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Taking Control of Smart Meters with Diagnostic Data

MARK STRZEGOWSKI

Senior Marketing Manager

DAVID LATH

Applications Engineer

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Presenters

Mark Strzegowski

Senior Marketing Manager

Analog Devices Energy Management Products

David Lath

Applications Engineer

Analog Devices Energy Management Products

Agenda

- Utility industry trends
- Challenges and current methods to solve them
- The need for a new approach
- *m*Sure® technology overview
- Using actionable insights and the ROI to utilities
- Next steps
- Q&A

Utility Industry Trends

AMI Deployments Are Transforming the Utility Business

Meter Reading

Data Mining

More Customer Choices

Better Service

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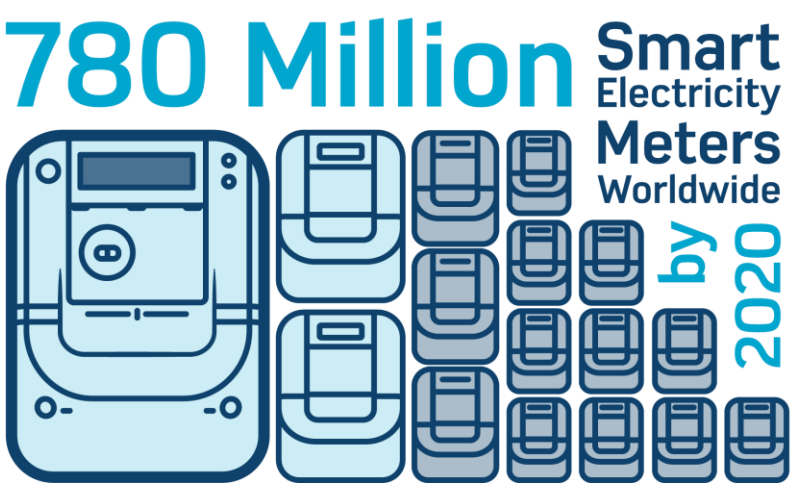
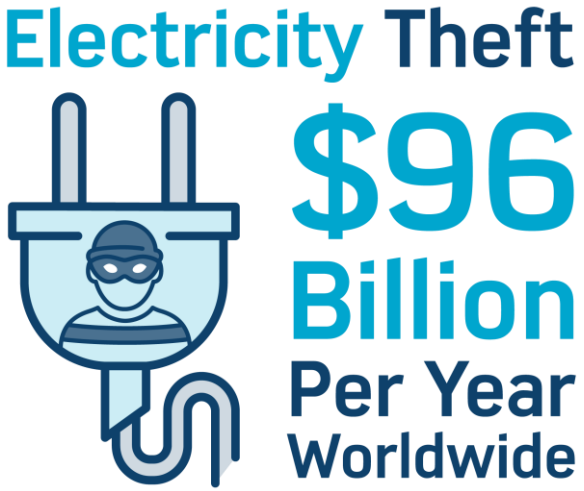
Challenges

Limited visibility into the health of millions of meters



Source: ABI Research, July 2015

Electricity theft is still growing

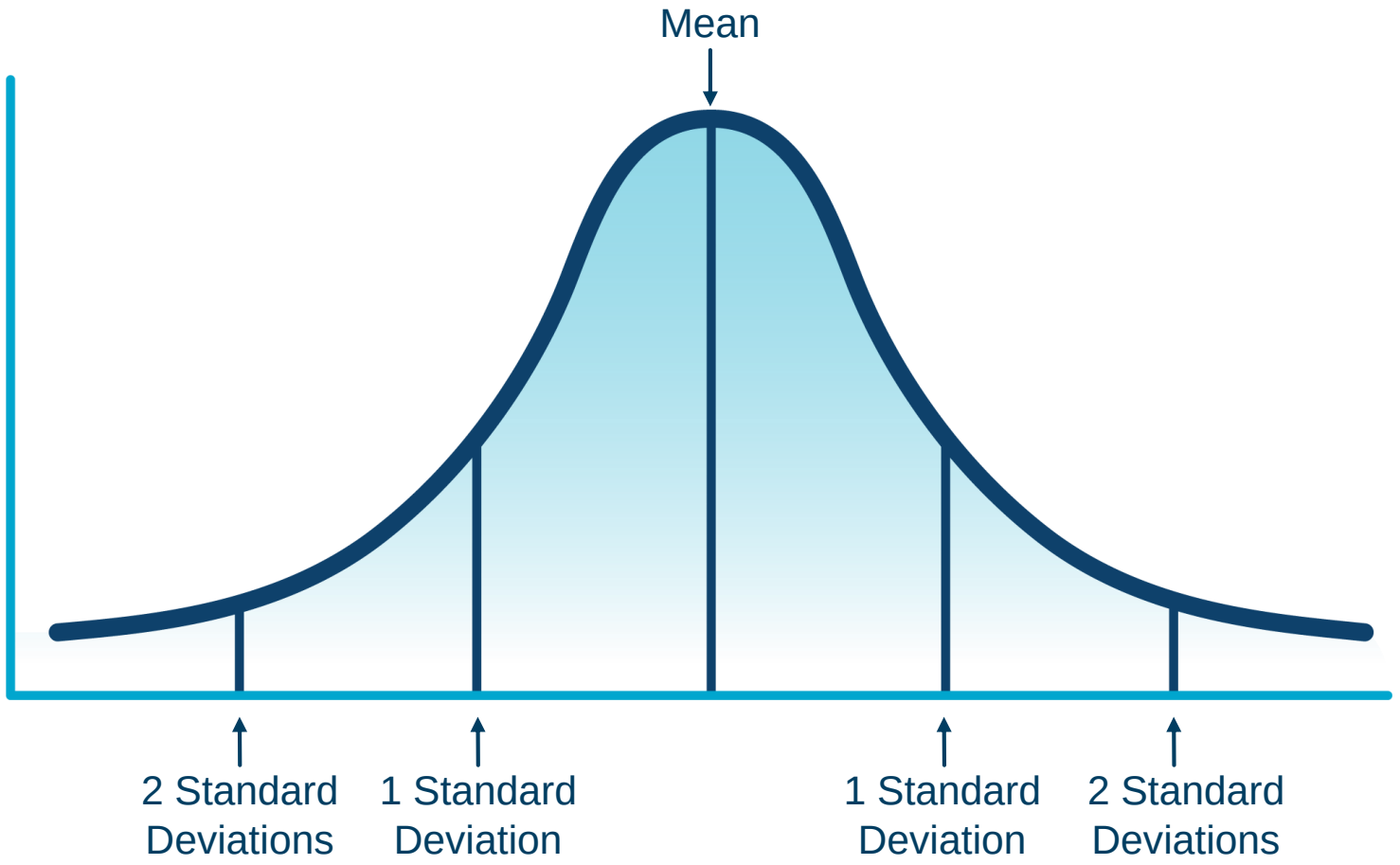


Source: Northeast Group, May 2017

Current Methods

Verifying Meter Accuracy—Sample Testing

Possibility of leaving hundreds of bad meters in the field!



