
Metering Overview

Metering Task Force of BAWG

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Metering Overview

Agenda

- Background
- System Metering
- Metered Information
- Metering Technologies and Registers
- Load Profile Recorders
- Communications
- Meter Suppliers
- Q & A

REITX Background



Berkshire Power Development



Company Highlights

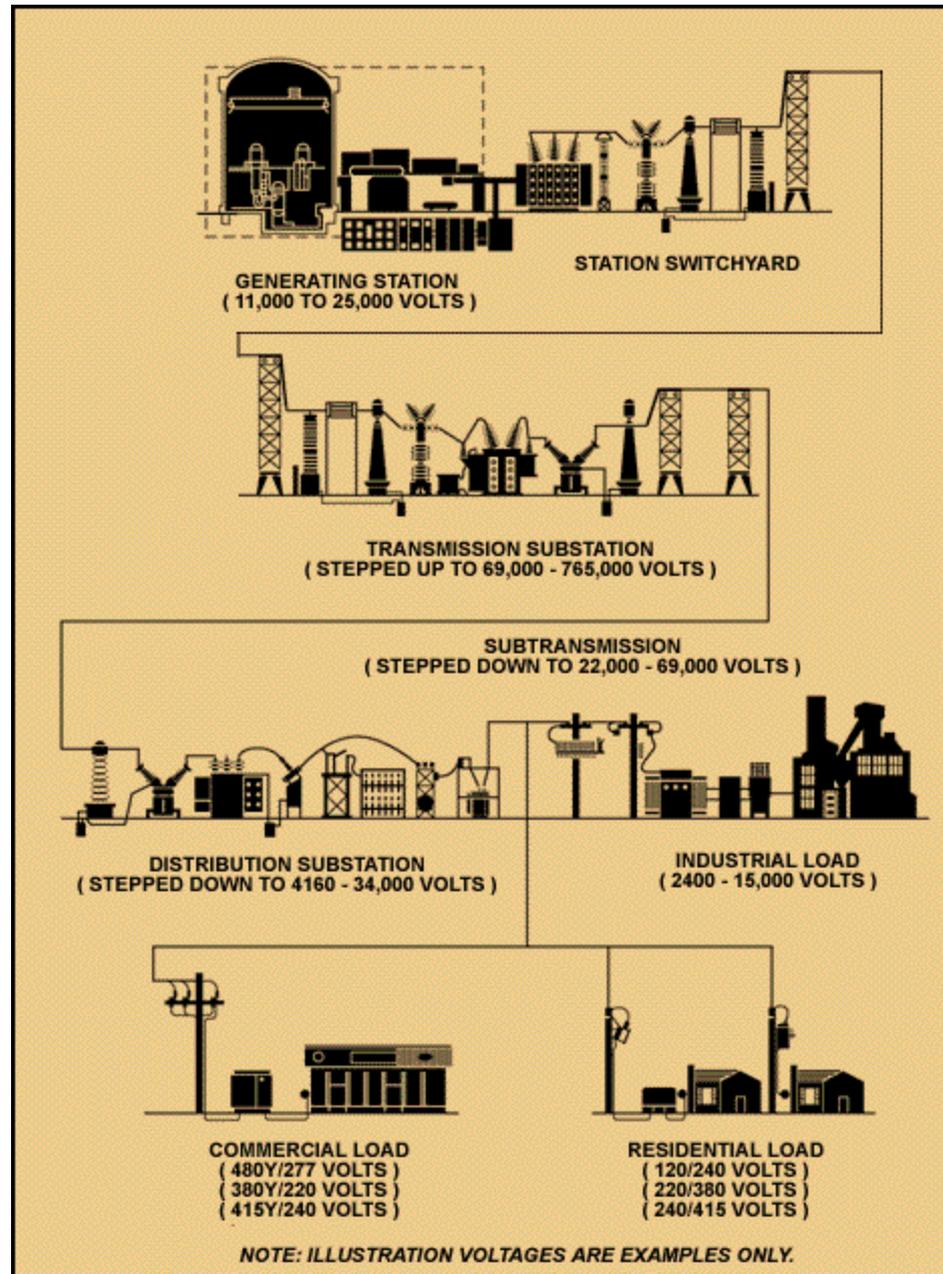
- Privately Held Company with HQ in Atlanta
- Business: software solutions to alleviate energy price volatility and reduce energy costs
- Over 100 combined years in the energy industry
- Created first Regional Negawatt Hub with ISO New England
- Operating in ISO-NE, New York ISO, and PJM service territories

