Metering – the Shape of Things to Come?

AEIC Measurement Technologies Working Group

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Our World Is Round

ANSI Meters are round. We all know this.

ANSI C12.1 shows “typical” wiring diagrams and drawings of standard round meters, specifications for sockets show round drawings. In our specifications we stop short only of saying that meters MUST round. But our infrastructure is overwhelmingly set up for round, socket based meters and anything else is “unthinkable”.

ANSI meters have been round since before they were ANSI (ANSI was founded May 14, 1918).

This is the AEIC Working Group. AEIC was formed in 1885 and most of the initial meter designs in use were already round or moving that way. Within 20 years of that time and by the time ANSI was founded virtually all electric meters in use were round and have remained so to this day, more than another hundred years into the future.

But at lunch this was pointed out to me….

Electrons are round, Q.E.D., Quod erat demonstrandum; thus it is proved

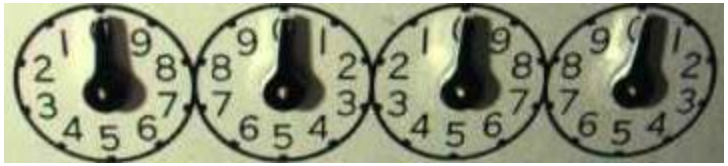
– All Electric Meters should be round.

Questions?

Why Are Meters Round?

The First meters were effectively clocks. Analog clocks have typically always been round. The first unit of commercial energy measurement in the U.S. was Lamp-hours.

- The meter simply measured the amount of time that there was energy on the circuit.
- The only electrical devices on the circuit were light bulbs all of the same type and each using virtually the same amount of energy.
- Bills were presented by time and the number of light bulbs (lamps) on the circuit.
- There were no switches so you could not turn any individual lamp, you could only switch off the entire circuit – which turned the meter on and off. This is also why meters had dials on them.



Infrastructure

We moved from analog dials to digital displays. But this did not fundamentally change our infrastructure.

Which raises an interesting question;

- Is there a compelling reason for them not to be round?

Infrastructure

Is there a compelling reason?

We have an infrastructure that accepts round, socket based meters. The cost associated with rewiring every residence and commercial location is quite high and would have to provide a return to the utility.

Changing Infrastructure

Our industry is very slow to change infrastructure. Socket based metering became the nearly universally accepted metering style between the late 1940's and the early 1960's but even now seventy years later we still have a significant number of A-base installations throughout North America. Most have adapters in them now but only in the past twenty years have we stopped manufacturing A Base meters.

The Test Switch Example

We have been using Test Switches since the early 1910's. The Test Switch solved the problem early on of being able to separate the metering circuit from the power being delivered to the facility. Large commercial installations could have their meter changed, serviced, tested without interrupting the service to the facility by simply opening the switches to the metering circuit.

The switches used at the time were knife blade switches as these were the switches in common use at the time for industrial applications.

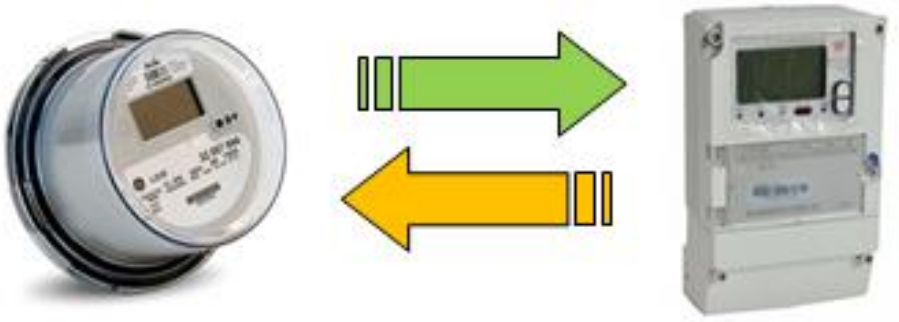
Some Things Do Not Change

We still use test switches with knife blade switches. Why? They work and the infrastructure is established. Field technicians understand how to operate them safely, field test equipment is designed to interface to them. Changing would present a significant financial cost to the utility, present a training and potential safety challenge, a financial burden to replace every installation and change or replace all of the field test equipment. The system is not broken so there is no need to “fix it.”

Is There Any Movement Away From Round Meters?

Clearly the IEC countries evolved with non-round meters, but there is no evidence that ANSI will ever convert to IEC meters nor IEC to ANSI meters. There is an interesting exception to this though that has occurred as a result of AMI.

Several Caribbean countries that were traditionally IEC found they were having trouble receiving IEC AMI meters. ANSI style meter manufacturer's had meters and infrastructure readily available and were ready and able to support their new Caribbean customers along with their existing Caribbean customers. Several islands now have a mixed population of IEC style and ANSI style meters).



So Why Would We Ever Move Away From Round Meters?

Perhaps we will not. That is always a possibility.

But the Numbers May Move Us That Way…..

There are approximately 145 million connected customers for ANSI meters in the U.S., another 16 million in Canada, and 33 million in Mexico.