Current Methods

Managing Risk—Possibility of Overbilling

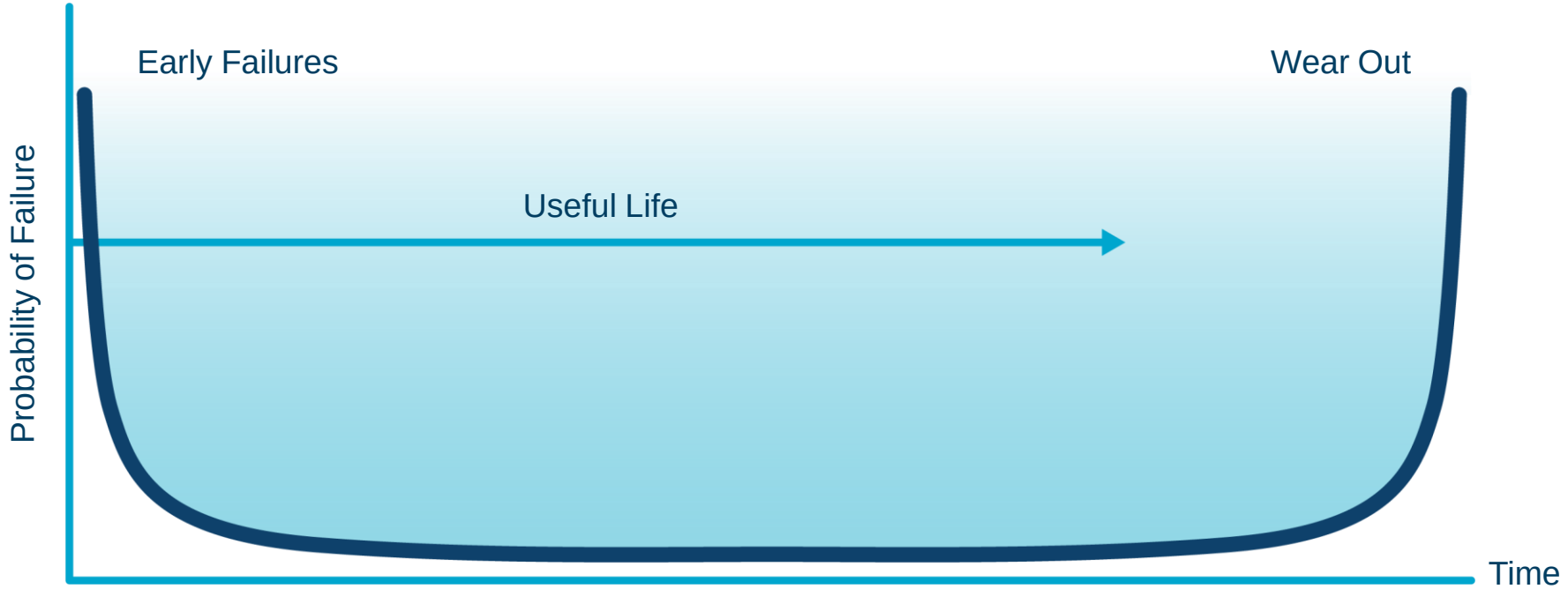
> “We had a meter that ran slightly fast and overcharged customers. We had to find all meters in the batch, replace them, work out refunds, and manage PR. It’s expensive.”

—Asset Manager at European Utility

Current Methods

Meter Replacement—Based on Probability

99% meters that are thrown out are still good!



Bath tub curve (Weibull function)—represents the expected rate of failure for the entire population, not an individual device.