Personal Background/Qualifications

- 19 years in the Electric Utility Industry
 - 5 years managing multi-function metering and communications solutions with Schlumberger
 - 8 years managing and developing energy usage and complex data management and billing system

System Metering

Typical Utility System Configuration



System Metering

- Each transition point in the delivery process is usually independently metered
- Important to know power that came in and power that went out
- Different metering technologies, registers and communications may be implemented at each transition point

System Metering

- Poly-phase metering
 - Often referred to as 3-Phase metering
 - Measures all three phases of the power delivered
 - Is typical for larger loads such as commercial and industrial facilities
 - Will be the primary metering for all delivery transition points

System Metering

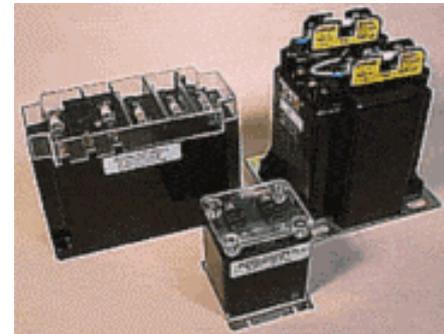
- Single-phase metering
 - Only measures one phase of the power delivered
 - Typical for residential and light loads such as street lights
 - May be seen in tie points for facility metering, such as buildings, grounds lighting, etc.

System Metering

- When the service voltage or current is too great to meter directly, instrument transforms are used
 - CTs to step down the current, PTs to step down the voltage
- Large industrial facilities generally utilize instrument transformers
- Smaller loads such as small commercial or residential loads have these transformers integrated within the meter



Current Transformer



Voltage Transformer

Metered Information

Metered Information

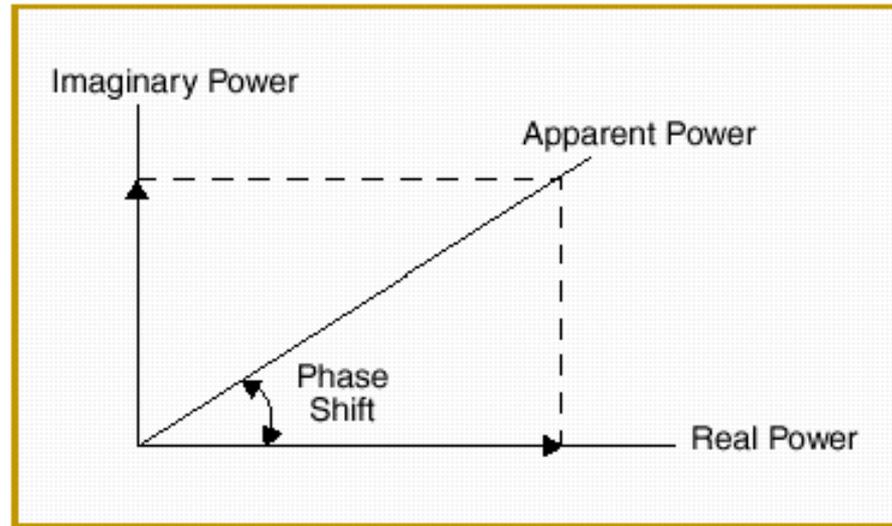


FIGURE 14

Relationship between real and apparent power in a sinusoidal system

- Three phase power delivery consists of three primary measurement quantities:
 - Real Power (kW)
 - Apparent Power (KVA)
 - Reactive/Imaginary Power (KVar)

