consumption including submetering equipment to measure and record energy uses within the tenant space
  - Negotiate a lease where energy costs are paid by the tenant and not included in the base rent

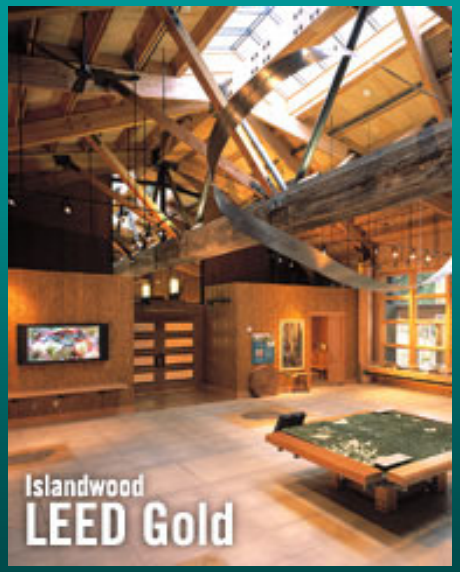
LEED Certified Buildings





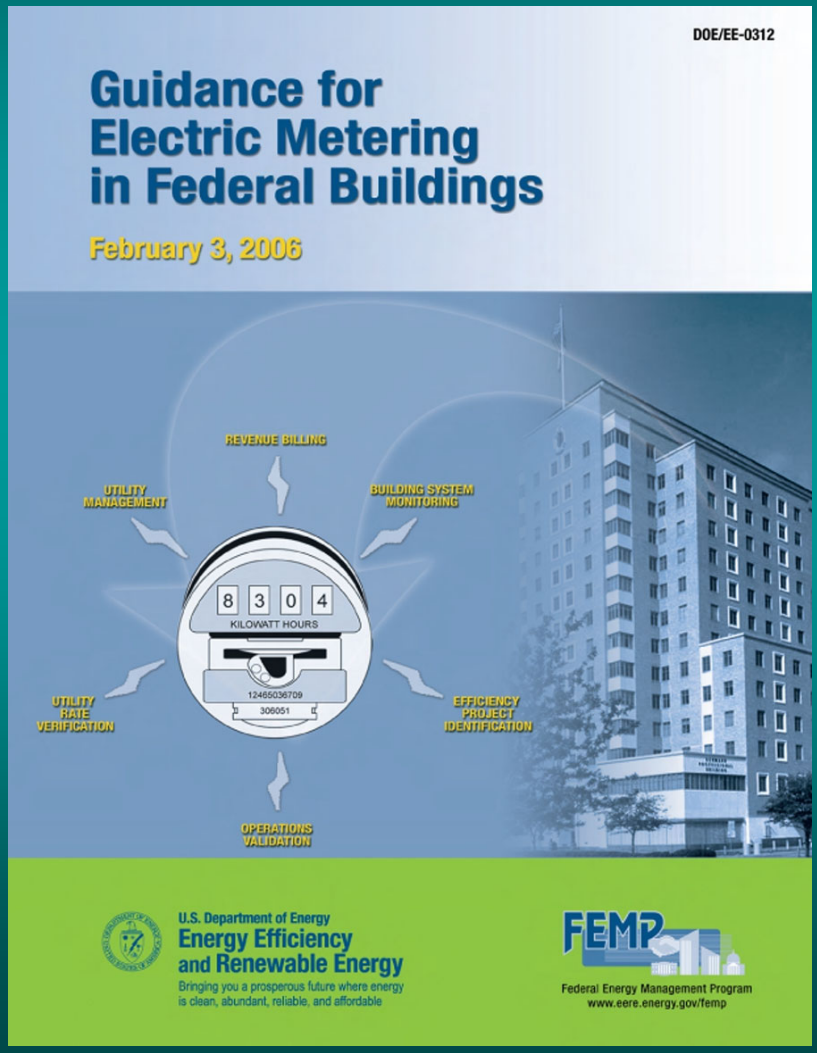






Section 103
Energy Use Measurement & Accountability

- All 500,000 Federal facilities required to be metered or submetered by 2012
- Smart meters – Interval data, communications, etc.
- Economically feasible, assumptions
  - 10 year payback
  - $5,000 installed cost (very high)



www1.eere.energy.gov/femp/pdfs/adv_metering.pdf

Federal Buildings Efficiency

- 500,00 Federal buildings
- Section 102 - Set efficiency goals for existing buildings to increase 2% per year to 20% by 2015
- Section 105 - Extends Energy Savings Performance Program to 2016
- Section 109 - New buildings must comply with ASHRAE 90.1 – 2004
    - Goal of 30% below 2004 standards
    - Apply sustainable design principles

