

Leveraging Data, Analytics, and Grid-Enhancing Technologies to Address AT&C Losses

Analytics for Distribution Operations and Planning

Matt Rylander, mrylander@epri.com

Analytics Research Lead

<https://dop.epri.com/public/research-areas/analytics.html>

AIDA Webinar
24 August 2026

Distribution Operations & Planning Program

Enabling utility transition to tomorrow's distribution platform using a **balanced approach** to grid modernization.



PLANNING

Planning methods, tools & criteria to account for future needs & uncertainties



OPERATIONS

Operator technologies, tools & practices to modernize the DCC



PROTECTION

Guidance, tools & technologies for protecting grids with DA, DER



ANALYTICS

Modernize grid modeling & data utilization for efficient analysis



TECHNOLOGY TRANSFER

Analytics

Modernize grid modeling, use of available data streams, and wide-area assessments for effective and efficient engineering analytics.

Grid Modeling

Improve distribution grid models and the processes to develop them to meet the needs of operations and planning engineers.

Measurement Data

Enable utilities to fully leverage new and existing data to support distribution planning and operations decisions.

Studies

Develop tools and analytics to enable effective and efficient analysis of wide area grid impacts from electrification, decarbonization, extreme events, etc.

“EPRI’s grid model verification and validation guidance streamlines the model cleaning process, allowing engineers to focus on analysis rather than model preparation. This improves overall study efficiency and enhances the accuracy of the models, reducing risk in planning decisions.”

- Alex Young, National Grid



Studies | Technical Losses

Loss Studies

Limited Data and Tools

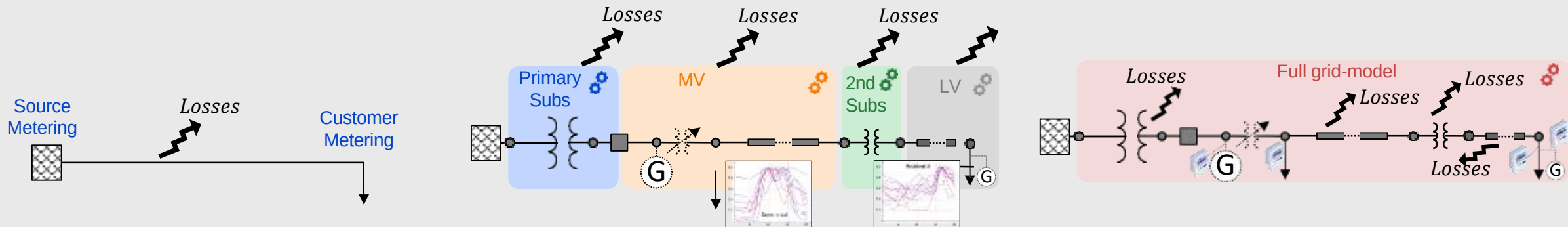
- **Modeling:** None
- **Computation:** Measurement-based, utilizing distribution injection and consumption
- **DER modeling:** Limited adjustment to metering
- **Circuit level measurement Data:** All

Adequate Data and Tools

- **Modeling:** Representative grid model/data
- **Computation:** Component-based, utilizing empirical formulas and factors (load factors, loss factors, utilization factors)
- **DER modeling:** Limited DER modeling
- **Circuit level measurement Data:** Some

Ideal Approach

- **Modeling:** Detailed static grid model down to low-voltage customers across entire service territory, including control devices and their settings
- **Computation:** Power flow-based (time series analysis); Losses extracted for each individual component; UFE allocation based on available SCADA data
- **DER modeling:** All FTM DERs modeled; BTM DERs accounted for in actual AMI data
- **Circuit Level Measurement Data:** Substation and MV Feeder SCADA, customer AMI



Wide range in loss study methodologies. (not accounting for billing efficiencies)

Hybrid Methods for Loss Studies

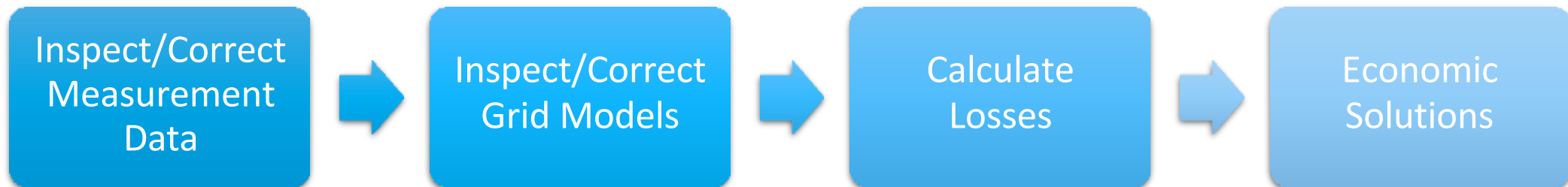
Question the Method Must Answer	Methodology Logic
Why are losses calculated in the first place?	Regulatory, Billing, Internal Monitoring, Grid enhancement, etc.
What parts of the system are considered “inside” the loss calculation?	HV/MV/LV, lines, transformers
Which parts of that system are directly observed versus inferred?	System inputs, outputs, midpoints, tie points
What information is available about physical assets?	Specifications, datasheets
How are those assets abstracted into a network model?	Coverage, sampling
How is load mathematically translated into losses?	Loss factors, load curves
Are non-technical losses separated from physical losses?	Reconciliation
Are results validated or reconciled against measurements?	Calibration, Iteration
How are distributed energy resources reflected?	Handling of DER

