TESCO METERING

Metering Operations and Upcoming Impacts to Utilities: DERs to EVs to Grid Modernization

Dan Falcone
TESCO Metering

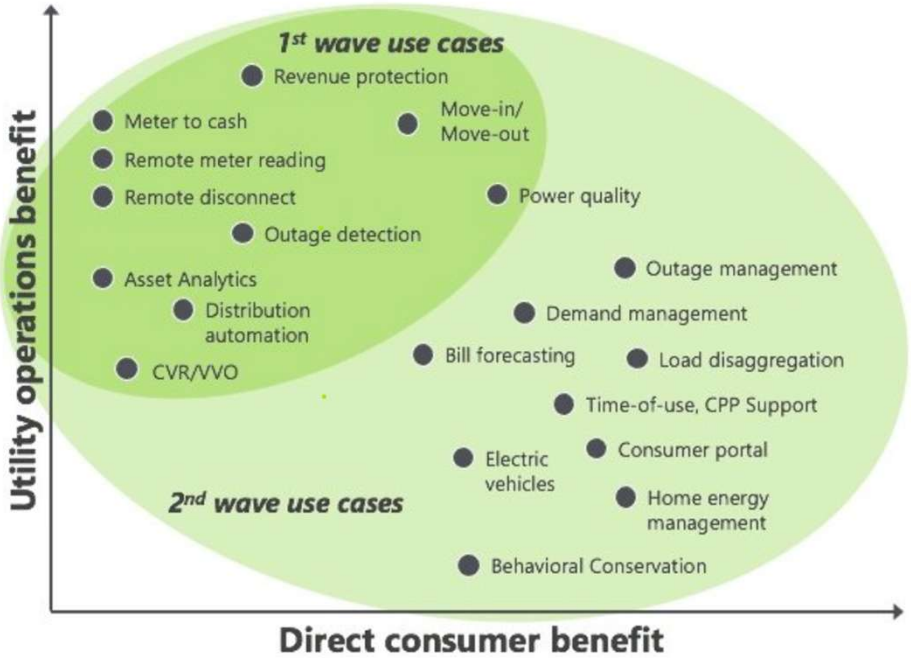
North Carolina Meter School
Wednesday, June 10, 2026
3:30 PM

Topics to Cover as We Look to the Future

- How Metering Has Changed from the 1870's to the 2010's
- Metering Today and the status of our Advanced Metering Infrastructure, Smart Meters and a Smartgrid
- Meter Services role in the utility of the future
  - Big Data and Rolling Trucks
- Meters – the shape of the future?

Presentation Goals

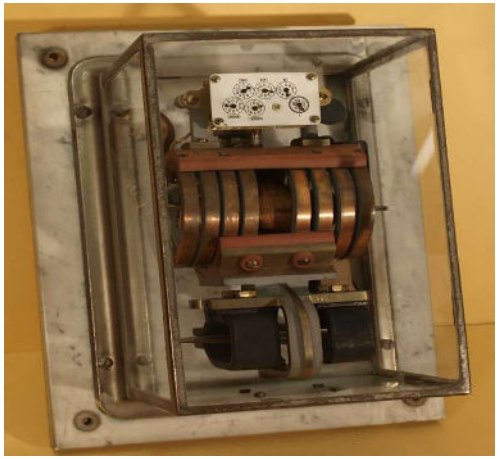
1. Provide a high-level overview of technology innovations and related market influences for meter operations departments in electric utilities
2. Offer an industry review of AMI technologies past and present with insight into next generation technology and impacts
3. Look ahead at ongoing and expanding DER penetration, preparation for VPPs, and Electrification Initiatives