EPACT Tax Deduction

- EPACT 2005 Section 1331
  - Commercial buildings tax deduction up to $1.80 per sq. ft.
    - Exceed 50% savings over ASHRAE 90.1 – 2001
    - New Construction or renovation
      - Put in place from1/06 to 12/08
  - Qualifying Systems
    - Interior Lighting Systems
    - HVAC
    - Building Envelope

Other Market Drivers

- Renewable Energy Projects
  - Solar, Wind, Distributed Generation– required net metering
  - Advanced Green Net Meter - Delivered, Received, Net
- Demand Response
  - Payments made to customers for curtailing load, metering critical part of validation
  - Meters with load control
- Energy Efficiency Initiatives
  - In general, movement towards saving energy
  - Energy management requires energy measurement

Where to find sales opportunities

- LEED accredited Engineers (39,000 accredited since 2001)
- Be the "go to" person for Green Buildings in your market.
  - Be a green building and LEED resource for your customers. Contractors & Distributors get a person to become a LEED Accredited Professional
- USGBC Local Chapters
  - Participate in local GBC chapters programs and events
- BOMA Members Shooting for Green Building Status
  - BOMA programs to assist with green building initiatives

Where to find sales opportunities

- Schools & Universities
  - University of Central Florida: In 2006, the university adopted LEED Silver for buildings that are new or undergo major renovations
  - Massachusetts Institute of Technology: All new construction and renovations are required to achieve LEED Silver certification
  - Dartmouth College: All new construction must achieve LEED Certification

- Federal Government
  - GSA: The General Services Administration requires that all building projects meet the LEED Certified level with a target of LEED silver. The GSA is the nation's largest landlord, managing space in over 8,000 owned and leased buildings for over one million federal employees.
  - US Army: The Army adopted LEED into its Sustainable Project Rating Tool (SPIRIT). A memorandum was issued stating that it will transition from SPIRIT to LEED beginning in FY 2008. All new vertical construction projects will achieve LEED silver certification. Additionally, the Army will adopt LEED for Homes when it is released.

CASE HISTORIES

- Retail
- Government
- Manufacturing
- Property Managers
- Entertainment Venues
- Apartments
- Bill Gates House

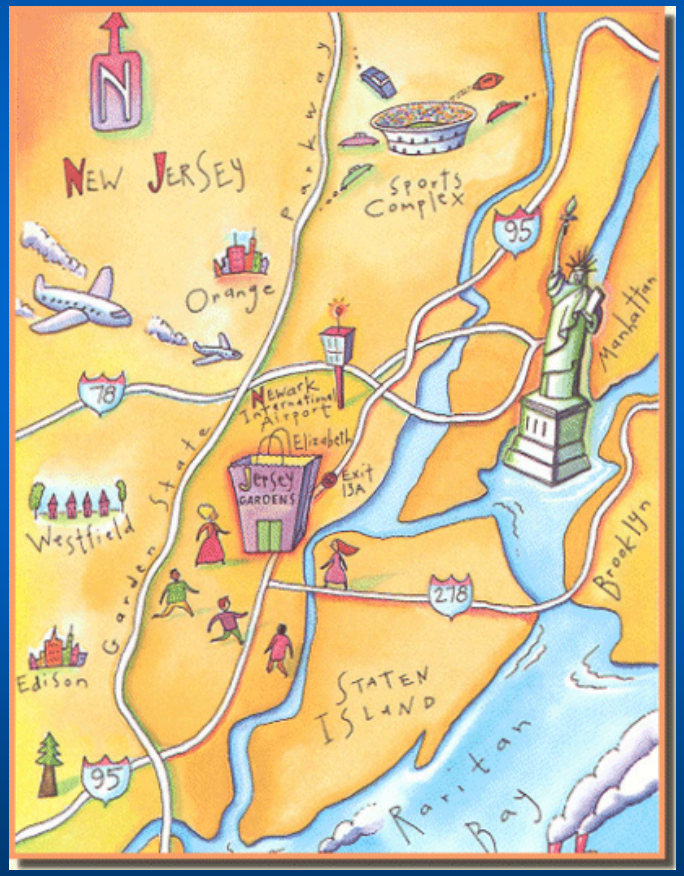
The Shoppes at Liberty Place Philadelphia, PA