Utility	Empirical	Empirical + PF	PF Time-Series
A	✓		
B		✓	
C		✓	
D		✓	
E		✓	
F		✓	
G	✓		
H	✓		
I		✓	
J			✓
K		✓	
L		✓	

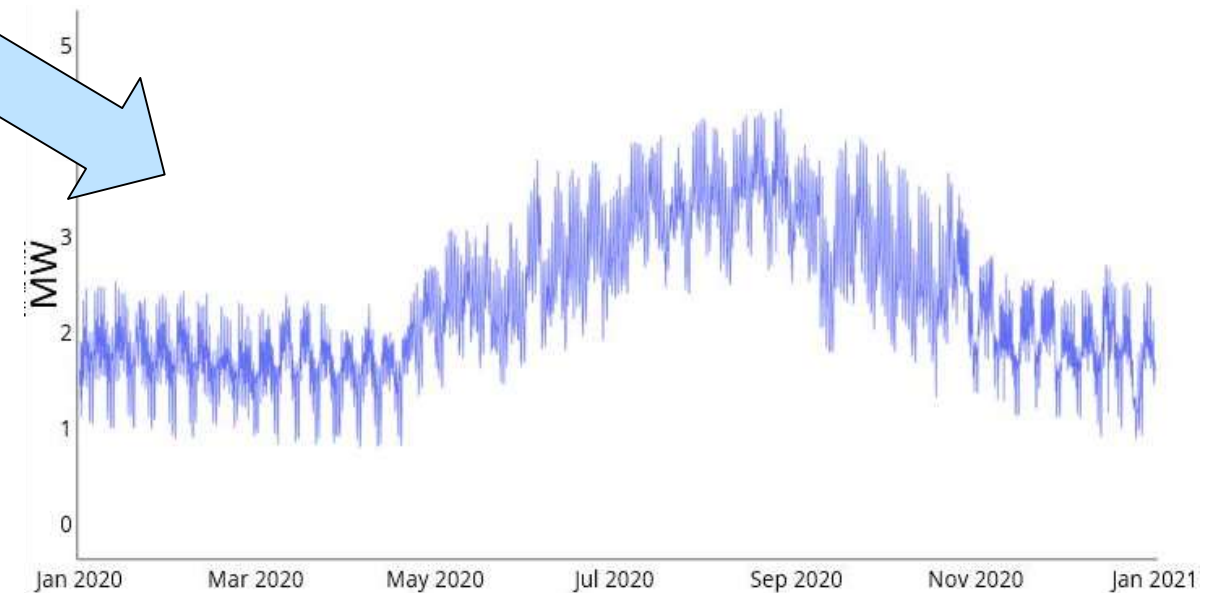
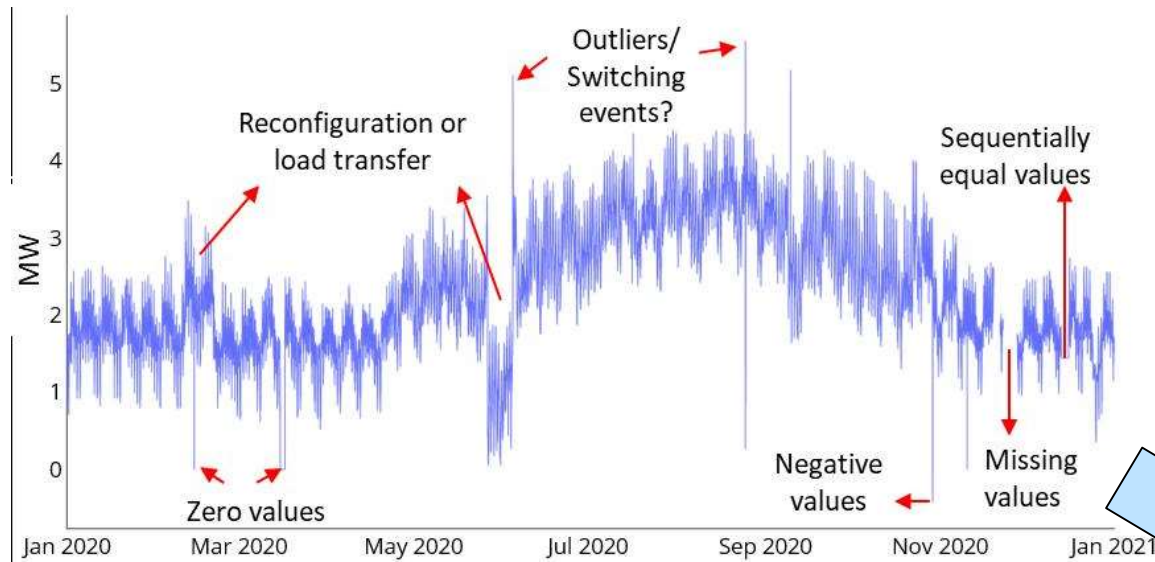
Great variety of methods and very little standardization.