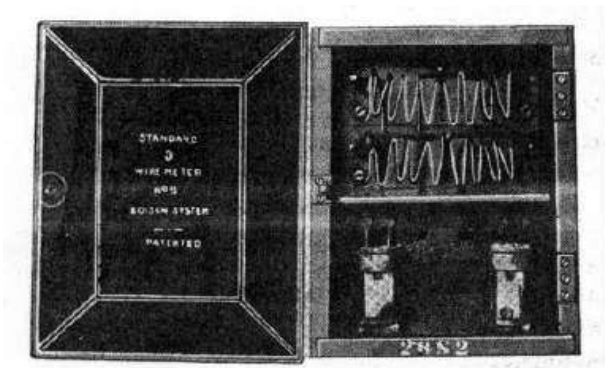


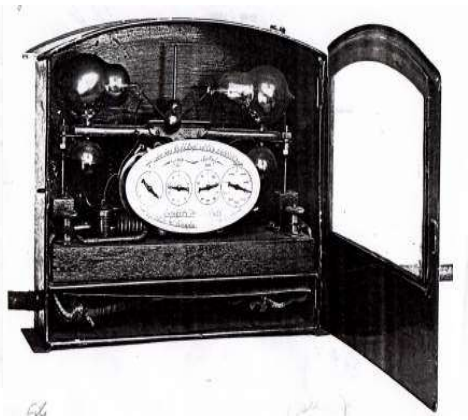
*https://www.greentechmedia.com/squared/dispatches-from-the-grid-edge/how-to-ensure-the-next-generation-of-smart-meters-are-smart-enough-for-the-grid-edge

1870's to 1900

- Electric Metering is Invented
- After a few interesting "false starts" several inventors and firms developed and began producing induction meters that are still recognizable to us today
- Four of the five present meter manufacturers were producing meters:
  - Sangamo (Itron)
  - GE (Aclara)
  - Westinghouse (Honeywell)
  - Duncan (L+G)





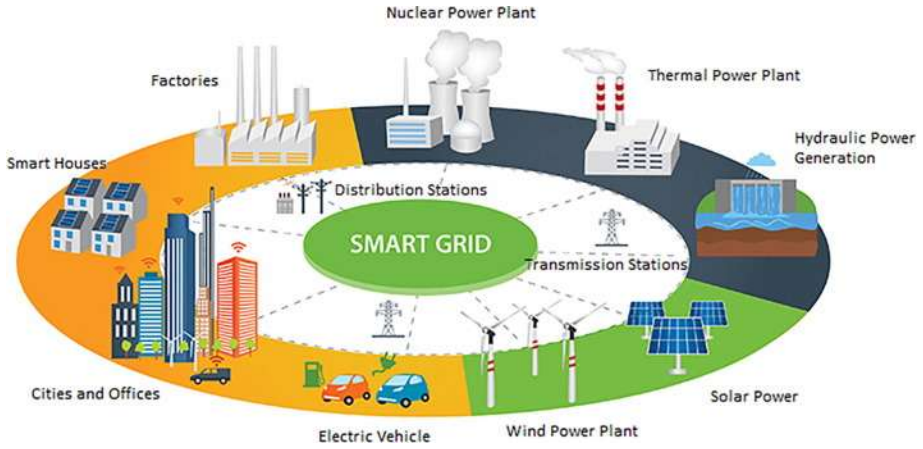


1900 to 2000

- Not much changed – we use an induction meter for most of the century and only toward the very end of the century start using electronic meters.
  - Meters are standardized in the first half of the century
  - NC Meter School begins 1923 – they had a bell
  - Socket base meters take over for A-base meters
  - Electronic meters are introduced
  - Communications begins to be integrated into higher end metering
  - Same big four meter manufacturers

2000 to Present

- The last electromechanical meters are produced. All new meters produced in North America are electronic
- The concept of a Smart Grid is introduced as like our metering infrastructure the grid had not changed much in design since the inception of the grid more than a century ago
- The “brains” of a Smart Grid is an Advanced Metering Infrastructure (AMI)
- The heart of this Infrastructure is a “Smart” meter as the meter becomes a two way communication device with more features built in than just metrology