Current Methods

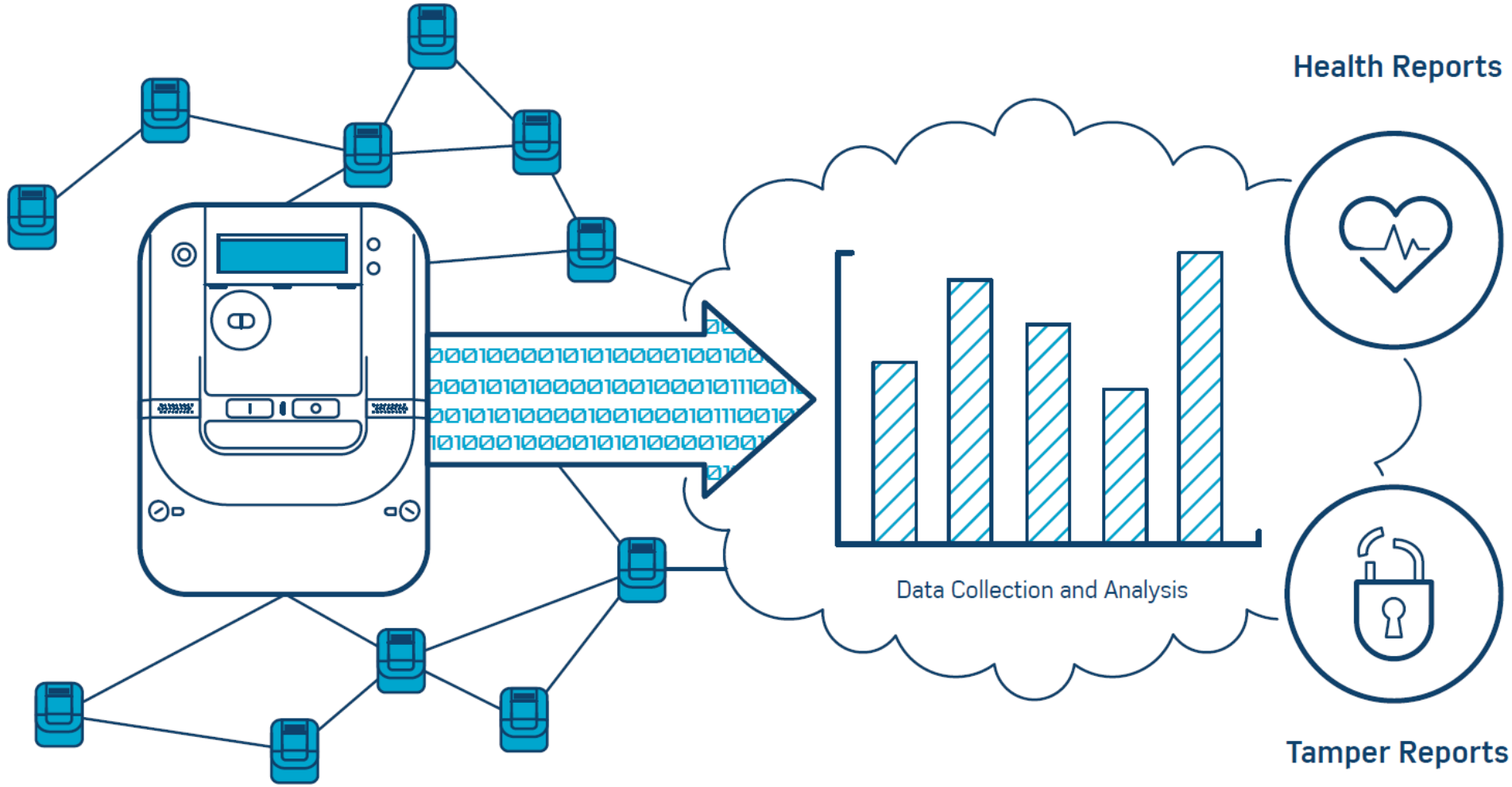
Electricity Theft

up to **30%** of All Electricity Generated in Some Countries

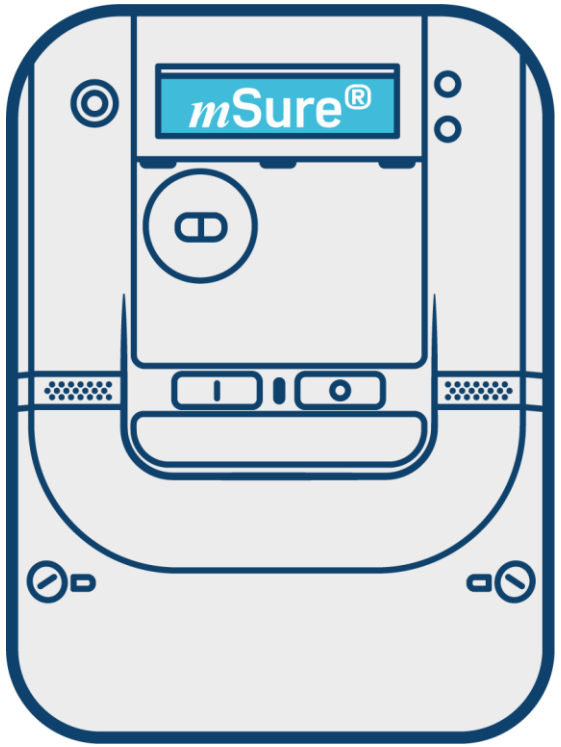
Tamper Detection

- False Positives
- Can't Locate Meter
- Can't Estimate the Amount of Tamper
- Can't Discover New Tamper Types
- % Based on Historical or Neighbor Data

A New Approach Is Needed



*m*Sure® In-Meter Diagnostics



Real-Time Health Monitoring and Intelligence

Get Visibility into Your Entire Meter Population

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With *m*Sure®

Eliminate In-Field Testing

Extend Meter Lifetime

Predictive Maintenance

More Revenue Protection

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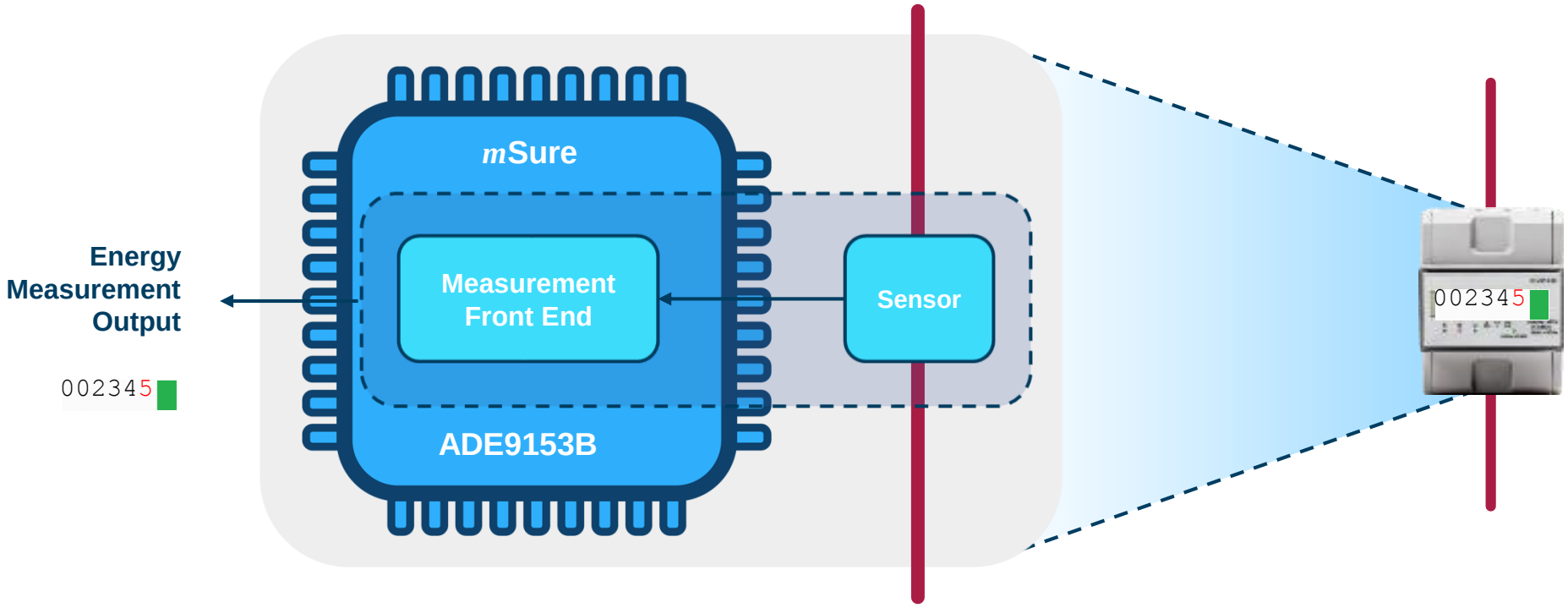
Technology Overview

*m*Sure® Diagnostics

*m*Sure in the ADE9153B

*m*Sure® is a technology that resides in the energy measurement IC, and it provides accurate monitoring and self-testing capability for the entire system, including the sensor.

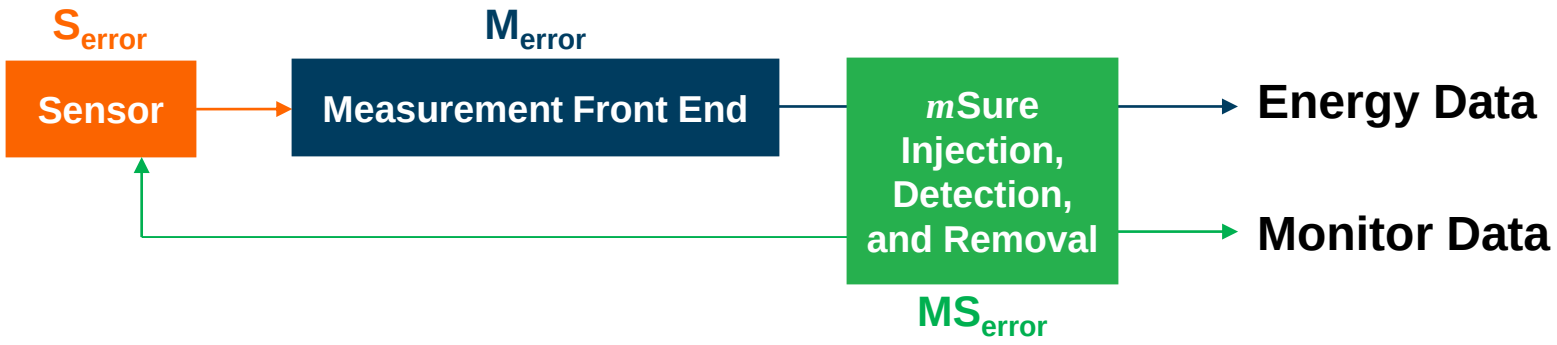


*m*Sure® Servo Loop Monitor

- **Open-loop (existing systems)**
  - Each component made precise, but accuracy is only known when meter is manufactured