Metered Information

- Quantities are a result of phase shifts between the voltage and current of the power being delivered
- Power Factor can be derived from these quantities (kW/KVA)
- When Real Power equals Apparent Power, Power Factor equals 1.0
- Many facilities and utilities are concerned about Power Quality and measure this information
 - Total Harmonic Distortions (THD)
 - Voltage sags and swells
- Single phase power (such as for a home) is one phase of the three phase delivery system
- Each quantity is measurable and provides the delivering entity with useful information on system

Metering Technologies and Registers

Metering Technologies



- Electromechanical-

- Measurement is electromechanical.
- All electromechanical kilowatt-hour meters have a rotating disk in them. The disk's rotational speed is proportional to the amount of electricity consumed
- Each disk rotation is equivalent to energy consumed (Kh)
- Accuracy is typically in the +/- 2% range
- Registers are fixed and calibration is done mechanically
- Older measuring technology with a large existing installed base.
- Still most common for single phase installations, all but obsolete for new three phase installations

Metering Technologies



- Solid State Metering

- Uses electronic circuitry to measure consumption
- Measuring technology varies from each manufacturer
- Much greater accuracy obtainable since it is microprocessor controlled with no moving parts
- All measuring quantities (kW, kVA, kVar, Pf, etc) available from single measurement source
- Meters configured and calibrated through software application
- Predominant in all new poly-phase metering installations
- Initial introductions into single phase market

Billing Registers

- Many billing register quantities and measurements exist in the industry.
 - Energy (kWh), Demand (kW), KVA, KVar, PF penalties, Time-of-Use, Real Time Pricing
- The most common registers are energy and demand
- For residential and small commercial users, most common register is kWhs
- For poly-phase users, energy and demand are the primary registers, but this differs greatly by utility and geographically
- Many meters in the market today offer all of these registers as standard

Billing Registers

- Some of the more complex registers try to reflect the cost of delivering the service to the customer.
 - Demand reflects the cost of delivery during the highest demand time periods. It encourages maintaining a consistent peak demand level.
 - TOU reflects the cost of delivery during different times of the day and encourages usage when costs are low.
 - KVA and KVar best reflects what is being delivered by the supplier
 - RTP reflects the real time cost of the energy delivered, generally on an hourly basis.

Register Accuracy

- Industry requirements are changing with the improvements in technology
- Majority of utility standards call for +/- 2% accuracy
 - Carryover from electromechanical technology
- Solid State technology accuracy far exceeds EM capabilities
 - Generally +/- .5% but +/- .2% or better is not uncommon
- Initial focus on poly-phase improvements
 - Greatest revenue impact
 - First to implement SS technology
- Anticipate single-phase improvements with technology improvements
- Accuracy governed by ANSI and IEC standards

Metering Installations

- There are several types of meter installations



Socket base



Panel Mount

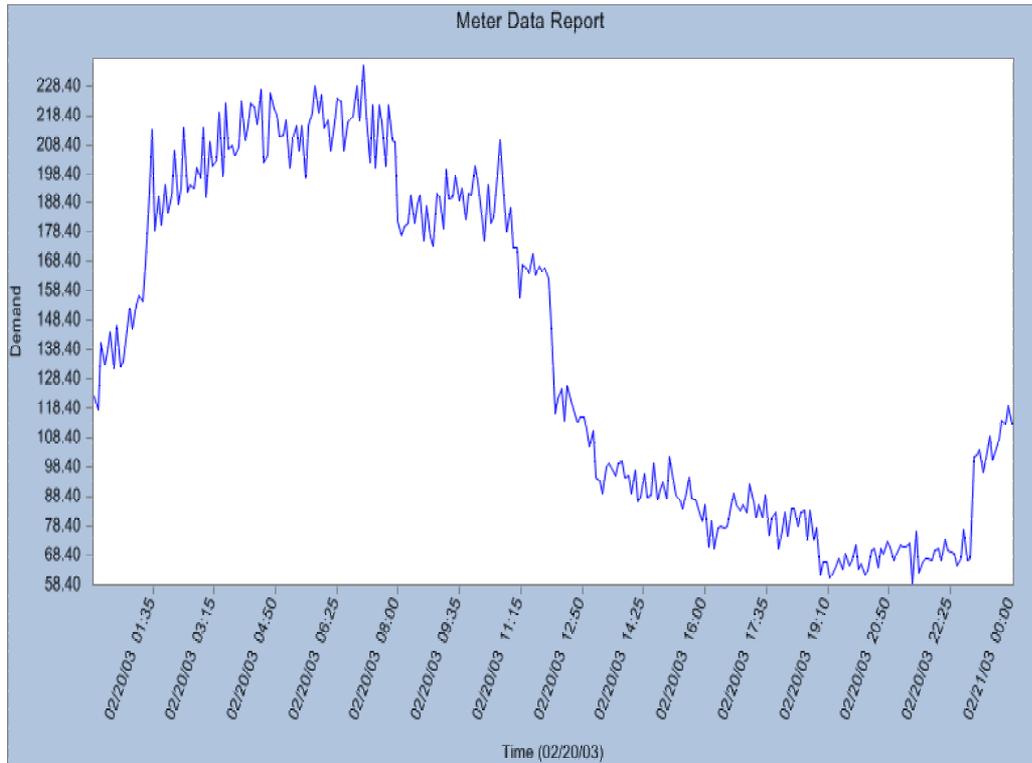
- In addition, there are A-base, Rack mount and stand alone recorders
- Meter type depends on load and equipment at location to be metered