2000 to Present

- A host of new communication vendors enter the market and work with meter manufacturers to put their technology under the cover of the meter
- Meter Manufacturer's also develop their own communication technology to put under the cover
- Additional features such as Disconnect switches and power quality monitoring become standard accessories to be included under the cover of a new meter
- Meters are no longer looked at as simply energy measurement devices

Evolution of Meter Operations Workload

- History focused on billing accuracy, measurement, and consumption
- Evolution from mechanical meters to solid state to AMR to AMI
- Expansions of AMI use cases and reduced truck rolls
- Advent of advanced analytics, customer access to data, and interval billing
- Evolution to automated systems that are now a hub for everything from DER integrations to electrification planning
- Expertise with data management and large data sets
- Expertise with regulatory driven initiatives
- Evaluations of competing new technologies
- Physical Post Installation Inspections to Over the Air inspections via power quality reads
- Meter exchanges for rate changes to Over the Air Reprogramming
- Meters now see an Expected Useful Life (EUL) of 10-15 years instead of 20 years
- Less than 3% of the 125M+ Smart Meters installed across the US fulfill the initial 2009 promise of customer savings*

*https://www.utilitydive.com/news/97-of-smart-meters-fail-to-provide-promised-customer-benefits-can-3b-in/632662/

Evolution of AMI Technologies

- Power Line Communication – leverages existing infrastructure
  - Cost effective, less bandwidth, interference
- Radio Frequency – unlicensed and licensed spectrums, mesh or point-to-point
  - Licensed vs Unlicensed
  - Base stations vs Collectors and Repeaters
  - Fixed pathway vs self-forming and self-healing
- Cellular Endpoints
  - Faster deployments, network reliability, cost, obsolescence concerns
- Hybrid Communications
  - Multiple communication methods on a single radio – Wi-Fi, Zigbee, PLC, Mesh, Cellular
- "Future – Proof" Meters with software updates and "apps"
  - Reduced restrictions from memory capacity and firmware prohibited upgrades

Evolution of AMI Analytics & Use Cases

AMI with Alarms, Flags, Events, & Intervals

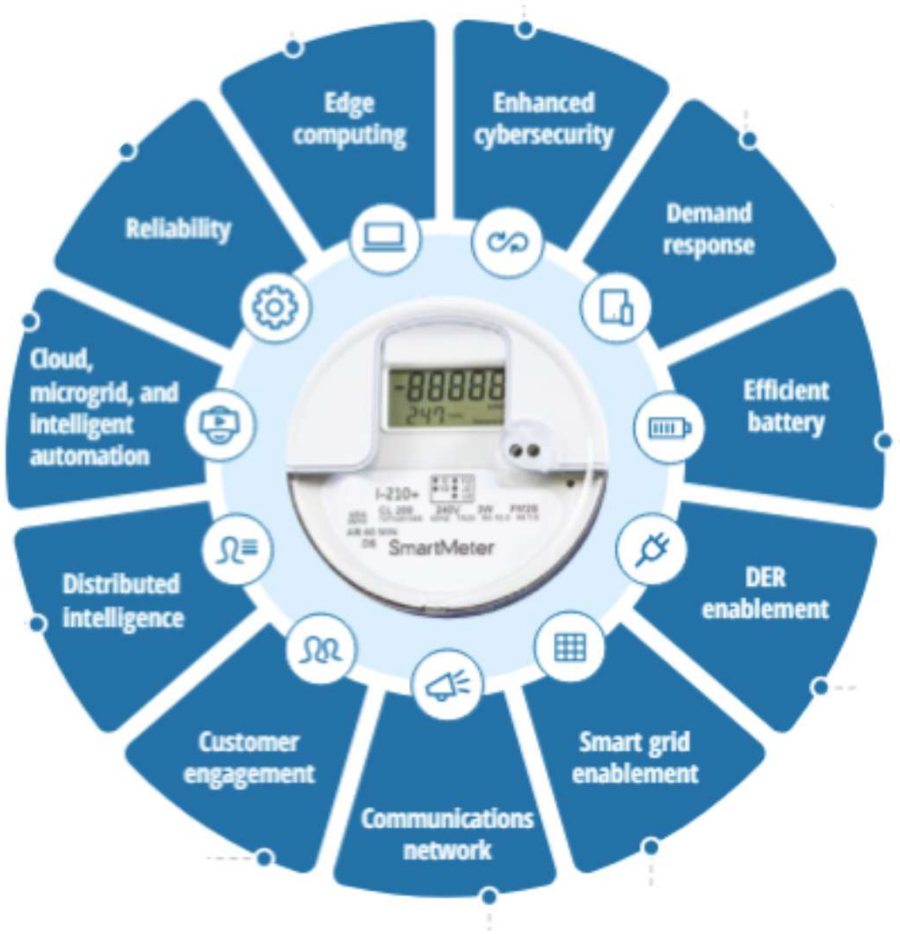
- Outage Reporting
- Theft and Tamper Events
- Interval Data Analysis
- Voltage Monitoring
- Temperature Monitoring
- Load Disaggregation
- RCDC for Credit, Move – In / Move – Out, PrePay
- Analytics Platforms