- Over 70 Stores in a Office Skyscraper
- Over 100 meters
- Tenant Billing
  - As leases expire
  - Third-Party Billing
- Tenants:
  - Victoria Secrets, Motherhood, J. Crew, Nine West
  - Food Court

Forest City Management
Retail Shopping

- Venetian Hotel, NV
  - Over 100 meters
- Galleria at South Bay, CA
  - 37 Meters
- The Avenue at the Tower City
  - Hard Rock Café, 4 meters

Jersey Gardens Mall



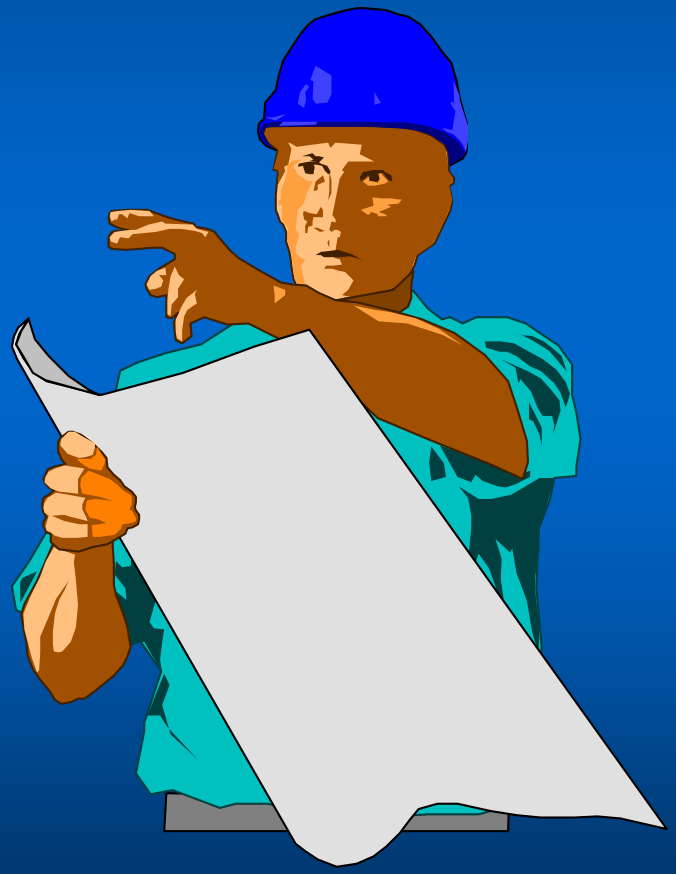
- Over 200 Outlet Stores
- 341 Meters, 57 IDRs
- Anchor Tenants
  - Old Navy, Saks, BBB
  - Neiman Marcus,
- ESCO owns electrical distribution
- Buys power at Primary rate
- Owner receives rate differential

National Accounts Subleasing

- Circuit City- PA
- Staples
- Target Stores – D.C.
- Footlocker - NJ
  - Submetering adjacent space
  - Billing tenants for actual use.

Washington National Airport

- $6.5 Million annual electric bill
- Over 1 million square feet
- 35 boarding gates
- 65 tenant locations
- 11,000 Employees



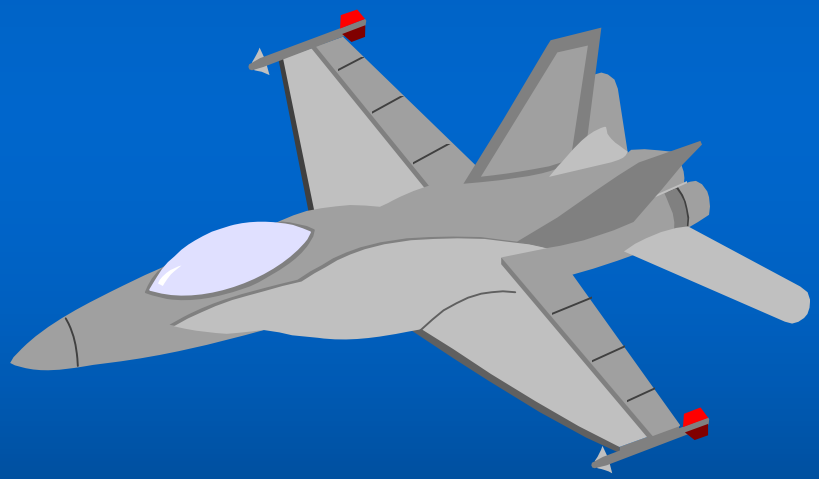
Tenant Billing at the Airport

- Jet Gate Power
- Pre-Condition Air
- Airline Offices
- Restaurants
- Retail Spaces
- Offices
- FAA

