METERING LEADER SINCE 1904

TESCO®

THE EASTERN SPECIALTY COMPANY

INTRA-GRID SENSORS AND ATI FOR DISTRIBUTION TRANSFORMERS

Distribution Transformer Monitors

Tuesday, May 2, 2023

10:00 AM

John Kretzschmar, SAMSCO

SAMSCO

METERING LEADER SINCE 1904

TESCO

THE EASTERN SPECIALTY COMPANY

What is an Intra- Grid Sensor?

A sensor used to provide detailed information about conditions that exist between the distribution transformer and the meter.

METERING LEADER SINCE 1904

TESCO

THE EASTERN SPECIALTY COMPANY

WHY DO WE NEED INTRA- GRID SENSORS?

We are now stressing grid assets with increased unplanned burden and never previously conceived pressures.

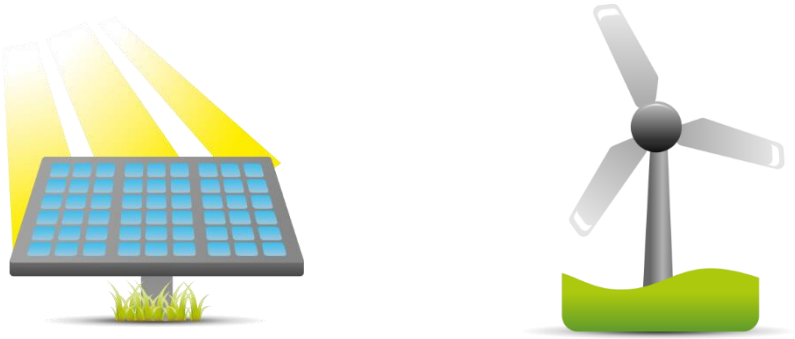
Many utilities are still without the comprehensive data that will accurately reveal the intra-grid dynamics created by these changes.

DISTRIBUTED ENERGY RESOURCES (DER)

Through solar and wind renewables, we are introducing Reverse Energy onto the distribution grids.

The millions of existing transformers were not designed to handle this impact.

While renewables are beneficial, Reverse Energy can produce unstable, and unsafe grid conditions.

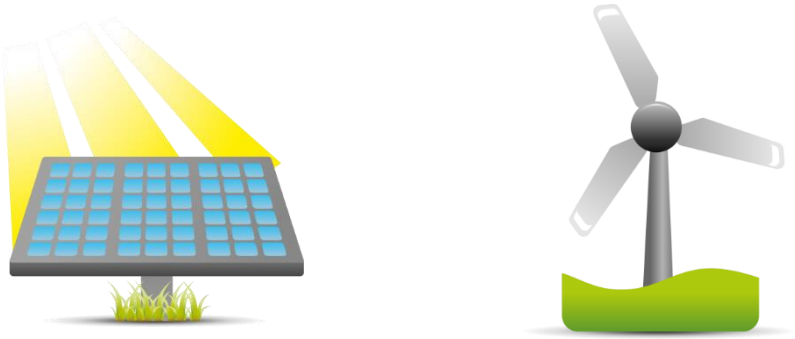


DISTRIBUTED ENERGY RESOURCES (DER)

Intra-grid sensors accurately measure and report Reverse Energy, and its impacts on the grid.

Utilities without AMI, or “smart meters” need intra-grid sensors to understand the Reverse Energy impacts inside their grid.

Utilities with AMI need intra-grid sensors to understand Reverse Energy impacts on transformers.



DISTRIBUTED ENERGY RESOURCES (DER)

The reality is that AMI generated Reverse Energy data does not accurately indicate impacts on transformers or the resulting grid impacts.

AMI data is typically not accurately aligned to the upstream transformers due to pervasive GIS mapping errors, thus causing aggregated AMI data to be unreliable.

REVERSE ENERGY

The reality is that AMI generated Reverse Energy data does not accurately indicate impacts on transformers or the resulting grid impacts.