AMI 2.0 with Distributed Intelligence & Edge Computing

- Location Awareness
- Bypass Detection & Magnetic Tamper
- 8+ Channels of Interval Data
- Impedance Detection
- Temperature Trending
- EV and Solar Detection
- Smart Prepay
- App Platforms

AMI 2.0

- AMI 1.0 operational benefits have been captured
- A second round of capital replacement is under way
- Costs are harder to justify as labor resources and reduced truck rolls have been already offset
- Consumers want benefits that are automated and easy to acquire
- Meters can now be paired to Apps via Wi-Fi



*https://www2.deloitte.com/us/en/pages/energy-and-resources/articles/next-gen-advanced-metering-infrastructure.html?nc=42

*"Any electric utility that deployed AMI prior to 2010 or which has not yet deployed AMI should be in the planning phases to replace their aging AMI assets today"

AMI 2.0

Can we use our existing infrastructure?

Do we have to rip out and replace with a new infrastructure?

What about LTL back haul or a Private Network?

What about Power Line Carrier? Is there life there for my most remote service areas?

AMI 2.0 Infrastructure

- Second Generation AMI and potentially new communication paradigms as LTL data becomes less and less expensive and reaches larger and larger areas – without new infrastructure

- Research in Power Line Carrier Technology may provide expanded bandwidth to allow for greater data transfer more frequently without as much new infrastructure

- Mesh networks continue to improve and AMI 2.0 is anticipating leveraging the infrastructure installed in AMI 1.0

Strategic Partnerships

Many hardware-based providers are finding value leveraging relationships by shifting to software and loading into existing hardware with market fit (smart meters)

- Landis+Gyr and Sense (from CTs and modules to meters)
  - In-home high resolution energy monitoring and machine learning via app
- Landis+Gyr and SPAN (from smart panels to utility connection via meters)
  - Sub-metering at circuit level, prep for VPPs, and DER control
- Aclara and Utilidata (from adapters to meters)
  - Distributed AI with NVIDIA module and KARMAN platform
- Itron and Schneider and MS Azure
  - ADMS, IOT Solutions, VPP prep

Distributed Energy Resources (DERs)

Small-scale units of local generation connected to the grid at the distribution level. These resources can include renewable energy systems, energy storage, demand response technologies, and electric vehicles.