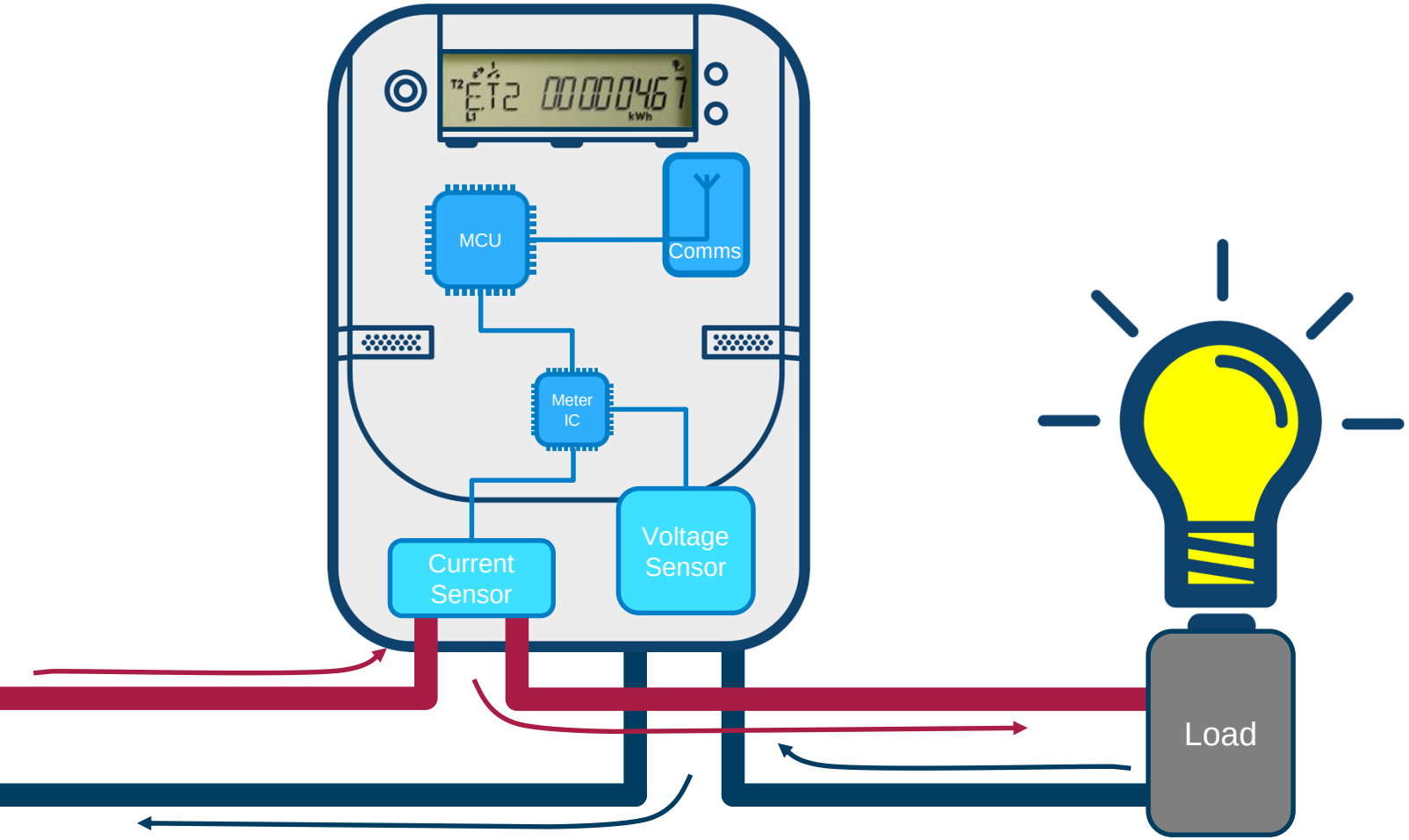
Total Error
= S_{error} × M_{error}
(sensor is a major contributor)

- **Servo control loop monitors and reports measurement accuracy**
  - Control loop works in parallel to normal open-loop systems to monitor sensor



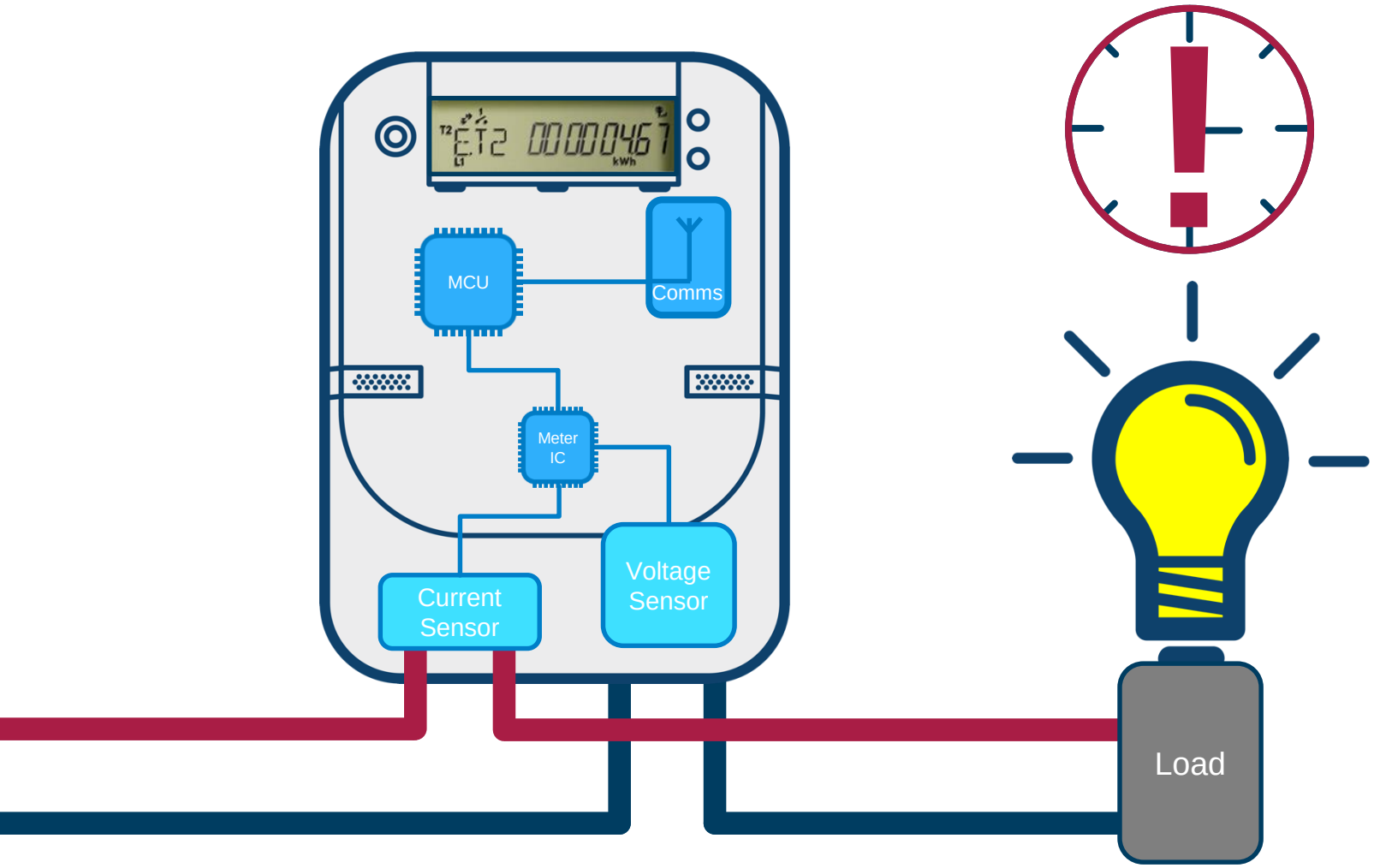
- Initial accuracy stored at manufacturing, but system provides continuous monitoring of the whole chain's accuracy relative to factory settings
- System does not interfere with normal metrology or energy data