Load Profile Recorders

Load Profile Recorders

- Captures energy usage over time to create time series data
 - Typically this is kWh but other quantities can be measured
 - Typically it is in 15 minute intervals but 1, 5, 30 and 60 minutes are also common
- Can view data tabularly or graphically to show Load Profiles
 - Shows typical load patterns
 - Identifies best practices and problem areas
 - Used as procurement information
 - Used as usage analysis information

Views of Load Profile Data



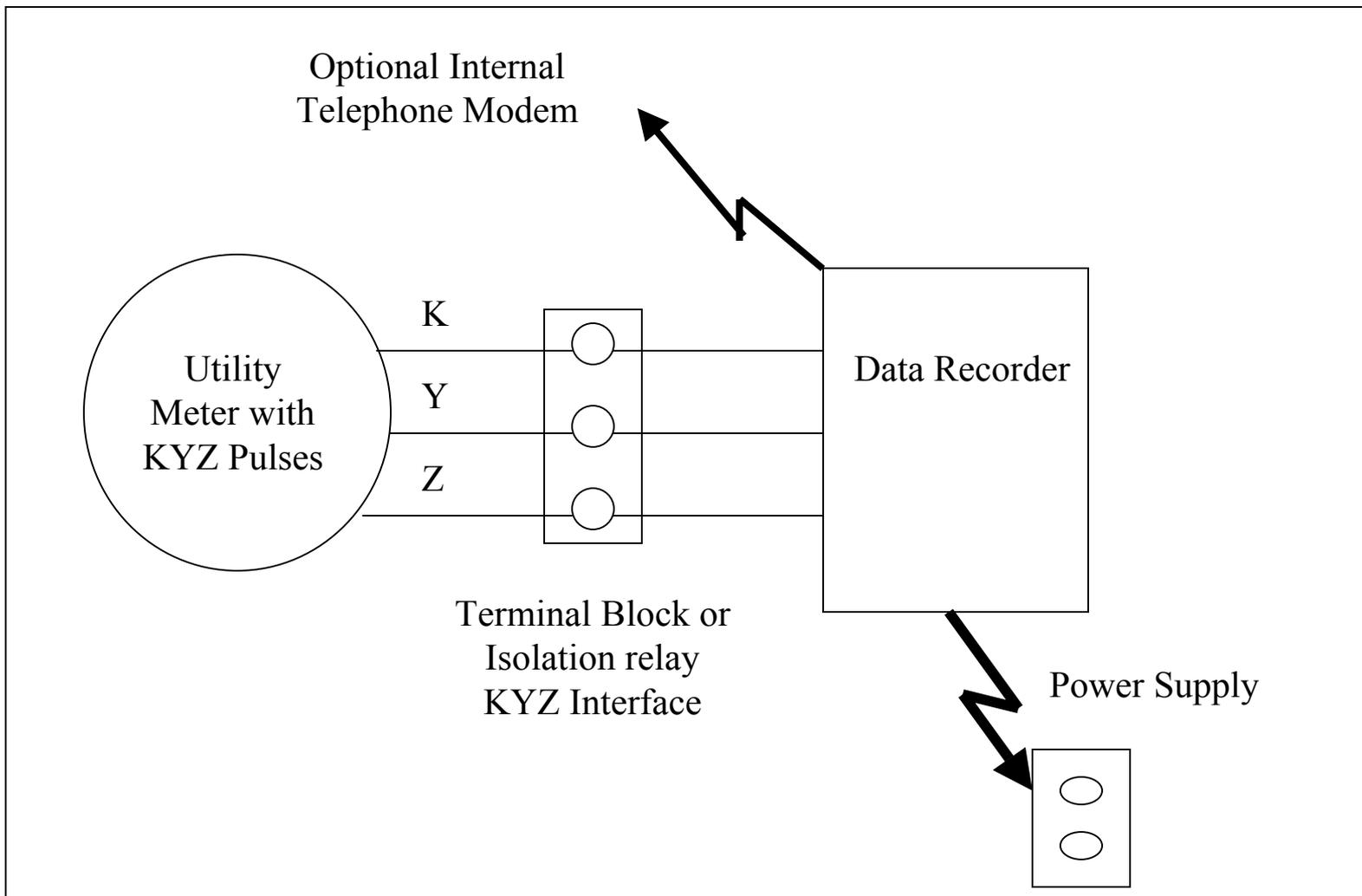
Graph View

Time	kWh
2/20/2003 0:05	122.4
2/20/2003 0:10	117.648
2/20/2003 0:15	140.784
2/20/2003 0:20	133.32
2/20/2003 0:25	137.868
2/20/2003 0:30	144.36
2/20/2003 0:35	132.252
2/20/2003 0:40	146.58
2/20/2003 0:45	132.624
2/20/2003 0:50	134.46
2/20/2003 0:55	145.764
2/20/2003 1:00	152.724
2/20/2003 1:05	145.62
2/20/2003 1:10	153.684
2/20/2003 1:15	156.804
2/20/2003 1:20	154.836
2/20/2003 1:25	168.18
2/20/2003 1:30	191.928
2/20/2003 1:35	213.324
2/20/2003 1:40	179.04

Table View

Typical External LPR Installation

- Initially provided as external "stand-alone" recorders that interfaced to revenue meter



Load Profile Recorders

- Load Profile Records are becoming a standard feature on most poly-phase meters
 - Commonly referred to as mass memory recorders
- Software package is required to configure the quantities to be recorded and to view results
- Generally meter manufacturer's software is required to configure the recorders but multiple software packages are available to view data