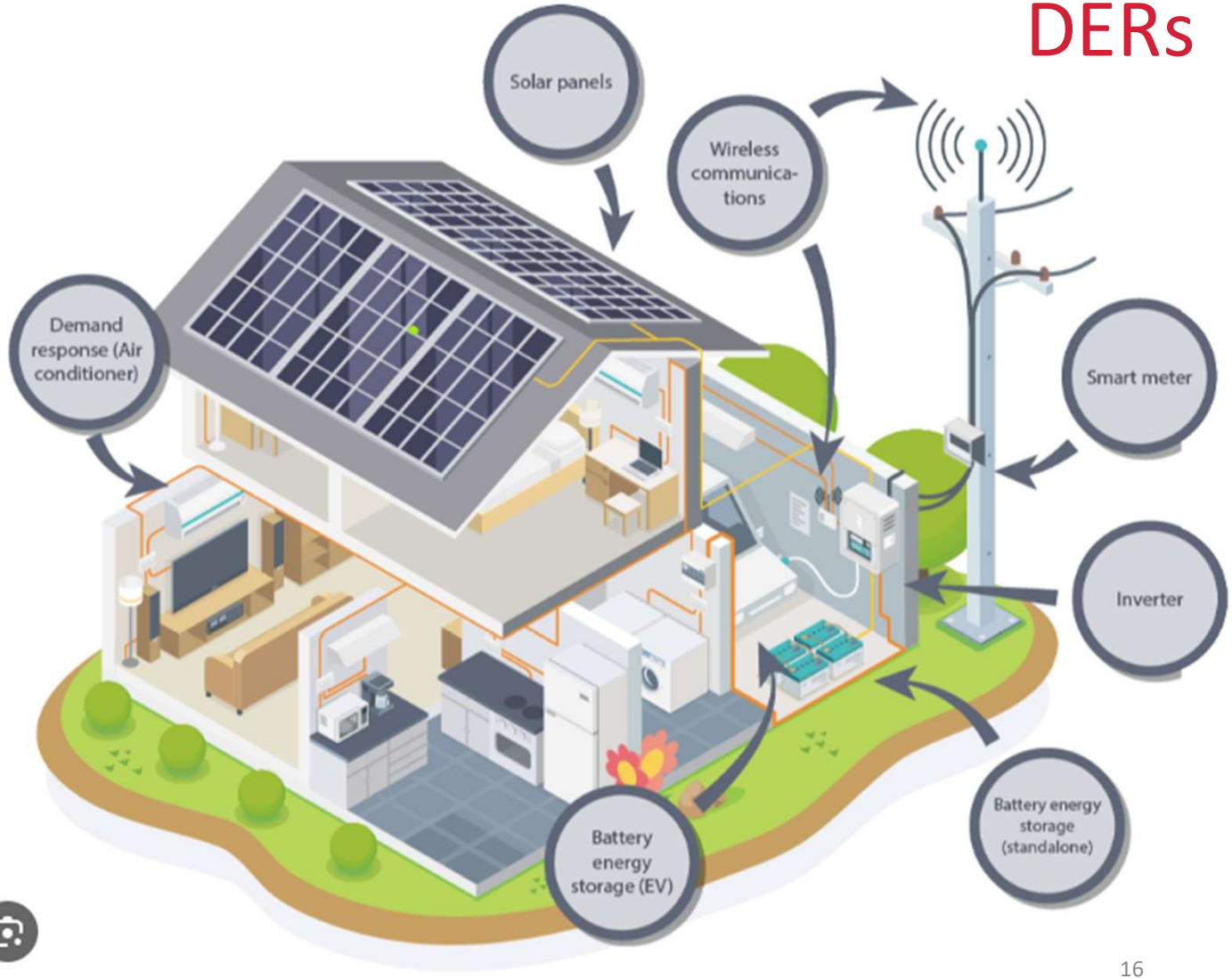
Benefits

- Grid Reliability and Resilience
- Environmental
- Economic Efficiency
- Energy Independence
- Customer Empowerment
- LMI & REC Programs

Challenges

- Grid Integration
- Regulatory and Policy
- Economic Barriers
- Technical Challenges
- Customer Satisfaction
- Dated Infrastructure & Installation Cost

DERs



*https://www.cummins.com/news/2021/11/04/what-are-distributed-energy-resources-and-how-do-they-work

Virtual Power Plants (VPPs)