What's Inside an Electricity Meter



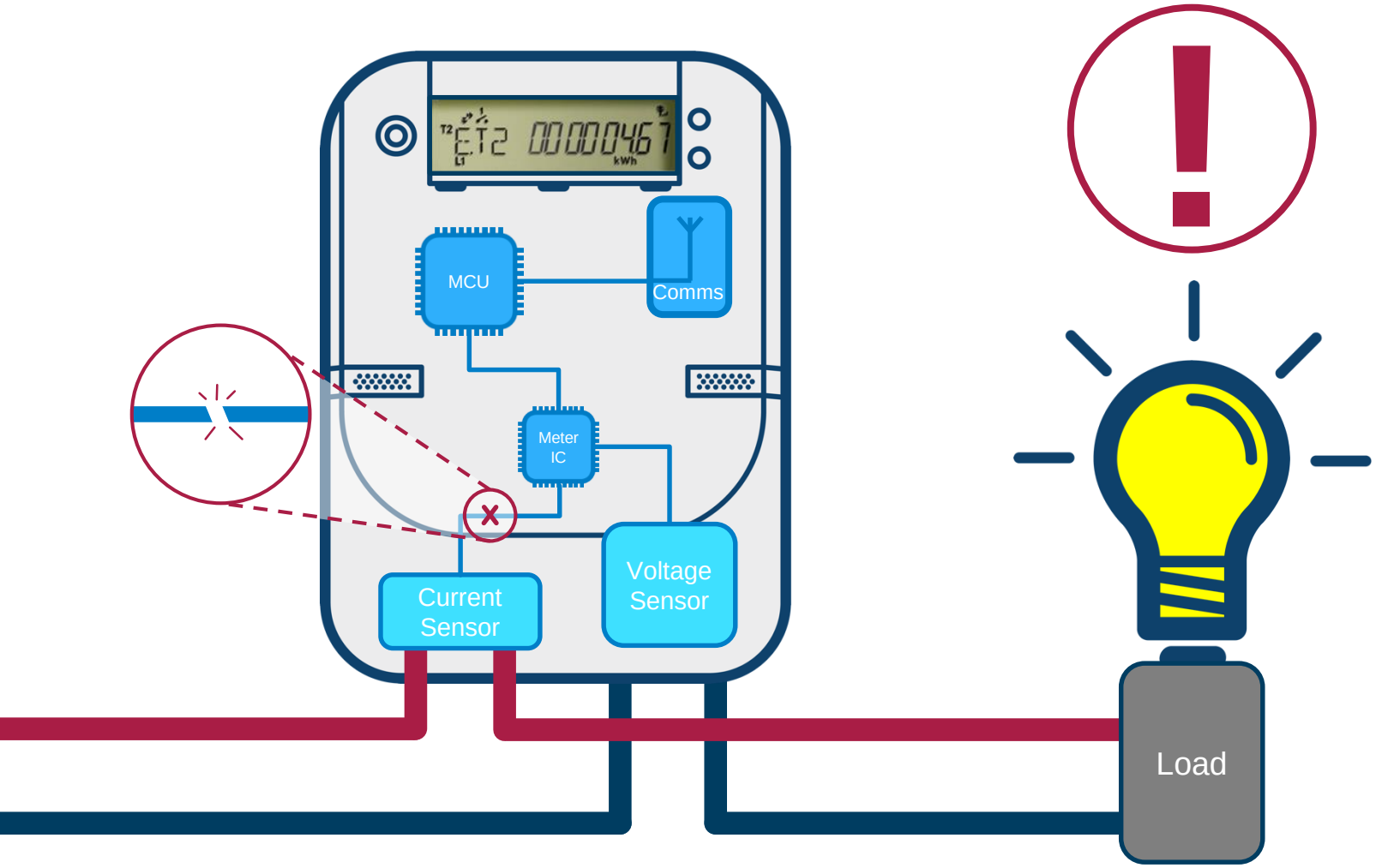
Identifier	Accuracy	Out of Spec	Tamper	Failure
Meter 1	0.03%	Ok	Ok	Ok
Meter 2	-0.02%	Ok	Ok	Ok
Meter 3	0.06%	Ok	Ok	Ok
Meter 4	0.02%	Ok	Ok	Ok
…	…			
Meter X	-0.04%	Ok	Ok	Ok

Aging—Out of Spec Meters



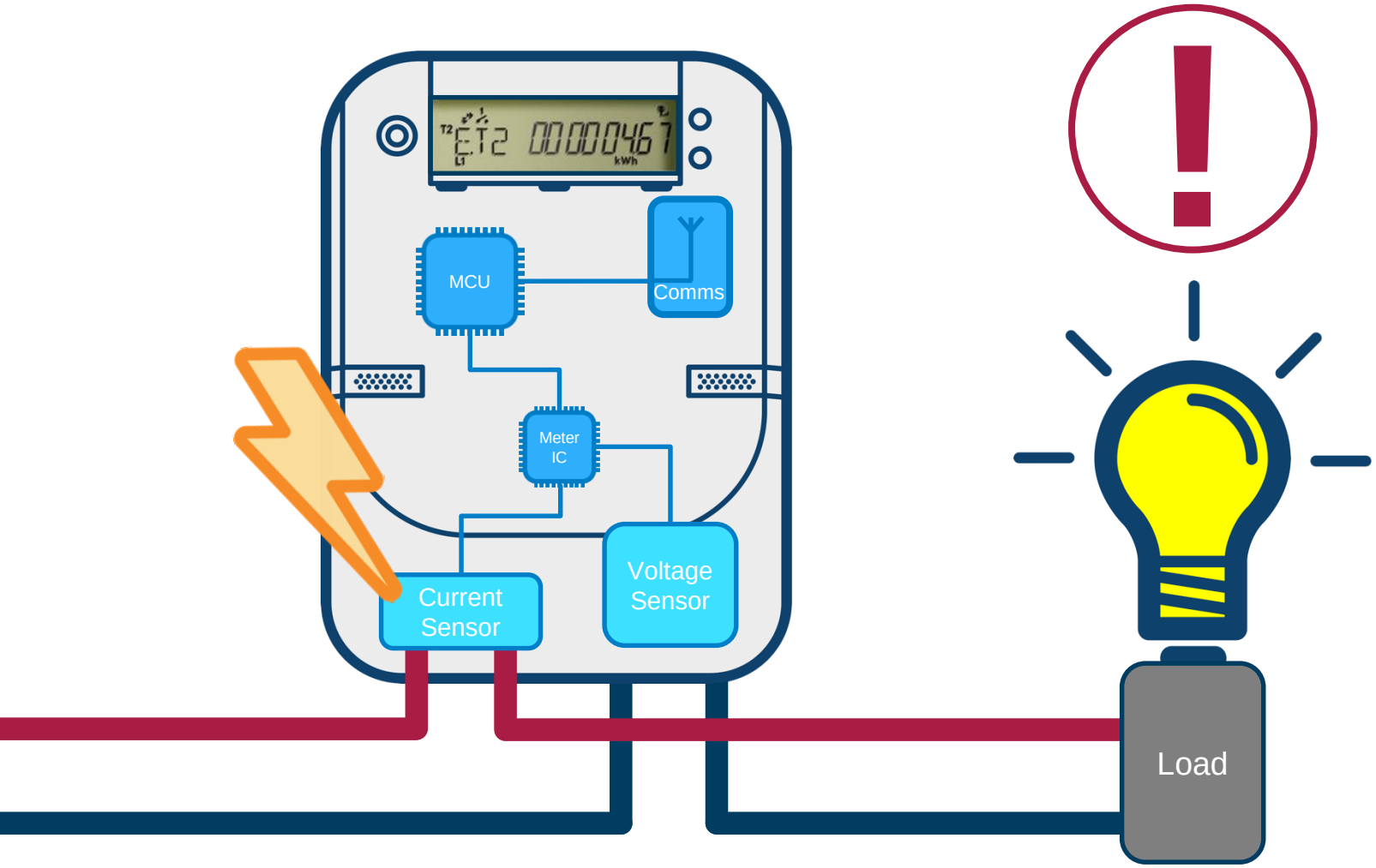
Identifier	Accuracy	Out of Spec	Tamper	Failure
Meter 1	0.03%	Ok	Ok	Ok
Meter 2	-0.02%	Ok	Ok	Ok
Meter 3	0.06%	Ok	Ok	Ok
Meter 4	0.02%	Ok	Ok	Ok
…	…			
Meter X	-0.04%	Ok	Ok	Ok

