Utility Metering History

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1990s - Introduction of Automatic Meter Reading by a number of utilities

1931 - Roll-out of standard clock-face meters

1889 - First watt hour 'spinning disc' electricity meter

1980 - Introduction of solid state and digital metering in homes

1851 - Gas meters used for streetlights

1923 - Introduction of early gas meters across homes

1976 - First non-analog meters are introduced for businesses replacing traditional 'clock face' dial meters

2009 - Smart meters featuring two way communications and remote access to data

19th Century Utility Meters

Mid 1800s – Gas sold from a central plant network to customers who pay a recurring fee for service – predominantly the gaslight business

1870s - Electricity sold from a central plant to multiple customers via transmission lines used to power arc lamps connected in series

- Samuel Gardiner – DC lamp-hour meter
- J. B. Fuller – AC lamp-hour meter

1880s – Transformer becomes commercially feasible – foundations for natural gas use in residential cooking & heating

- Edison Electric – chemical ampere-hour meter
- Professor Forbes – heating element & windmill meter
- O. B. Shallenberger – rotating electric field ampere-hour meter

1890s – Measuring varying voltage and low power factors on AC circuits used to run commercial & industrial motors

- William Stanley – floating disk watt-hour meter
- Shallenberger – polyphase watt-hour meter
- Paul McGahan – two single-phase meters w/common shaft/register

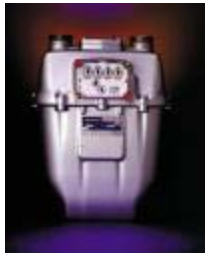
20th Century Utility Meters

- Early 1900s – availability of low cost transformers increased transmission distance and economies of scale resulted in the end of the era of electricity as a luxury
  - Sangamo Electric – spirally slotted disk covered by a “bay window”
  - Westinghouse – first incorporation of ball bearings
  - GE – introduced the first mass-produced meter - the Type I
- 1920s/30s - key advancements in design compensate for a range of temperatures and loads
  - Westinghouse introduces the first socket-type meter
  - National Electric Code revise to allow meters to be placed ahead of switches and fuses
  - Industry consortium standardizes two designs
  - Sangamo introduces the last mechanical prepayment meter
- Mid 1900s – key advancements in materials for bases and magnets
- 1980/90s – introduction of electronic registers and automatic meter reading devices

Meter Technology

Mechanical

Electromechanical



Electronic

Better data for enhanced analysis and control

Meter Technology Drivers

- Investment costs to purchase *and install* meters
- Recurrent costs to read meters and to issue bills based on consumption instead of bills based on flat fees
- Intermittence of supply
- Impurity in the utility
- Billing cycle

Objectives of Utility Metering

- Economical
  - Charge customers based on usage
  - More informed capacity decision making through awareness of demand patterns
- Technical
  - Allows better location of distribution losses
- Environmental
  - Incents conservation practices

Meter Reading

- Customer self reporting
  - Writes down the meter reading and mails in a postcard with this info to the utility
  - Writes down the meter reading and uses a phone dial-in system to transfer this info to the utility
  - Logs in to the website of the utility, enters the address, meter ID and meter readings
- Utility usage collection
  - Meter reader comes to the premise, reads usage at device or on echoed display unit and records the meter reading
  - Small radio is hooked up to the meter to automatically transmit readings to corresponding receivers in utility collectors (handheld computers, vehicles or other distributed collectors)
  - Small computer is hooked up to the meter that can either dial out or receive automated phone calls that give the reading to a central computer system.

Statutory Meter Requirements

EPACT 2005 Section 103

(e) METERING OF ENERGY USE.—

(1) DEADLINE.—By October 1, 2012, in accordance with guidelines established by the Secretary under paragraph (2), all Federal buildings shall, for the purposes of efficient use of energy and reduction in the cost of electricity used in such buildings, be metered. Each agency shall use, to the maximum extent practicable, **advanced meters or advanced metering devices that provide data at least daily and that measure at least hourly consumption of electricity** in the Federal buildings of the agency. Such data shall be incorporated into existing Federal energy tracking systems and made available to Federal facility managers.

- **Advanced meters -** measures and records interval data (at least hourly for electricity) and communicates the data to a remote location in a format that can be easily integrated into an advanced metering system.
- **Advanced metering system -** collects time-differentiated energy usage data from advanced meters via a network system on either an on-request or defined schedule basis. The system is capable of providing usage information on at least a daily basis and can support desired features and functionality related to energy-use management, procurement, and operations.
- **Standard meters** electromechanical or solid state meters that cumulatively measure, record, and store aggregated usage data that are periodically retrieved for use in customer billing or energy management. Meters that are not advanced meters are standard meters.