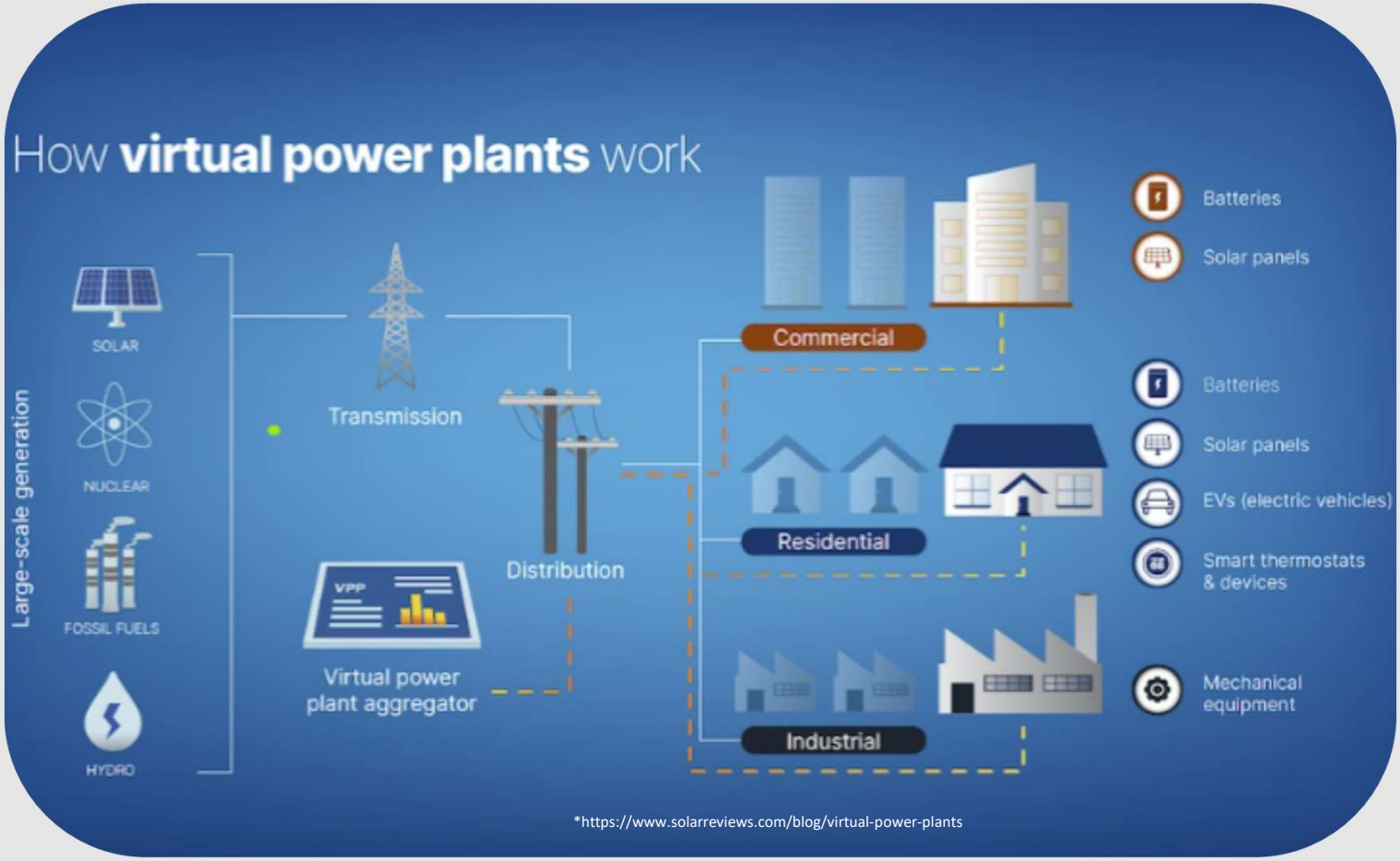
A system that integrates various Distributed Energy Resources (DERs) such as solar panels, wind turbines, energy storage systems, electric vehicles, and demand response units, using advanced software to manage and optimize their collective output as if they were a single power plant.