However new markets are emerging. And these new markets will have meters that are not necessarily best suited to be ANSI style meters.

Street Lights and Street Poles

There are an estimated 26 to 44 million street lights in the U.S. and over 300 million in the world.

Most of these are going to want to have cellular service on the pole. If we assume only 10 to 20% of these street lights are eventually outfitted with cellular service this represents roughly another 5 million end points in the U.S. alone and 30 to 50 million in the world.

For the U.S. this means that street light meters could represent a market of roughly one third the size of standard meters – with virtually no installed base at this time. This is clearly a growth market – and this is a market that an ANSI meter is poorly suited for.

Street Lights and Street Poles

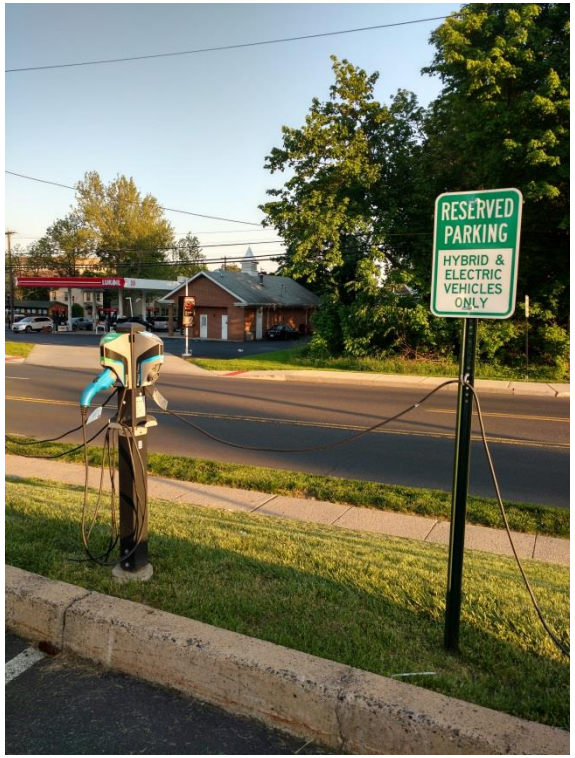
Street light meters have evolved over the past several years and several are now revenue grade meters – but do not have anything like an ANSI form factor.

A similar form factor is being used for cellular applications on top of the pole. And cellular is not the only technology vying for a spot on top of the pole. Municipalities, utilities and other private sector enterprises want to put anything from pollution monitoring devices to security cameras and more. New ideas are being suggested even as we are discussing this topic. Some, or all of these applications will require metering.

This makes the potential market size for these meters more than half of the size of the existing ANSI meter market size in the US and Canada – and growing.

Electric Vehicle Charging

Electric Vehicle Chargers - these applications are putting in embedded meters. There are presently between 50,000 and 60,000 vehicle chargers in the U.S. as of summer of 2018 with this number beginning to rise exponentially. By some estimates (using TESLA's network as a baseline) there are nine to 10 chargers per location. This does not include home chargers which typically would not need to be metered. Not a huge market, but the energy coming through these points has the potential to single handedly grow our entire market for electricity in the U.S., Canada, and beyond.



Sub metering – this is now approved and was approved with an eye toward the electric vehicle charging market. The sub-metering market sometimes uses ANSI style meters but often uses lower cost, lower accuracy, non-ANSI meters.

Electric Vehicle Charging

Depending on the state the Utility may be able to sell and meter this power or the utility will put a conventional meter at the feeder for a charging station and an independent third party will sell the power at the chargers.

Whoever is selling the power at each charger – utility or third party – the meter used there will not be a meter with an ANSI form factor.

Change?

These applications represent a significant amount of new demand for electric utilities. Electric Utilities are beginning to investigate and test these meters.

- The market size is becoming of serious commercial interest for electric utilities, equipment manufacturers and most importantly for the end users.
  - Municipalities want the street lights, consumers want the electric vehicles, and cellular companies want better blanket coverage without the expense of the huge towers.

These are powerful forces moving us to look at and even adopt non-ANSI form factor meters.

- We see in the Caribbean example that market forces will move a utility from one style of meter to another (IEC to ANSI), so there is no reason to believe that similarly powerful market forces will not move us away from ANSI style meters. There is no such compelling reason for test switches. There may be for electric meters,

Security and Theft

For some parts of the ANSI world security and theft are a driving factor. For these markets, securing the meter is important and keeping the utility personnel safe even more important.

Parts of the ANSI world meter techs enter certain neighborhoods under armed guard while others are basically not entered at all other than for outage restoration. For portions of the ANSI world Line Losses due to theft routinely exceed 30 and 40% with most theft occurring at the meter or just prior to the metering point.

Mexico – North American Example

Mexico is beginning to move to non-ANSI meter forms to counter security issues, revenue diversion issues and cost efficiency issues. Instead of putting an ANSI meter on the house they are starting to put non-ANSI style meters in cabinets on poles.

