ES75
Electrical Power Systems
Lecture 3

Environmental Studies Department
De Anza College

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Power Management
Engineering & Construction

- Many owners want the design to accomplish one goal, low initial cost. Since they may not have to pay the utility bill they don't care about efficiency.
- Title 24 and other standards require designs to meet to efficiency targets
- Owner/operators have a built in incentive to design for efficiency but with all of their problems it often is not on their radar screen we have to put the efficiency issue in terms that they understand, e.g., RELIABILITY, REDUCED OVERHEAD, HIGHER PROFIT, EASIER TO MAINTAIN, ETC.

Power Management
Operations and Maintenance

- for large facilities operations the focus is to keep it running
- maintenance is an easy target for cost cutting since the impact doesn't show up for some time
- proper maintenance will help keep equipment running efficiently and reliably
- preventative maintenance can further increase reliability

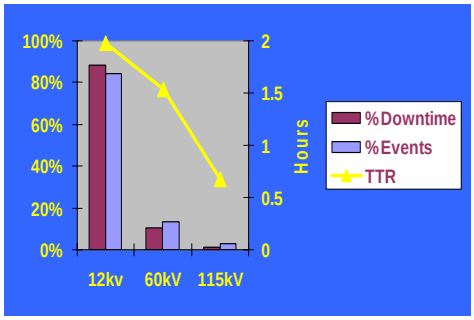
Power Management

Reliability and Power Quality

- SAIFI. System average interruption frequency index (sustained interruptions). The system average interruption frequency index is designed to give information about the average frequency of sustained interruptions per customer over a predefined area.
- SAIDI. System average interruption duration index. This index is commonly referred to as Customer Minutes of Interruption or Customer Hours, and is designed to provide information about the average time the customers are interrupted.
- CAIDI. Customer average interruption duration index. CAIDI represents the average time required to restore service to the average customer per sustained interruption.

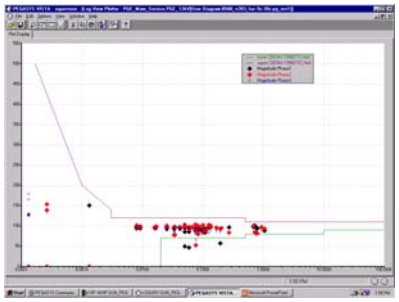
Reliability and Power Quality

The Utility View

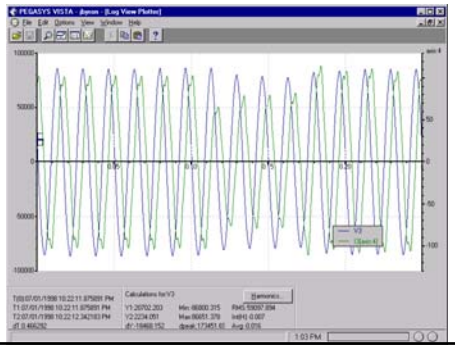


Reliability and Power Quality

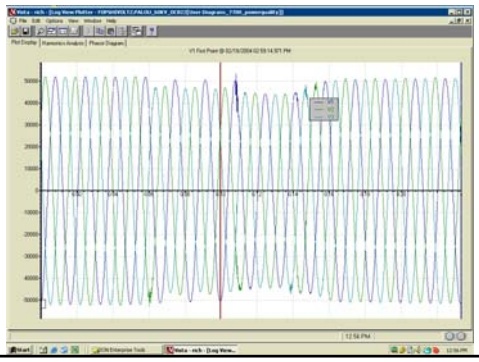
The Customer View



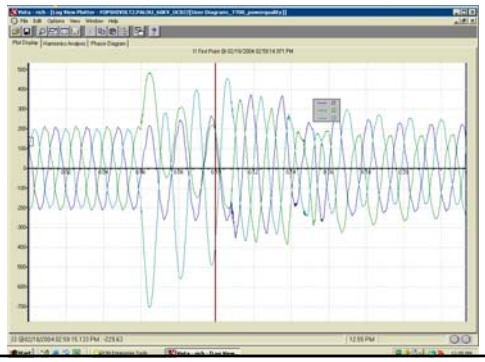
Reliability and Power Quality
The Customer View



Reliability and Power Quality
The Customer View



Reliability and Power Quality
The Customer View



Metering

Revenue Meters Vs. Panel Meters Vs. Advanced Meters

- RMs are directly connected <600 volts, 200 amps. Higher voltage or current requires transformers.
- Voltage Class - kV: 0.6, 1.2, 2.5, 5, 8.7, 15, 25, 34.5, 110, 250, 350
- Indoor Vs Outdoor
- Accuracy and relay or metering class

Metering

- Potential Transformers
- Limitations include Voltage/Insulation Levels, Accuracy, Temperature

Metering

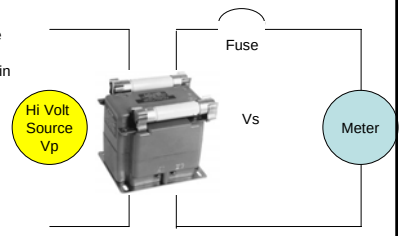
- Current Transformers
- Limitations include Voltage/Insulation Levels, Current capacity (low and high), Accuracy, Temperature
- Split vs Solid Core

Metering

- Safety and Shorting vs. Disconnect
  - Voltage Source needs fusing to protect from short
  - Voltage Source requires a means to disconnect

Vp = Vs X Turns Ratio

If the circuit is shorted, the PT current output will increase to try and maintain the ratio. Left unprotected this high current can burn up the PT or the wires.