Why EPRI is Researching Efficiency Studies

- **Overview:** Previous grid efficiency studies were limited by models and measurement data, but now both models and measurement data are more available. A hybrid-method distribution assessment can be focused on exploring losses and ways to reduce.
- **Goal:** The outcomes from this research include guidance, demonstration, and illustration of new analytics.



Measurement Data Inspection, Correction, and Quality Assessment



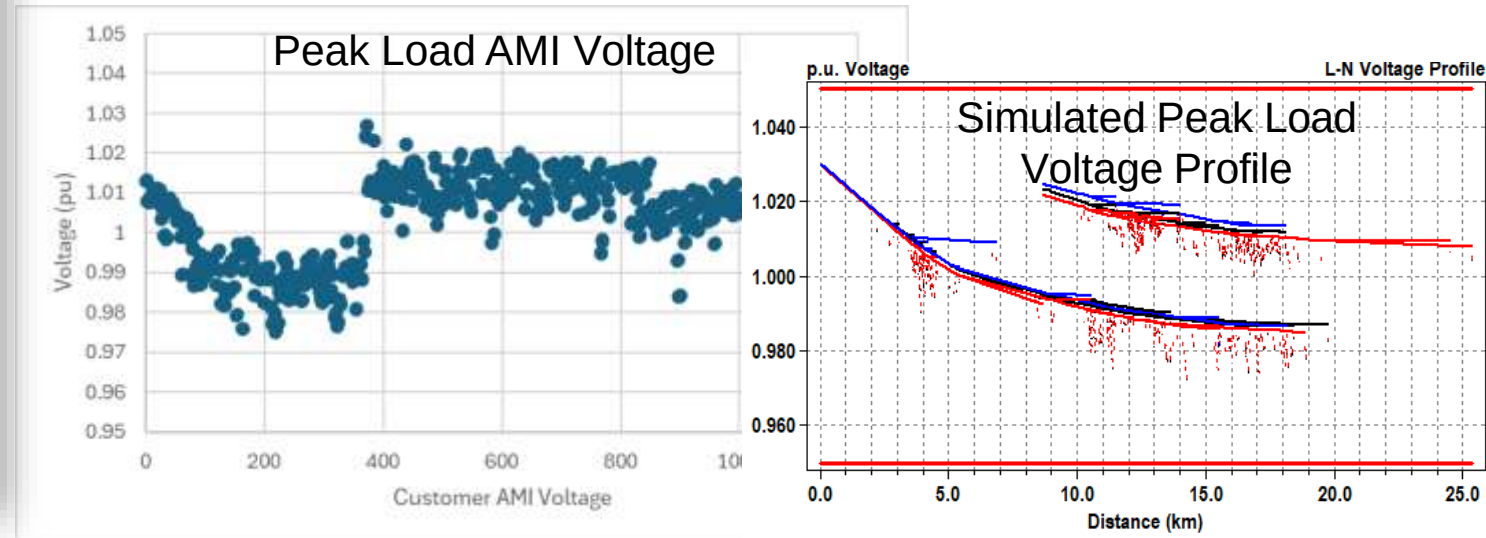
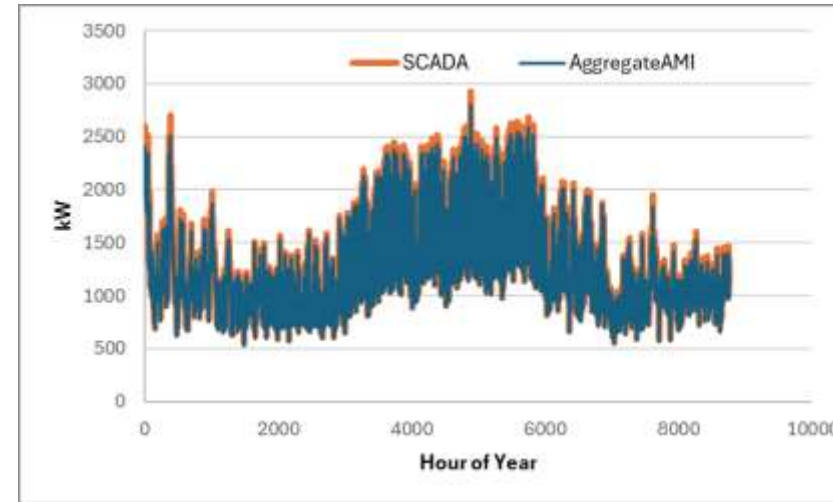
Inspect measurement data, clean measurement profile, and report quality.

Grid Model Inspection, Correction, and Quality Assessment

Leveraging measurement data, models are inspected and updated.