Functions and Capabilities

- Combine multiple DERs into a single manageable entity
- Real time monitoring and control
- Demand response via load shifting and peak shaving
- Energy trading – participate in energy markets to sell excess or provide services like frequency regulations

Regulatory involvement, AI and software integration, and cyber security pose risks but also offer opportunities

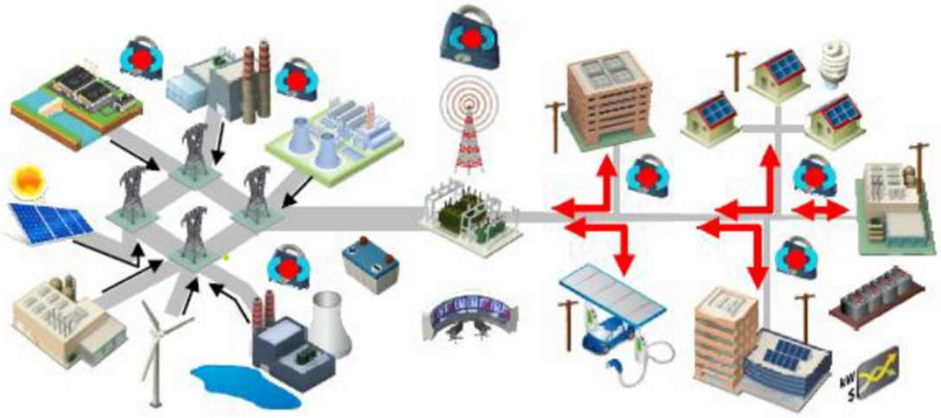
VPPs



*https://www.solarreviews.com/blog/virtual-power-plants

Grid Modernization

- AMI
  - DI, Edge Computing, Monitoring, 2-Way Comms
- Grid Automation and Control
  - SCADA, ADMS
- Integration of DERs



  - Encryption, Firewalls, Intrusion Detection

This is the process of updating and enhancing the traditional electric grid to improve its reliability, efficiency, resilience, and ability to integrate with new technologies. It involves implementation of advanced technologies and practices to meet the changing needs and challenges of the energy landscape.

TESCO METERING

This is replacing fossil fuel-based technologies with those that are powered by electricity. This shift aligns to sustainability goals, reduces greenhouse gas emissions, and enhances energy efficiency.

- Electric Vehicles
- Appliances
- Electric Hot Water
- Air Source Heat Pumps

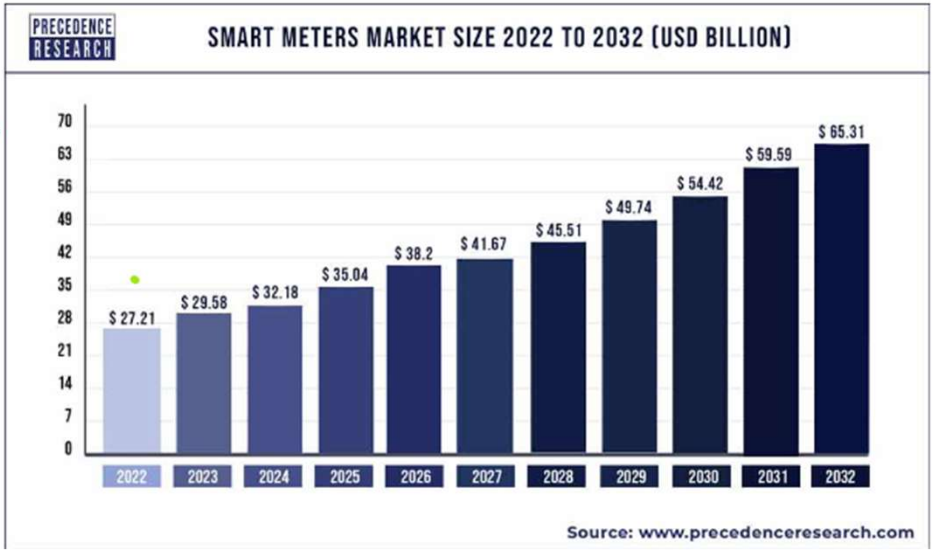
Regulatory Frameworks, subsidies, rebates, and pricing initiatives all drive increases.