- Availability in single phase meters will expand with migration to SS metering

Metering Communications

Metering Communications

- Probably the greatest area of advancement for meters since solid state technologies
- Multitudes of communications technologies exist and are supported in metering today
 - Telephone
 - Wireless
 - One way radio
 - One and a half way radio
 - Two way radio
 - Public and private networks
 - Ethernet
 - Point to point (RS232, RS485, etc.)
- The nature of the communication dictates the communication technology

Communication Applications

- Automatic Meter Reading for billing
 - Most common in residential and small commercial applications
 - Predominantly uses public and private radio
- Analysis
 - Used to analyze a load using load profile data, outages
 - Due to large quantity of data, telephone, Ethernet and point to point technologies are most common
- Alarms
 - Outage alarms at all level of the network
 - Thresholds; demand, PF, etc.
 - Can use any form of communications but primarily wireless and telco.
- System management and control
 - SCADA
 - Demand Response/Curtailments

Meter Suppliers

Meter Suppliers

- Introduction of Solid State metering has enabled many new suppliers
- Four major revenue meter manufacturers
 - General Electric
 - Schlumberger
 - Landis + Gyr (formerly Siemens and L&G)
 - Elster Electricity, LLC (formerly ABB)
- Other prominent providers
 - Power Measurements Limited
 - TransData
 - Scientific Columbus
- Some new entrants
 - Engage Networks
 - Envenergy
 - Many others

Questions and Answers

RETX, Inc