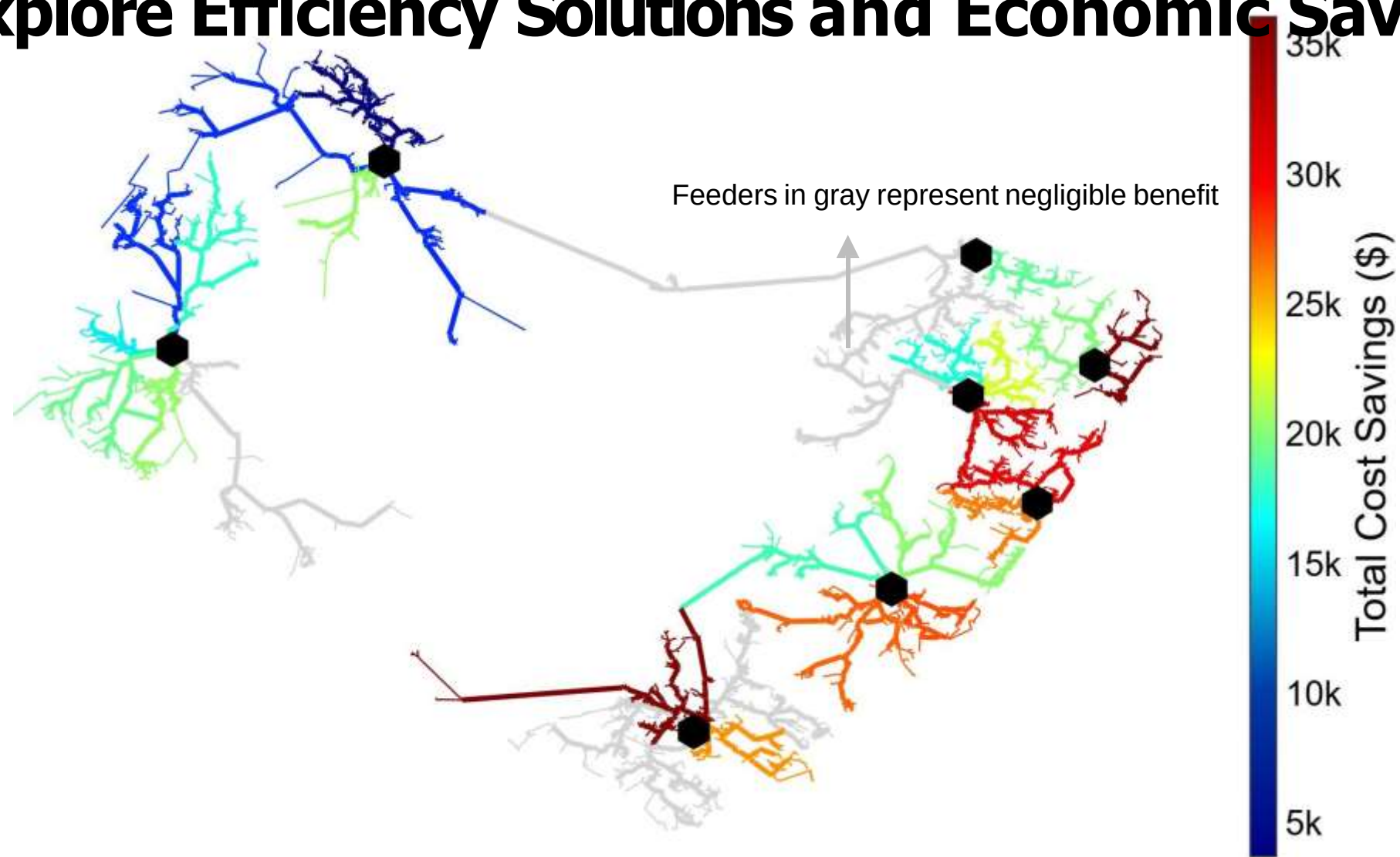


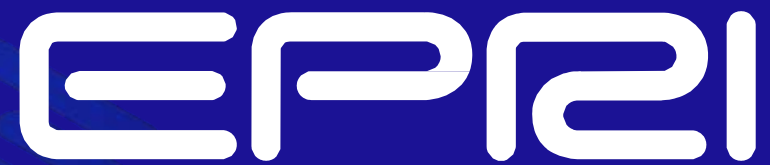
Potential
Phasing
Issue



Inspect grid data, clean grid model, and reports quality.

