Electricity Metering: Past, Present, & Future

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The First Debate – Meter vs. Contract - 1887

Discussion of the Merits of Contract and Meter Systems.

Mr. Wood advocated the contract system, and wanted to be informed at what price lamps should be sold.

It was stated that at the last meeting it was resolved that all companies be advised to charge 85 cents for lamp renewals, and that the customer ought to be charged for the current only.

Mr. Sherwood, of Jackson, Mich., spoke in favor of the contract system, and stated that they have now connected 1,800 16 c. p. lamps, and that they are adding new consumers every month.

Suggestions were asked as to how to control the lighting of contract customers. Mr. Vail suggested a switch at the store door or window, which could be reached by a key from the outside, and the current turned off at a specified time by an employee of the Company.

Mr. Chinnock suggested a clock movement to turn the current on or off, which would probably cost about $2.

Motion: That a committee be appointed to establish a standard of rates and regulations for selling light, and make recommendations.

Committee: Mr. Brooks, Mr. Vail, Mr. Rockwell, Mr. Doubleday, Mr. Shaw, Mr. Wood.

A special committee should be appointed to devise for the Association a table of rates, based on 1,000 cubic feet gas.

It was said there is no doubt that the meter system is the best system, if the company is large enough to purchase it and back it up. A meter department for the smallest size station will cost not less than $1,000, and its operation will cost $30 per month, that means $360 a year.

The meter performs just this office: it makes a record whereby each customer is charged for the exact current he uses. It places the company in the position of selling nothing but current to the consumer.
The DC Lamp-Hour Meter – 1872

• Samuel Gardiner patented a DC Lamp-Hour Meter in 1872 that utilized an actuator which recorded hours when current was present.
Metering Influences

George Westinghouse

Thomas-Houston

J. Pierpont Morgan

Opportunity is missed by most people because it is dressed in overalls and looks like work.
- Thomas Edison

I don't care that they stole my idea. I care that they don't have any of their own.
- Nikola Tesla

Henry Ford
The “Standard” Edison Electrolytic Meter - 1890

ON THE NEW STANDARD EDISON ELECTROLYTIC METER.

Since the last meeting of the Association, the new and improved pattern of the Edison meter has been decided upon, received Mr. Edison’s approval, and has been completed by the Edison General Electric Co. It has already been introduced into two stations, Brooklyn and Winnipeg, and the reports upon its behavior in each case are excellent.

There are four standard sizes of these three-wire meters, Nos. 1, 2, 4 and 8, designed to supply 40, 80, 160 and 320 lamps, respectively. Meters of larger capacity than these are made specially. In all sizes, however, the bottles and plates are alike and of the pattern shown, the spools are alike, making the resistance of the bottle circuit the same in every meter, and the drop of potential in the shunt at full load is the same, namely, four-tenths of a volt.

Edison’s chemical meter, 1881
The Birth of the National Electric Code - 1890

A NATIONAL CODE OF INSURANCE RULES AFFECTING ELECTRIC LIGHT AND POWER INSTALLATIONS.

It has often been noted as one of the evidences of the incomplete development of the present systems of electric light and power construction that the rules enforced by the underwriters in different sections of the country are so widely different as to make it impossible for a construction firm in Boston to be at all certain of being able, without further education, to do work in Philadelphia acceptable to the insurance inspector, or for a supply man in Chicago to be sure he is furnishing material which the underwriters of Cincinnati will approve.

Credit: Minutes of Association of Edison Illuminating Companies 6th Annual Meeting - 1890
AEIC Committee Formation – Emerging Issues

• 1890 – Committee To Connect Neutral Conductor to the Earth in 3 wire systems
• 1892 – Committee To Protect Electrical Circuits From Lightning
• 1896 – Committee On Storage Batteries
• 1896 – Committee on Use of Incandescent Lamps
• 1898 – Committee on Electric Meters
• 1898 – Committee On Electric Automobiles
• 1898 – Committee on Municipal Relations
Early AEIC Meter Committee Activity

- The Wright (Demand) vs. Barstow (TOU) Debate
- Emerging Technologies
- Research and Development
- The Great Dial Debate
- Pre-Paid Metering
- Battery Storage Implications
The Rise of the NELA Meter Committee

• NELA Meter Committee Established in 1908, With Alex Dow, Edison Illuminating Company of Detroit, Presiding