The cabinets are typically being mounted on the pole top with people security guards (as opposed to squirrel guards). Each cabinet can have 20 to 40 meters inside for the same number of premises. Opening the door of the cabinet by an unauthorized user will shut off the power to all users. Energy diversion occurring after this location would be theft by one consumer from another and not from the utility. Energy diversion before the meter would be more difficult and more dangerous. And changing the form factor of the meter makes the density of installations much more efficient.

Beyond Energy Diversion

While Energy diversion may be one of three compelling factors in the Mexican Market, the other two are similarly compelling for both Mexico as well as the rest of North America – especially in the U.S. and Canada.

- Safety (Customer and Utility)
  - This is both a safety issue and a security/privacy issue
- Efficiency

The Customer Premises

Having the meter on the customer premises presents a number of issues:

- Access by utility personnel requires crossing onto personal property of the customer. This is not ideal for the utility nor for the customer.
- Dogs, landscaping, fences, security perimeters, distance from road.
- For indoor meters this means an interaction with the customer (taking time from their day and allowing an unknown person into their house) and often means multiple trips to access a meter.

Ownership and Access

Ownership of service continues to be an issue.

- Most customers still do not understand that the meter socket belongs to them (not in all service territories but in the overwhelming majority).
- This typically causes friction with the customer if their service is deemed unsafe and in need of service or replacement.
  - The amount spent by the utility to follow-up and ensure that the customer has complied with this request is often more than the cost of the work, the customer never appreciates having to do this work, and until the work is done a potentially hazardous condition exists in the field.

Moving the Meter Off the Customer Premises?

Imagine if we can do that? Not much different from metering an apartment complex. The meter is remote from the apartment. But what if we could move to a centralized cabinet mounted near the street or even on a pole. While we do not need to put at the pole top for the same energy diversion reasons, we could if that was the most convenient location. We could also just locate close to the pad mount transformers.

- Access by the utility personnel is dramatically improved.
- The ability to work on a service or install new meters is greatly improved.

Moving the meter off the customer premises?

Multiple issues are addressed if we pursue this paradigm shift. Just considering the customer interaction:

- Easier access for utility personnel. Utility efficiency improves as the visit is not to the customer premises but to a location at or near a Utility pole or transformer.
- Perceived “Trespassing” is no longer an issue for the customer, and the invasion of the customer’s privacy is no longer an issue. No interaction with customers required for servicing or accessing their meter.
- Ownership of service is no longer an issue. This removes a potential point of contention between utility and consumer
  - No more Hot Sockets at customer locations
  - No more accidental damage by contractors drilling or cutting service wires when working on the other side of a wall or partition from the metering location.
  - Utilities and meter manufacturers would no longer be called into home fire investigations as a result of the meter being located on or in the home.
- Less opportunity for tampering and theft of service

Overall there are far fewer interactions with the customer that typically would be neutral or negative. Overall perception of the utility would improve.

Potential Utility Cost efficiencies

- New opportunities to use a centralized AMI system that would have less hardware per end point and therefore be lower cost per endpoint
- Changing the form factor of the meter allows for more efficient layout of this “metering box”. Without a display the meter can be far smaller, be part of an AMI network, still have a disconnect and still be as accurate as ever. The meter could have standard blades with similar or different spacing.
  - For commissions that want a display an in home display or a web portal can be provided which can provide far more information than typically available from the front of a conventional ANSI meter.
  - The dials on electro mechanical meters were deliberately installed backwards in the early part of the 20th century so that the consumer could not readily determine how much electricity they had consumed but a trained utility meter reader could still quickly take and manually record the reading. A web portal or in house display would clearly be a significant improvement for any commission that wanted more information more readily available to the customer.
- A more efficient form factor would be rectangular and not round.
  - Shipping and handling
  - Handling and testing in the meter shops
  - Density at installed locations
- Changing of meters and upgrading or changing AMI systems becomes far easier

Summary

We do not need to do what we have always done because we have always done this.

The rapidly growing markets for non-ANSI style meters in street light, electric vehicle and other sub metering markets is already driving us to consider how to design, build and certify non-ANSI meter forms. Now is also a good time to re-examine what we consider a meter should look like and where this meter should be located. This is a point of friction that every utility has “lived with.” Both customer and utility have learned to “live with” this issue.

But why do we need to persist in this practice?

There is no good reason

There has to be a business case. There always has to be a business case. If the cost to implement would be regained in avoided cost of future AMI installations, reduced capital cost per metering installation and reduced cost to service plus the “intangibles” or soft cost of fewer negative customer interactions and a better customer perception of the utility and this business case starts to become very compelling. Add in the avoided cost of accidents to utility personnel and consumers, safety related issues from utility personnel being attacked and harmed, and reduced energy diversion the case may be readily made for many utilities.

This change does not need to occur over night but can be gradually implemented in new construction and in the oldest sites with inside metering to begin.

But we have to start by even considering the possibilities.

Questions and Discussion

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This presentation can also be found under Meter Conferences and Schools on the TESCO web site:
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