Explore Efficiency Solutions and Economic Savings





Contact

Matt Rylander

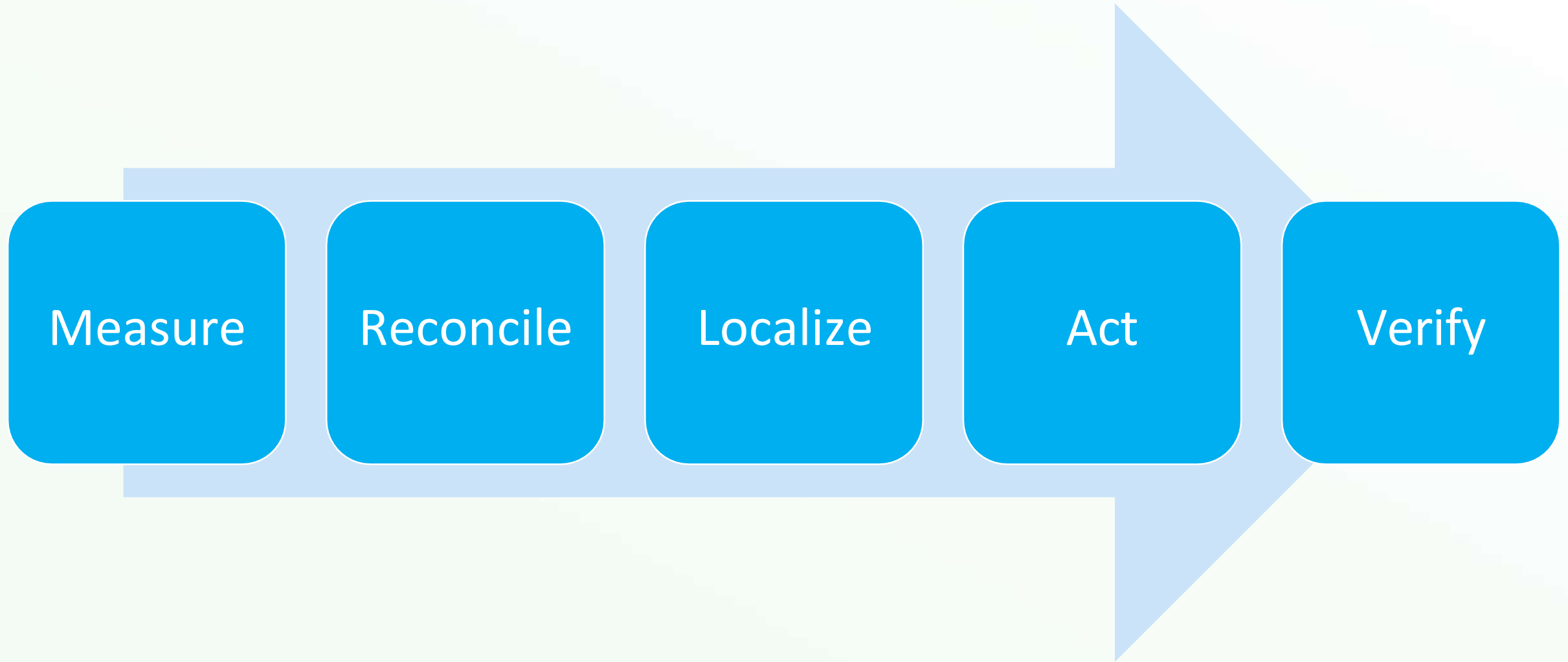
mrylander@epri.com

Grid Technologies Supporting Loss Reduction and Distribution Efficiency



Joe Potvin
Program Manager, Distribution Systems
August 24, 2026

From Calculating Losses to Taking Action...



Sensing technology can enable actionable grid visibility

AT&C Losses Require Multiple Types of Visibility

Technical Losses

- Network loading
- Conductors and transformers
- Voltage and current
- Phase conditions
- Network topology