Airport Summary

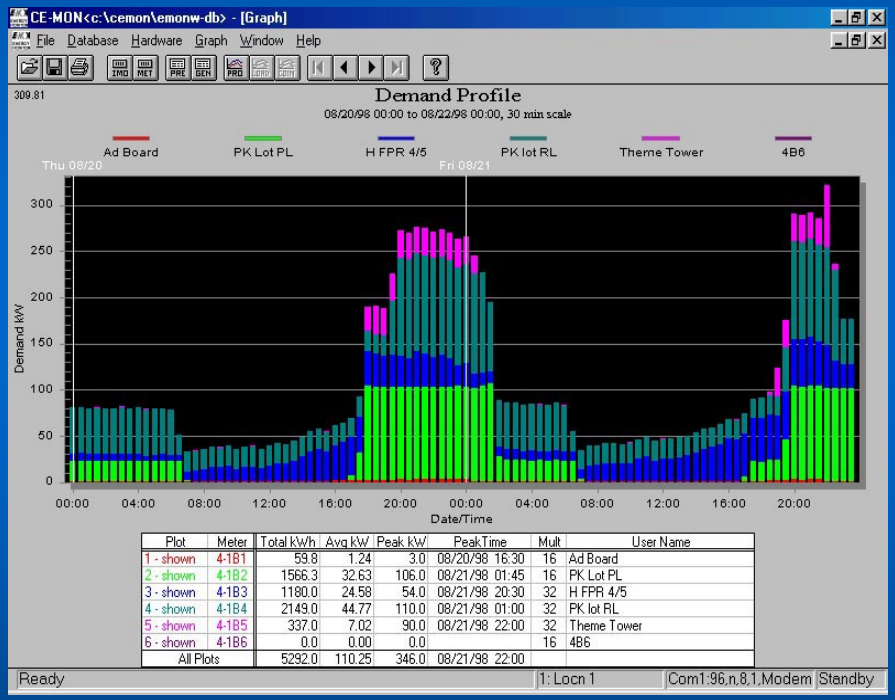
- Over 200 points being metered
- Approximately $300,000 installed
- Estimated Savings from tenant billing 10%
- Estimated Savings from Cost alloc. 5%
- Estimated Savings from Conservation Measures, potential of 10%
- Minimize tenant/landlord disputes

LA Airforce Base



- Identify energy saving opportunities
- Verification of Savings
- Energy Budgeting
- Comply with energy reduction mandates

LA Airforce Base Hardware



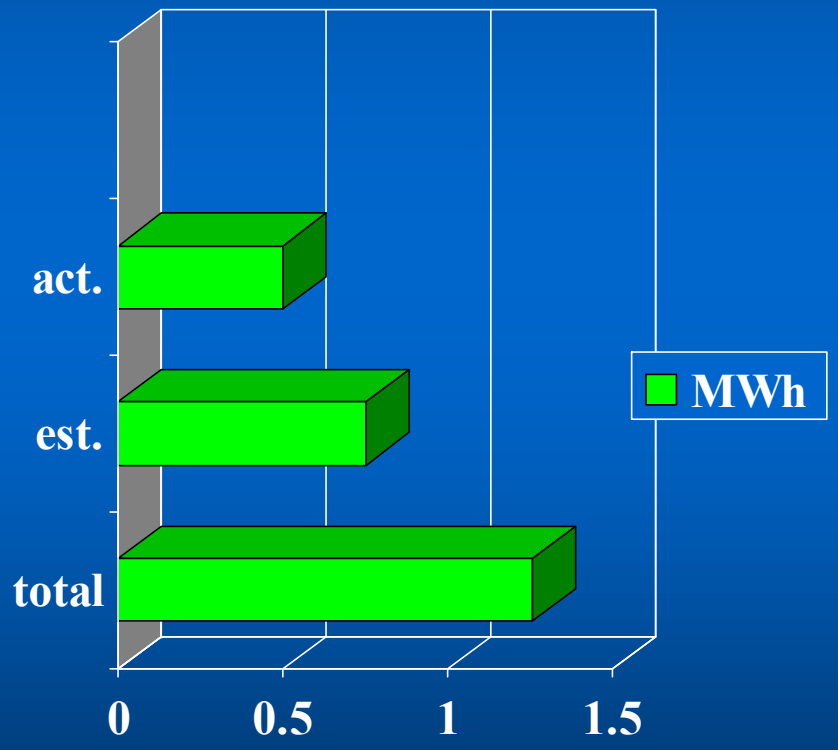
- Over 50 E-Mon D-Mon submeters
- 21 IDR data accumulators
- E-Mon Energy software
- Est. Cost $50k
- Used to verify over $1 million in savings