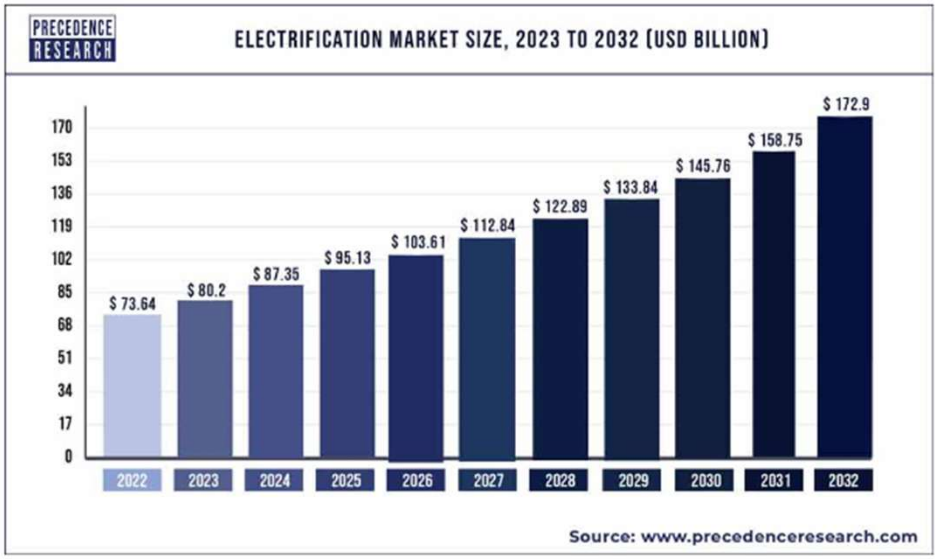
Many of these changes require added home wiring, service panel upgrades, and challenges with location of assets and availability of circuits.

3X Market Size of Smart Grid

>$100B in next 2 years

tescometering.com





Solutions for Electrification & DER Integration

Many competing systems and technology solutions exist to solve the crux of the electrification problem – growing demand, aging infrastructure, cost avoidance and load / source limitations for both the utility and consumer.

Consumers can adopt some solutions independently via a DER application while others require varying levels of utility interaction and/or approval.

- Meter Socket Adapters (MSAs)
- New DER ready ANSI form 42S / 43S meter / sockets
- Smart Panels
- Load And Energy Management Systems
- Power Control Systems (PCS)

What Does it all Mean for Meter Operations?

- Education and Training
- Resource Allocation
- Funding for AMI 2.0
  - How to EOL current hardware & software
  - Trending equipment failure rates
  - Replacement schedule
  - New vs existing networks
- Standardization and Interoperability
- Customer Driven Programs

Ultimately, this will result in the evolution of the Meter Operations practice!

The Shape of Metering to Come 2026 and Beyond

Meters that do not look like meters as we know them, will become a part of our world.

- Streetlights
- Smart Poles
- Electric vehicle chargers
- Sub meters – which may now become our meters

Questions and Discussion

Dan Falcone

VP Engineering, Product and Support

dan.falcone@tescometering.com

TESCO Metering *Bristol, PA*

215.228.0500

This presentation can also be found under Meter Conferences and Schools on the TESCO website: tescometering.com

ISO 9001:2015 Certified Quality Company
ISO 17025:2017 Accredited Laboratory
ISO 27001: 2022 ISMS

TESCO Hospitality Suite

We would like you to join us in the TESCO Hospitality Suite for networking and more discussions about metering. The discussion will not be exclusively metering…….but we love metering and that is the most common topic.

TESCO Hospitality Suite 301 – Brighton Tower

Monday and Tuesday 8:00 PM – 10:00 PM

We Hope you Can Join Us!