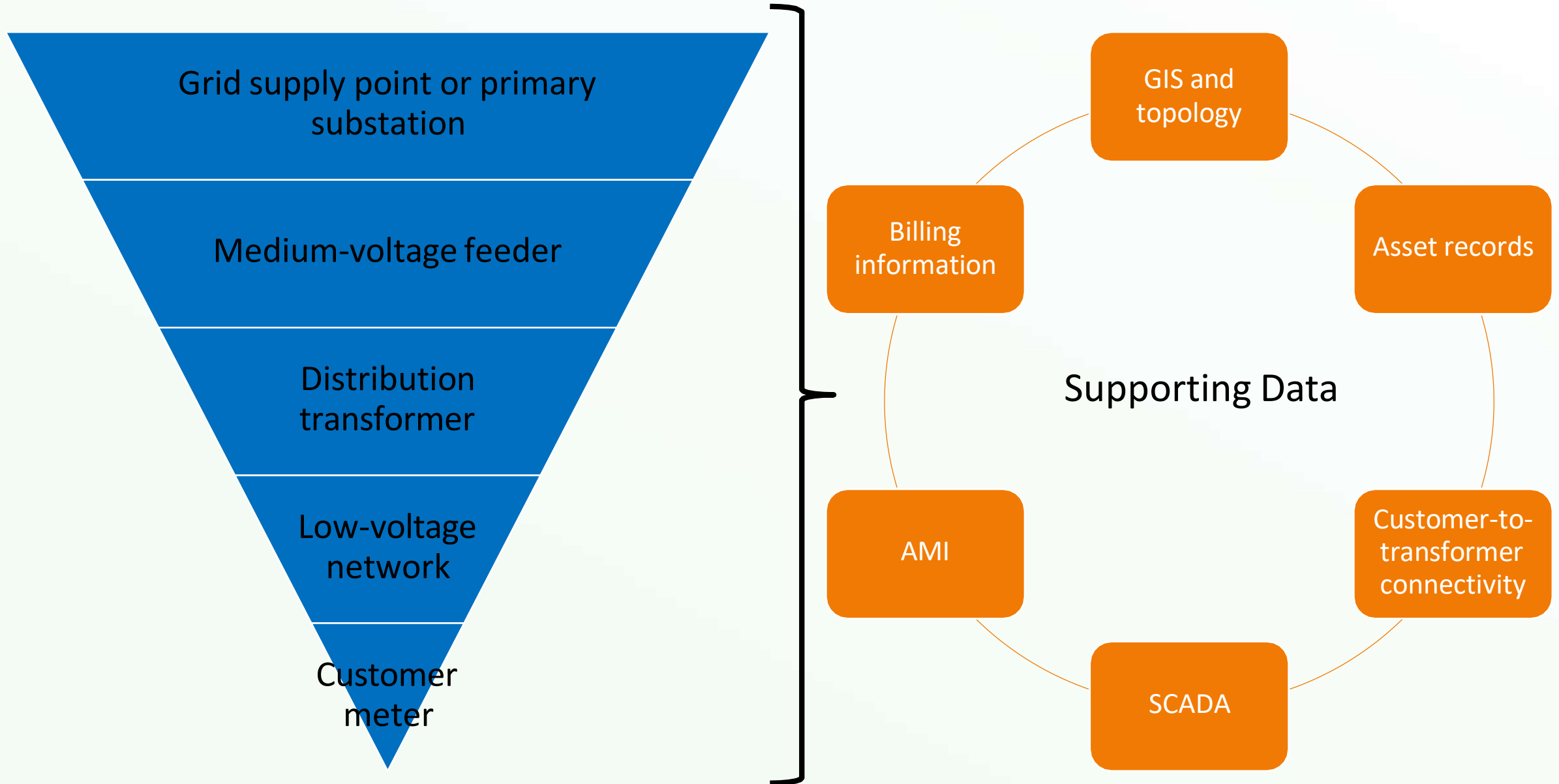
Commercial and Billing Losses

- Meter accuracy
- Meter bypass or tampering
- Unmetered consumption
- Customer-to-transformer mapping
- Billing completeness

Collection and Billing Losses

- Amount billed
- Revenue collected
- Commercial and customer processes

The Visibility Hierarchy



Technology Portfolio: Different Sensors Answer Different Questions

Technology category	Primary visibility provided	Potential loss-related role
System and feeder metering	Energy entering network segments	Energy accounting and localization
AMI	Customer usage, meter events, voltage, communications	Billing assurance, anomalies, transformer and secondary analysis
Asset-mounted sensors	Local loading, temperature, current, voltage, condition	Characterizing asset operation
Circuit-scale monitors	Conditions across portions of a circuit	Filling observability gaps and locating abnormalities
Imagery and remote sensing	Visual and geospatial asset information	Improving inventory, mapping, and inspection

AMI: The Bridge Between Commercial and Grid Applications

Meter and grid edge

- Meter reading
- Tamper events
- Theft or abnormal-usage detection
- Voltage and power-quality monitoring
- Remote connect and disconnect
- Outage and restoration confirmation

Head-end and meter-data management

- Centralized data collection
- Event processing
- System integration

Back-office analytics

- Billing and revenue assurance
- Consumption anomaly analysis
- Transformer loading and secondary analysis
- Enterprise visualization and use-case logic



EPRI NextWave AMI Project Overview

Unlocking the Full Potential of AMI – Modernize, not just replace AMI systems

1. Validated Use Cases & Performance Results Database / Repository

- Real-world insights from AMI Deployments, Lab Evals, Simulations, and Demo's (AMI 1.0 & 2.0)



Technical Feasibility

• "Can You Do It?"



Business Value

• "Should-you Do It?"

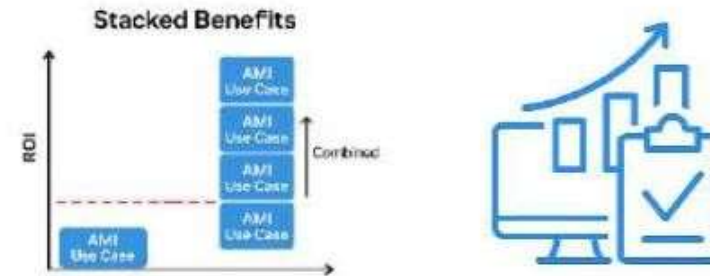
2. Modernization Frameworks & Roadmap Guidance

- Reference architectures, interoperability, comms, cybersecurity strategies, Meter Failure Database



3. Strategic Planning Tools for Demos & Analysis

- Cost-benefit analysis & tools to facilitate demos



4. Technology Transfer & Collaborative Leverage

- Webcasts, Workshops, Shared research, peer insights, and EPRI expertise to reduce risk



Maximizing AMI Now and for the Future
De-risk modernization & Accelerate Deployment

Beyond AMI: Filling Grid-Visibility Gaps

Asset-mounted monitoring, potential measurements may include:

- Current and loading
- Voltage
- Temperature
- Equipment operating state
- Power-quality or event information, depending on the device

Circuit-scale monitoring

- Monitoring between conventional SCADA points
- Additional visibility on long or lightly instrumented feeders
- Continuous capture of abnormal conditions
- Edge processing and communications

Imagery and geospatial technologies

- Asset inventory
- Location and connectivity verification
- Inspection information
- Support for improving network records