Ford Motor Company

- 26 Buildings throughout Detroit
- Meter each building to verify energy savings for lighting retro-fit
- 3rd-party meter reading
- Computerized system

NEW HAMPSHIRE FOUNDRY

- Estimated at 60% of total facility energy.
- Submeter proven at <40% of total.
- Eliminated 250 kW demand. ($2000/mo.)
- -$27,000/mo. in kWh.
- $348,000 yearly cost reduction. (kept foundry open and revenue to utility.)



Kroger Foods/Detroit Edison

- Monitoring program in Kroger Food Stores
- Monitoring freezer operations
- Integrating monitoring with Energy control systems
- Over 100 units performing monitoring in various sites
- Echelon Based Technology

Shorenstein Bank of America Building San Francisco

- 55 Story Building
- 2,000,000 sq. ft.
- 5,000 - 7,000 people
- Over 100 Meters
- Over 35 IDR's
- Goldman Sachs, Morgan Stanley, Price Waterhouse, Ernst & Young, Solomon Bros.

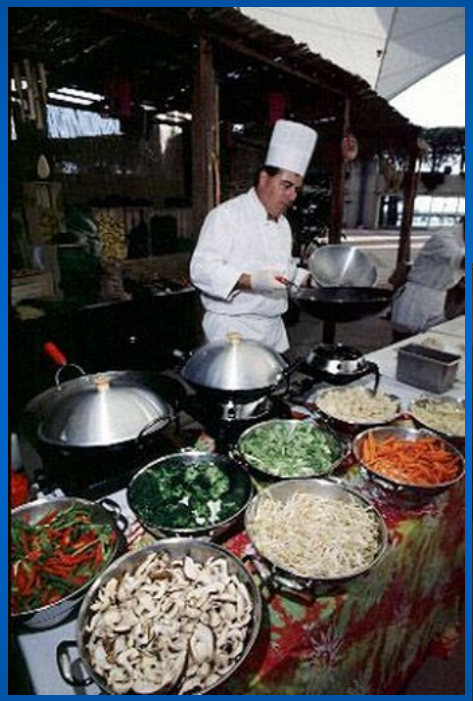
Recovered over $1,000,000 in excess energy usage

- 3 watts per square foot energy allocation
- 2-3 times over baseline allocations
- Restructured leases for submeters
- Recovered over $1,000,000

San Diego Convention Center

- Seven city blocks long
- 2.6 Million Square Ft.
- Recent $216 Million Expansion
- Ron Barham, Operations Manager
- Over 10 meters and software