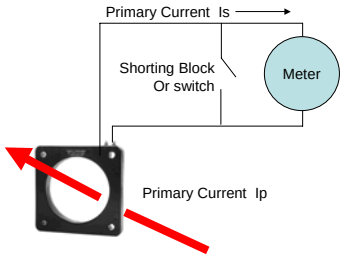


Metering

- Safety and Shorting vs. Disconnect
  - Current Source requires a means to short out the circuit

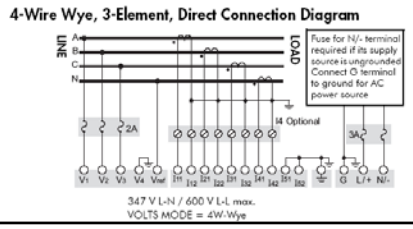
Ip = Is X Turns Ratio

If the circuit is left open after the meter is removed, the CT voltage output will increase to try and maintain the ratio. This can cause burns, arcing or destroy the CT.



Metering

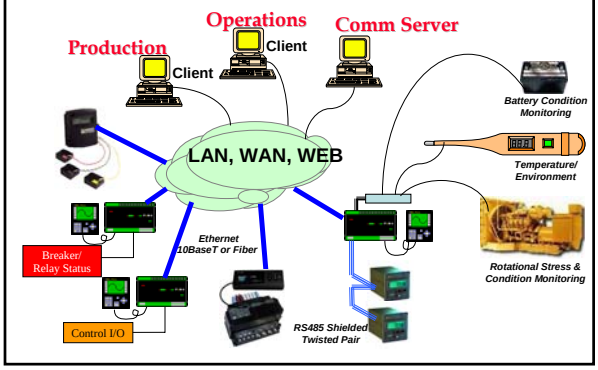
- Connecting meters - Incorrect wiring can cause significant errors. This adds up - $$$$$$
  - 4 WIRE WYE
  - 3 PT, 3 OR 4 CT
  - Polarity and Phasing



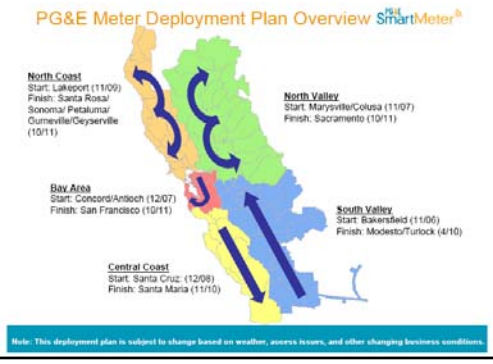
Metering

- Meter Types
  - Revenue meters
  - Sub-meters
  - Transducers
  - Dataloggers
  - Analyzers
  - Panel Meters
  - Mechanical, Analog
  - Electronic

Power Management



"Smart Meters"

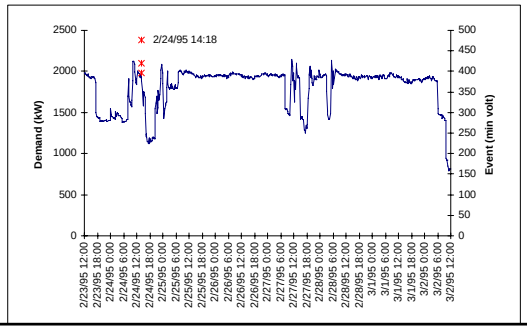


Power Management

- What do you do with all the information
  - Building Management Systems vs Power Management systems
  - Management Vs. Control – are they the same?
    - Sophisticated time clocks and temp control
    - Management process to incorporate best practices
  - Local Control Vs. Distributed Control

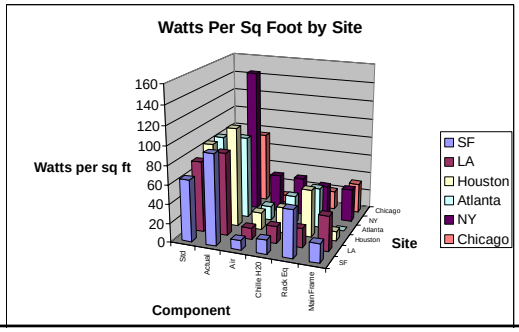
Power Management

- Analyzing how Power impacts operations



Power Management

- Analyzing how Power impacts operations



Power Management

- Analyzing how Power impacts operations

XYZ Corporation Aggregate Energy & Demand

From: July 1, 1998 00:00:00

Applied Power Technologies, Inc.

To: July 31, 1998 23:45:00

ENERGY

Tariff	Total kWh	Cost/kWh ($)	Cost for Tariff ($)
Off Peak	35,104.80	0.045	1,579.72
Partial Peak	36,649.74	0.075	2,748.73
Summer Off Peak	40,020.85	0.055	2,201.15
Summer Partial Peak	21,439.31	0.075	1,607.95
Super Peak	21,807.85	0.095	2,071.75
Total Cost			10,209.29

DEMAND – Total Peak

Tariff (# days in effect)	Time	Max kW	Cost/kW ($)	Cost for Tariff ($)
Max Demand (31 days)	27-Jul-98 12:00:00 PM	340.64	6.50	2,214.14
Partial Peak (15 days)	09-Jul-98 12:45:00 PM	333.49	7.00	1,129.57
Sum. Part. Pk (16 days)	16-Jul-98 11:45:00 AM	335.70	7.00	1,212.85
Super Peak (16 days)	27-Jul-98 12:00:00 PM	340.64	9.00	1,582.31
Total Cost				6,138.87

Energy and Demand Total	16,348.15