Example Distribution Network Monitoring Technologies

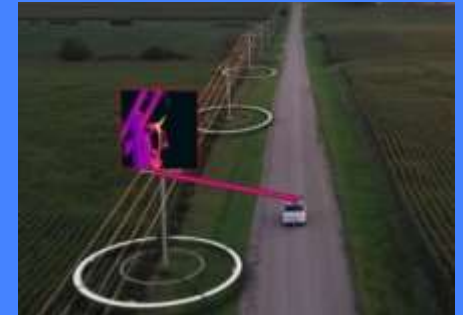
Asset Sensors & Monitors



Non-Contact Online Monitors



Imagery & Remote Sensing



Lab Assessment of Grid Technologies

Install good and degraded equipment on distribution line at EPRI Lenox laboratory

Investigate grid monitoring technology's ability to detect the defect



Example Pilot – Monitoring and Diagnostics for Future of Distribution

Objective: Evaluate the value of online monitoring, remote sensing, and asset monitoring technologies

Approach: Pilot multiple technologies on four distribution circuits to compare the technology performance.

EPRI Role: Project manager and principal investigator supporting the selection of sensors, documentation of findings and facilitating data analytics.



Line Sensors



Transformer Monitors



Pole Monitors



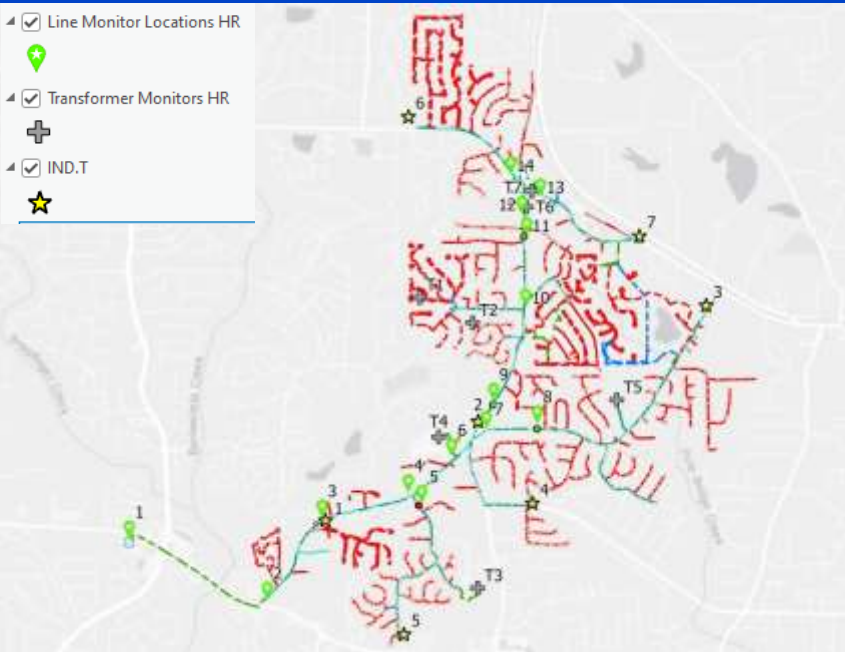
Grid Monitors



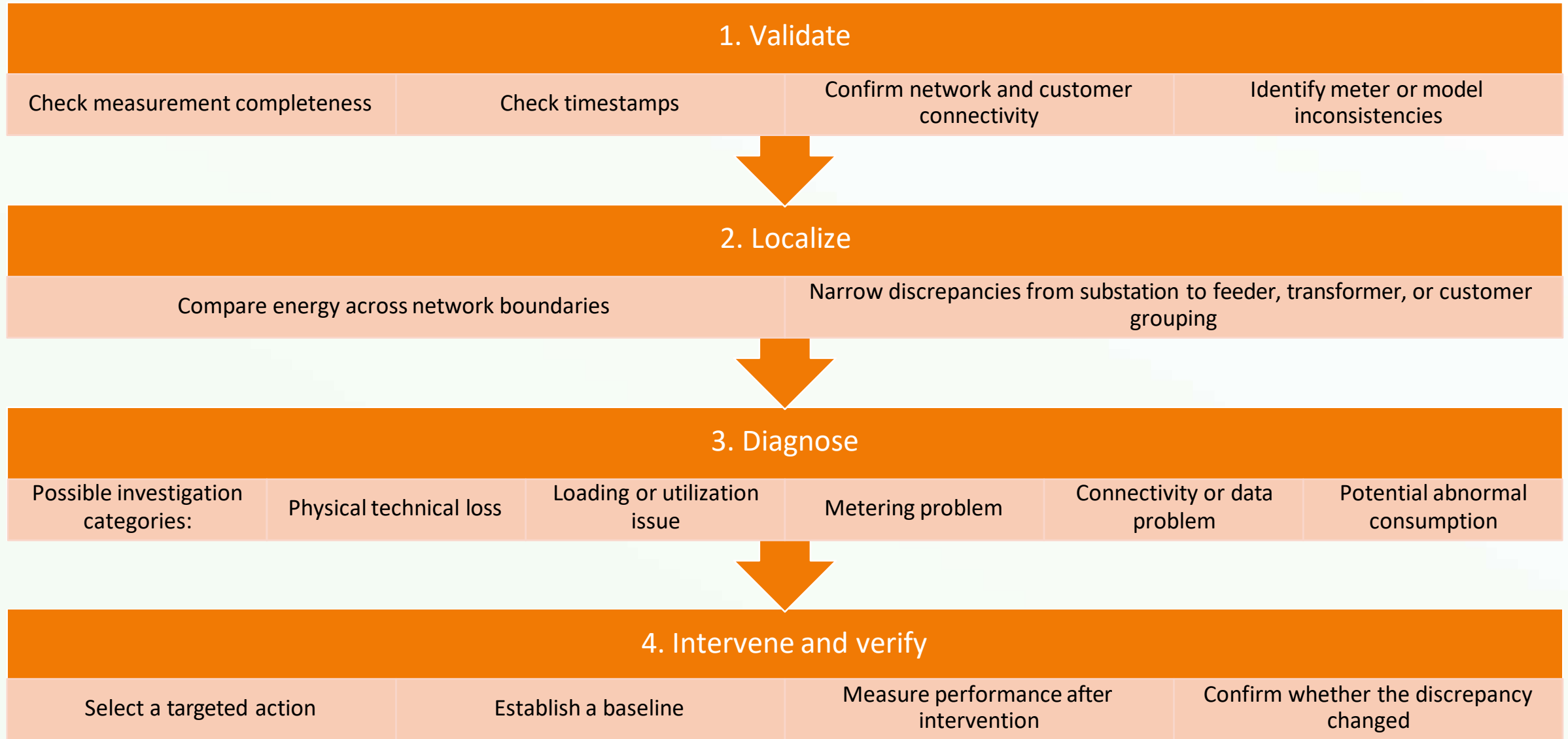
Vehicle-Based Imagery



Satellite Imagery Analytics



Turning Measurements into Action



Interventions Once the Problem Is Understood

Technical interventions

- Correct phase imbalance
- Address overloaded or poorly utilized assets
- Replace or resize conductors or transformers where supported by analysis
- Improve reactive-power or voltage management
- Correct network connectivity or configuration problems

Repair defective equipment or connections

- Metering and commercial interventions
- Test or replace inaccurate meters
- Correct customer-to-transformer and meter-location records
- Investigate tamper or abnormal-usage events
- Correct billing-data gaps
- Improve energy-accounting coverage

EPRI has research underway in these areas as well!

How EPRI Research Can Help

1. Methods and analytics

- Technical-loss study methodology
- Measurement and model quality
- Comparison of measurement, empirical, and power-flow approaches

2. Technology assessment

- Laboratory and field evaluation of sensors
- Monitoring technology performance
- Functional and lifecycle assessment

3. Use-case validation

- AMI use cases
- Grid and commercial applications
- Performance evidence