• Samuel Insull had great influence on both the formation of the Committee and the topics covered

• The first committee had many AEIC Members besides Dow, Including John Lieb (NY), Louis Ferguson (IL), and Charles Edgar (MA)
Publishing The First Works

- Beginning in 1897, NELA put a focus on publishing the first edition of the National Electric Code.
- Beginning in 1902, AEIC began work on collecting requirements from member companies for meter standardization.
- By 1908, the AEIC Committee began work on the Code for Electricity Meters.
The Coming Together of Metering Standards

• The AEIC and NELA Metering Committee first met in 1910 at the Hotel Frontenac in Thousand Islands, NY

• They met for the historic publishing of the AEIC Code For Electricity Meters – The predecessor to ANSI C12

• It was deemed in 1910 that all future work on the Code for Electricity Meters shall be collaborative between NELA and AEIC
The “Handbook”

- Based on the work of the AEIC Code, NELA Members began work on the first “Electric Meterman’s Handbook”
- Presented at the Historic Hotel Washington in Seattle, WA
- The NELA/AEIC Joint Presentation also Featured Vendors: Thomson (General Electric), Westinghouse, Fort Wayne, Sangamo, Duncan Columbia, The Eastern Specialty Company, Cutler-Hammer, Biddle, Leeds & Northrup and The States Company
The Rise of an Industry – 1890’s – 1920’s

Siemens & Halske  Diamond Meter Co.  Stanley Instrument Co.  Federal Electric  Holcomb & Hoke

The Depression Hits – 1930’s

• NELA and Meter Committee Was Disbanded in 1932 after Congressional Investigations

• Edison Electric Institute & Meter Committee was created in 1933 to continue the policy work of NELA

• FDR & The Birth of the $5 Meter – The Stewart/Warner 746

• The Big 4 Emerge – Duncan, Sangamo, GE, Westinghouse
The 1940’s – Wartime & Beyond

• Big 4 Meter Companies produce few meters during wartime efforts

• Nearly all aluminum and copper taken out of meters, name plates replaced with paper

• Big 4 Convert sections of manufacturing for wartime instrumentation & equipment
1950’s & 60’s – Standardization

- Brief Entry by Roller – Smith Company into the metering business, quickly folded
- All Meter Companies benefited from the large economic expansion post war
- Standardization on S-Base, Commoditization, and Compatibility became key themes
1970’s & 1980’s – Modernization Begins

- Rise of the Electronic Meters – ABB E-1 Hybrid & The Legendary Scientific Columbus JEM-1
- Introduction of Solid State Electronics creates big opportunities for measurement
- Both Duncan and Sangamo Sell In 1975
1990’s & 2000’s - Data!

- Rise of the Electronic Meters
- AMR Systems Begin To Proliferate Major Cities
- Standardization gets pushes aside for innovation
- Meter capability and data begin to grow
- New Meter Manufacturer – Invensys
- Westinghouse purchased by ABB, then Elster
2010 & Present – Rapid Change!

- Software Systems & Functionality dominate discussion and landscape
- Meter Data Management
- Analytics begin in earnest on earlier collected data sets
- Rise of Advanced Metering Infrastructure and Meter Data Management
Some Perspective For The Future...

• First meters commercially sold in 1889 by the Thomson corporation, sold for an average price of $150.00 in 1889, inflation adjusted to $3,143.32

• The electrical-mechanical watt-hour socket based meter design varied little for more than 70 years (1930’s – 2010’s) and pricing held fairly for close to 100 years at under $30 in large volumes for utilities, but this has changed significantly with R&D Requirements for innovative communication solutions.

• No vendors of Electro-Mechanical Meters Remain. Watt-hour meter functionality has advanced more in the last 15 years than in the previous 110 years combined. With AMI Technology, the watt-hour meter of the future portends to be a very complex customer gateway in the future.
Some Previous Predictions of the Future...

Dan’s 2008 Prediction:

“The watthour meter will have more advancements in the next 10 years than in the previous 120 combined...However, a standardized meter, with consistent hardware and software interfaces will not be available for more than 15 years from today.”
What Does The Future Hold?

• Standard Data Models (CIM, Multi-Speak, etc.) will continue to emerge as critical enterprise improvement tools for analytics.

• Metering will continue to evolve as a key aspect of energy transactions with less focus on standardization.

• Analytical solutions, transactional solutions, and Operational improvements will be keys to change.