Sensor Fault—Damaged Meter



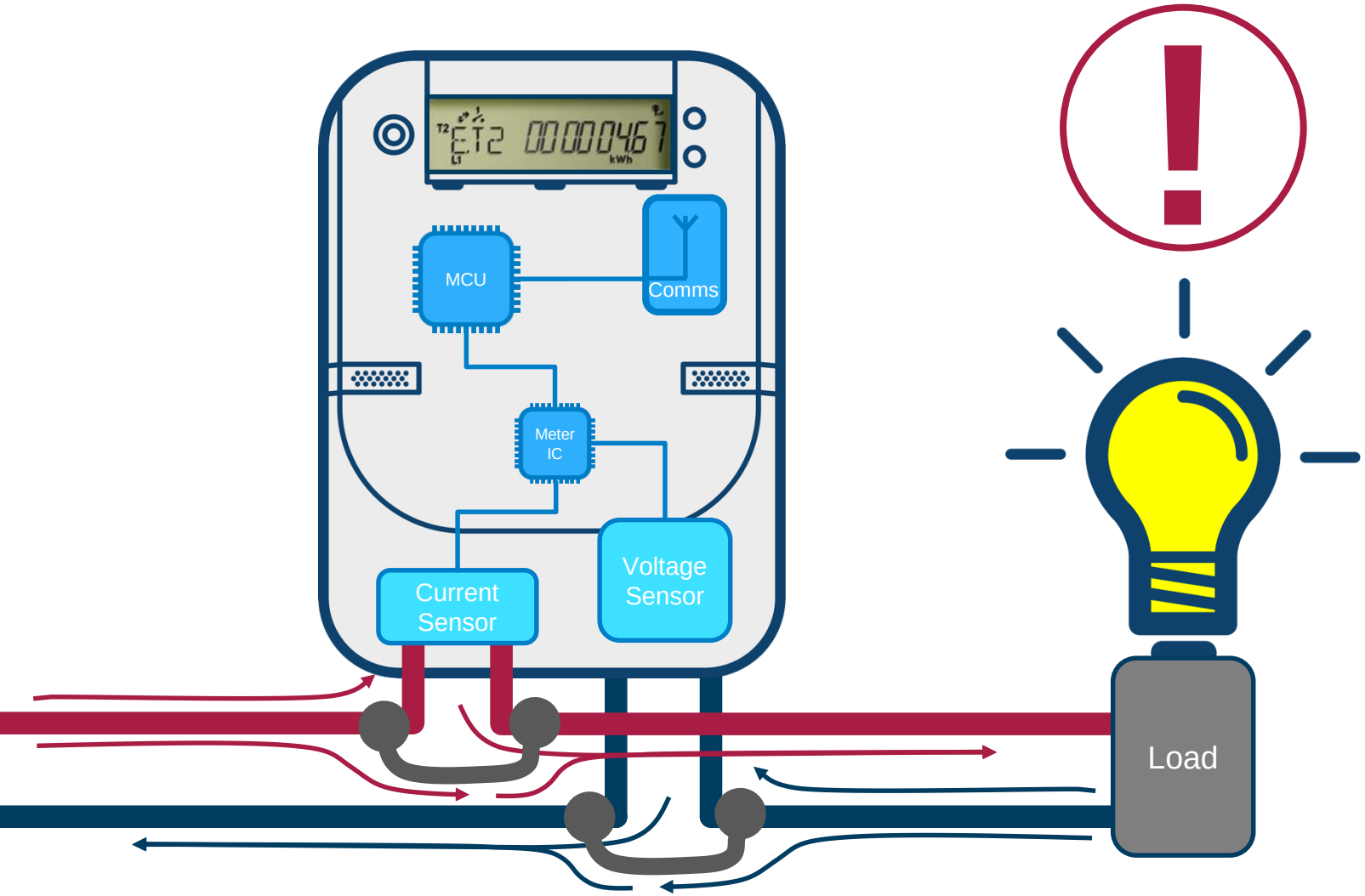
Identifier	Accuracy	Out of Spec	Tamper	Failure
Meter 1	-1.41%	Alert	Ok	Ok
Meter 2	-0.02%	Ok	Ok	Ok
Meter 3	0.06%	Ok	Ok	Ok
Meter 4	0.02%	Ok	Ok	Ok
…	…			
Meter X	-0.04%	Ok	Ok	Ok