- Cost-benefit and implementation considerations

4. Utility collaboration

- Common methods
- Peer learning
- Pilots and demonstrations
- Technology-neutral guidance

Four Takeaways

AT&C loss is broader than physical technical loss.

Different loss components require different measurements, data, and processes.

Sensing and AMI create visibility, but value depends on analytics, operating workflows, and verification.

EPRI can support methods, independent technology evaluation, use-case validation, and collaborative pilots.



TOGETHER...SHAPING THE FUTURE OF ENERGY®

EPRI NextWave AMI Project

<https://www.epri.com/research/products/000000003002033774>

Objectives & Scope – Unlocking the Full Potential of AMI

Modernize, not just replace AMI systems.

Value and Deliverables

- **Validated Use Cases & Performance Results Database**
 - Real-world insights from lab evals, simulations, and field demos
 - AMI 1.0 & 2.0
- **Modernization Frameworks**
 - Reference architectures, interoperability, comms & cybersecurity strategies
- **Strategic Planning Tools and Roadmap Guidance**
 - Cost-benefit analysis, demo templates, and meter failure database
- **Collaborative Leverage**
 - Shared research, peer insights, and EPRI expertise to reduce risk



NextWave AMI

*Riding the Current
Powering the Future*

3 Year Commitment (Start Q4 2025 – End December 2028)

- Tier 1: \$50k/year for 3 years (\$150,000 total)
- Tier 2: \$75k/year for 3 years (\$225,000 total)
- Tier 3: \$100k/year for 3 years (\$300,000 total)
- Field Demo pricing based on scope

Note: If you join
in 2025, you
can split costs
over 4 years

Contact your Technical Advisor (TA) for your Pricing

West: [Brian Dupin](#), [Brian Fortenbery](#)

Northeast: [Barry Batson](#), [Judy Ullmann](#)

Southeast: [Chuck Wentzel](#), [Elisabeth Wells](#)

Canada: [Warren Frost](#)

Technology Providers or Other: [Letitia Midmore](#)

Technical Contacts:

[Matt Wakefield](#) Or Program Managers in: PQ (1), ET (18), Storage (94), ICT (161), Grid Edge (170), DER (174), Dx (180), CS (183), DOP (200)

**Maximizing AMI Now and for the Future
De-risk modernization & Accelerate Deployment**



3 Year Project Schedule Overview