Why the Convention Center Submeters

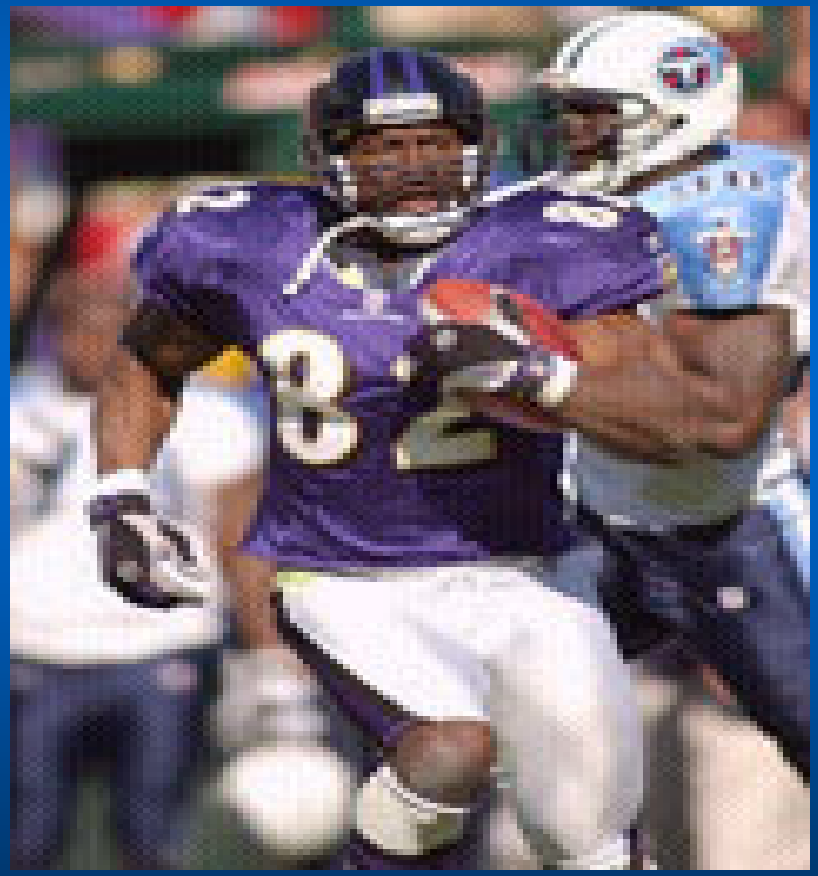


- Document Power Quality Events
- Cost Analysis of Energy Consumption for events
- Energy Conservation

Baltimore Ravens
Super Bowl Champions

- 69,000 Seat Stadium
- Energy 20% of operating budget
- 3.6 MW Power Plant
- Use of Meters:
  - Energy Management
  - Event allocation
  - Allocation between Ravens & Orioles
- Over 40 submeters

Baltimore Scores Big with Energy Savings



- Strategically Metered
  - Sports Lighting & Scoreboard
  - Luxury Suites
  - Kitchen & Air Handlers
  - Parking lot lighting
- Est. Cost - $50,000
- Savings, 10-15% or $750,000

New York High-Rise
2 Columbus Circle

- 39 Story Condo
- New Construction
- 131 Electric Meters
- 3rd Party Meter Reading
- Hard-wired System

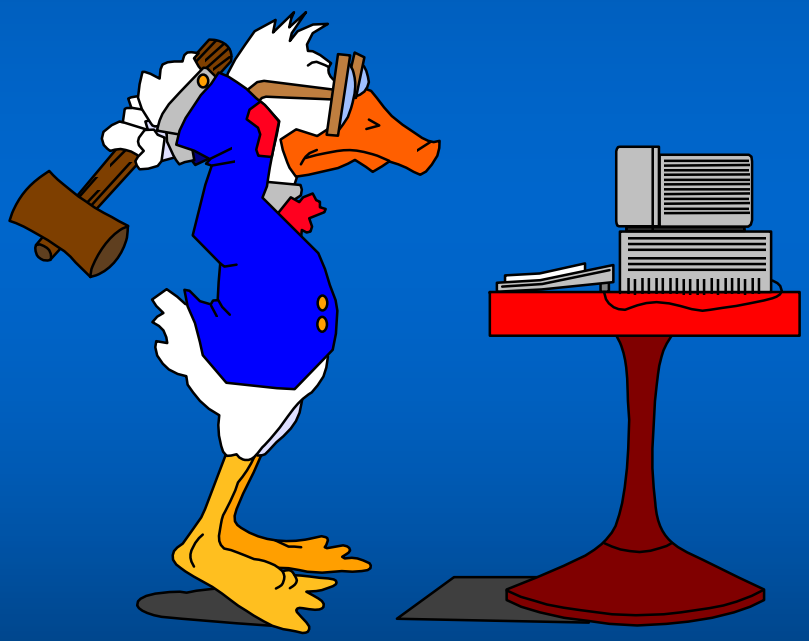
Citi Vista
Reno, Nevada

- 6 story mid-rise apartment
- Original design for 152 direct utility meters
- Engineering firm recommended Multiple Meter Units in electric rooms on every floor
- Master-Metered by Utility
- Savings of over $200,000 in installed electrical cost, over 20% savings.

BILL GATES HOUSE

- 7 YEARS TO BUILD
- 45,000 SQUARE FT.
- EST. $53 MILLION
- HOME THEATRE
- 18 HOLE PUTTING GREEN
- 100 PERSON HALL
- BADGE SYSTEM

BILL'S $30,000 PER MONTH ELECTRIC BILL



- THREE 800 AMP PANELS
- ELECTRIC ENGINEER OFFICE
- INSTALLED MMU-12
- SOFTWARE ON WIN95
- $30,000 PER MONTH
- SWITCH FROM RESIDENTIAL TO COMMERCIAL RATE

THANK YOU FOR YOUR TIME

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- Please visit our web site for electric, gas, BTU and water meters!