Sensor Fault—Overcurrent Damage



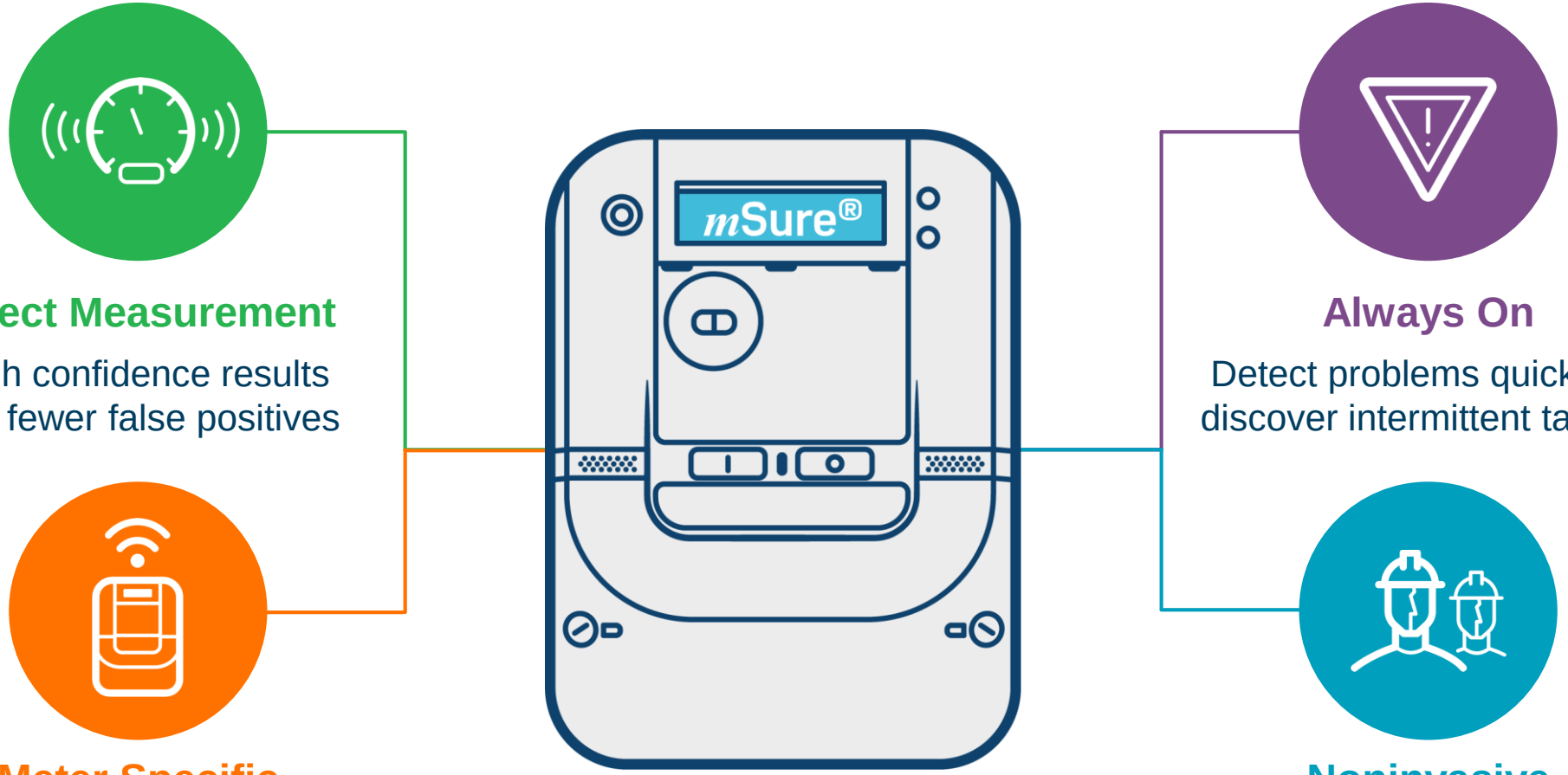
Identifier	Accuracy	Out of Spec	Tamper	Failure
Meter 1	-1.41%	Alert	Ok	Ok
Meter 2	Open	Alert	Ok	Alert
Meter 3	0.06%	Ok	Ok	Ok
Meter 4	0.02%	Ok	Ok	Ok
…	…			
Meter X	-0.04%	Ok	Ok	Ok

Bypass Tamper



Identifier	Accuracy	Out of Spec	Tamper	Failure
Meter 1	-1.41%	Alert	Ok	Ok
Meter 2	Open	Alert	Ok	Alert
Meter 3	1.62%	Alert	Ok	Ok
Meter 4	0.02%	Ok	Ok	Ok
…	…			
Meter X	-0.04%	Ok	Ok	Ok

*m*Sure Advantages



Direct Measurement

High confidence results and fewer false positives

Meter Specific

Locate meters with drift, tamper, or malfunction

Always On

Detect problems quickly or discover intermittent tamper

Noninvasive

No service interruption or extra equipment needed

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Actionable Insights

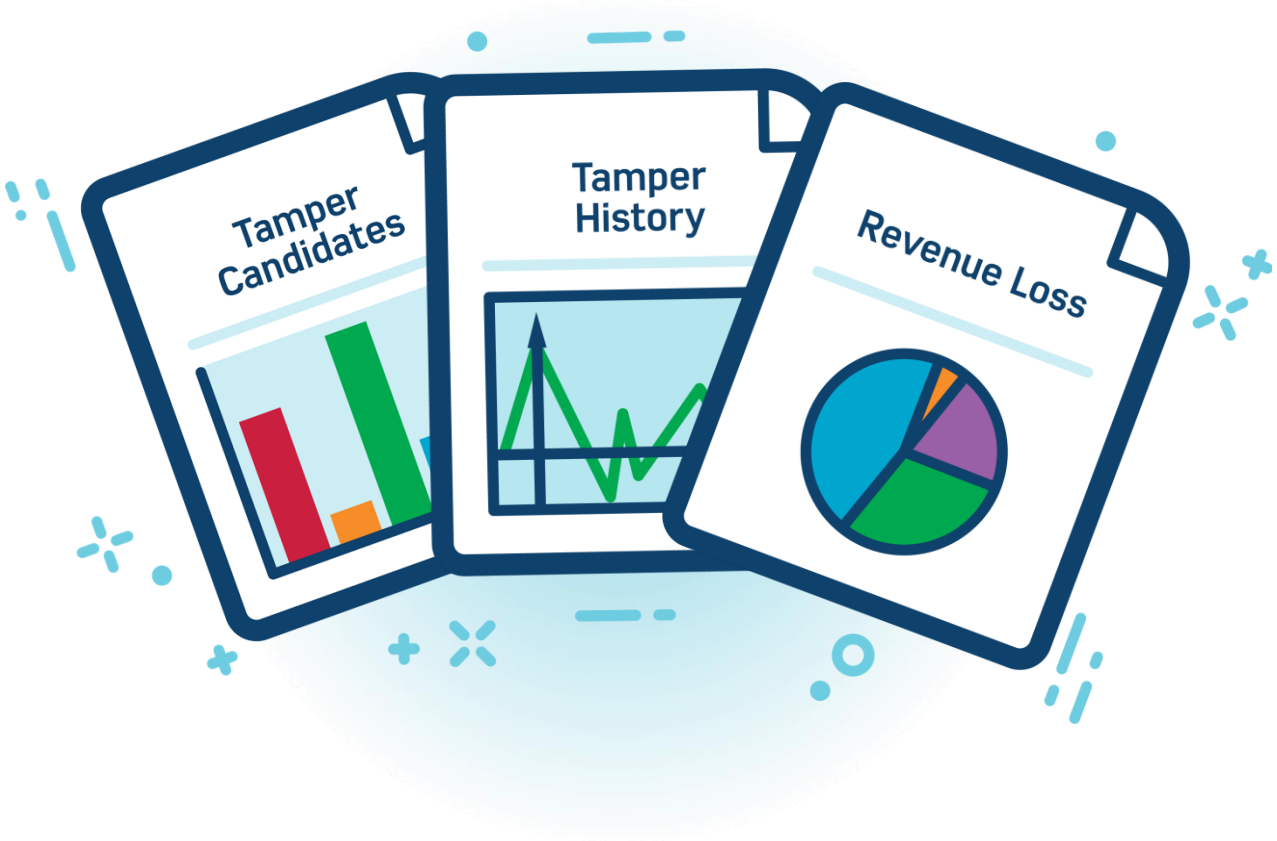
Analog Devices Edge-to-Cloud Utility Meter Analytics

Meter Accuracy over Lifetime and Meter Malfunction

Meter Health Analytics Module

Advanced Tamper Detection

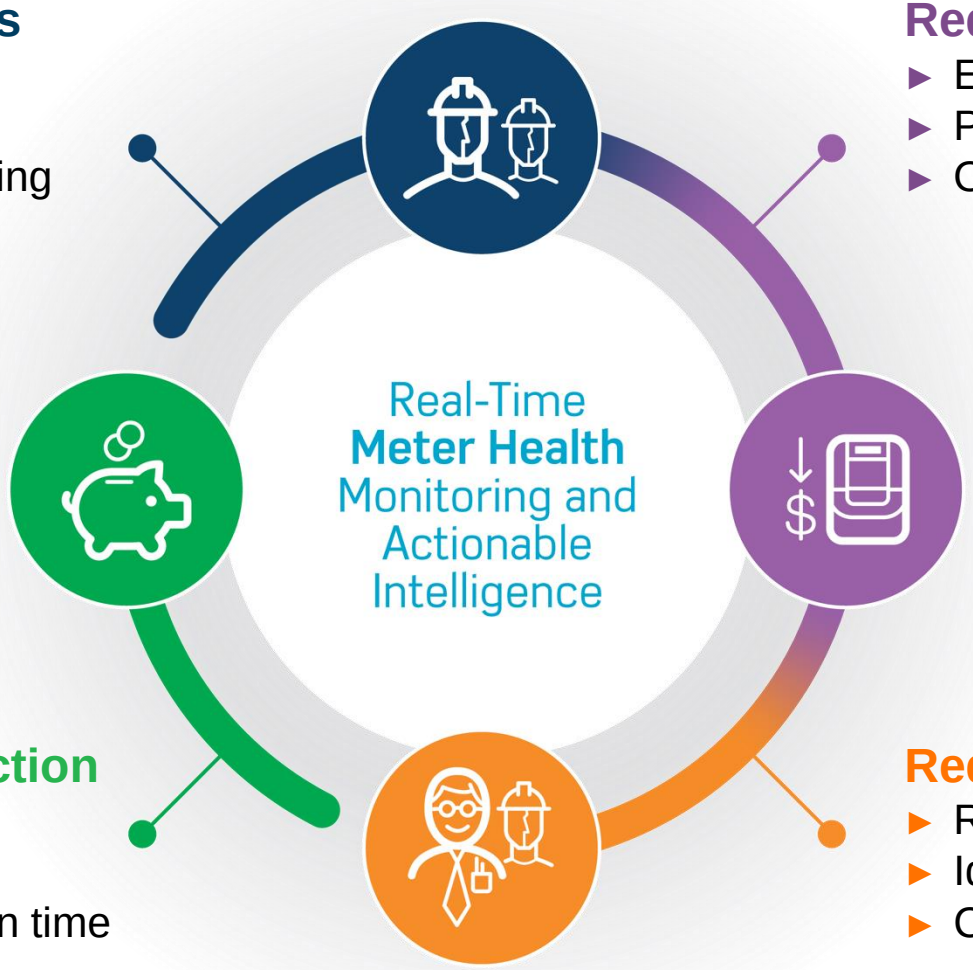
Advanced Revenue Protection Analytics Module



Return on Investment

Optimized Field Resources
- Faster faulty meter detection
- Efficient crew dispatch
- No service disruption for testing

Reduced Equipment Cost
- Extended meter lifetime
- Prioritized replacement
- Ongoing quality assurance

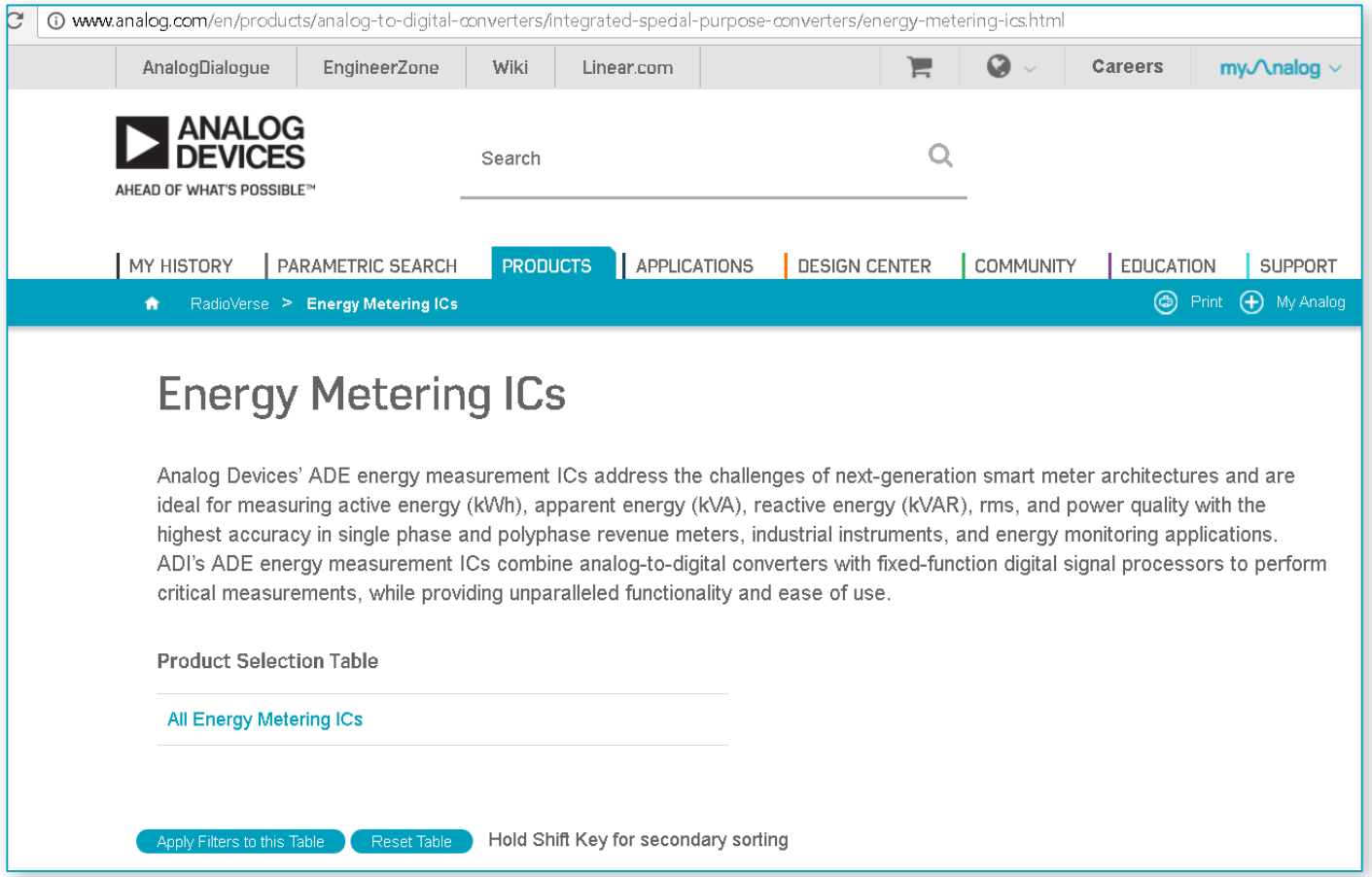


Advanced Revenue Protection
- Estimated amount of tamper
- More tamper types identified
- Reduced tamper investigation time

Reduced Risk
- Regulatory compliance
- Identify and prevent system failures
- Customer satisfaction—no overbilling

Next Steps with *m*Sure®

Visit analog.com/mSure for more resources



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