AMI data is typically not accurately aligned to the upstream transformers due to pervasive GIS mapping errors, thus causing aggregated AMI data to be unreliable.

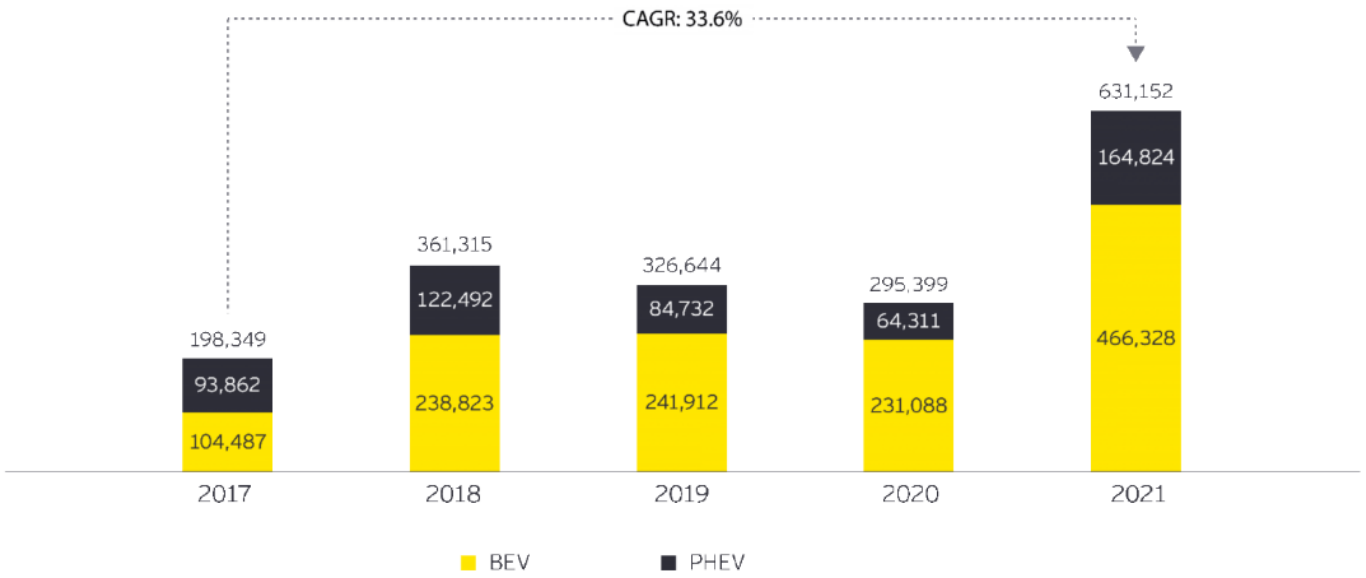
REVERSE ENERGY

AMI-deployed utilities might think they know Reverse Energy impacts, the truth is they typically do not possess accurate AMI-to-transformer information.

This can leave linemen in a position of not knowing what to expect when they approach DER-active transformers.

ELECTRIC VEHICLES

- To date, over **2 million** EV's have been sold in the **US**.
- By 2027, **annual sales** are expected to reach **2 million EV's.**
- Electric cars still make up just **1% of cars** on our roads.
- On average, EV's **cost about $10,000** more than a standard vehicle.



Source: "Global EV Outlook 2022," IEA.org, IEA EV Data Explorer, May 2022.

ELECTRIC VEHICLES

Electric Vehicle charging stations create a new, unplanned load on transformers. Each charging station has the capability of adding up to one additional homes' worth of power load on a transformer.

This unplanned loading impacts transformers and may exceed a transformer's designed capacity causing major problems.

METERING LEADER SINCE 1904

TESCO

THE EASTERN SPECIALTY COMPANY

ILLEGAL MARIJUANA PRODUCTION

Illegal marijuana grow houses commonly steal significant levels of power from the grid.

Theft occurs simply by tapping power lines in front of the meters.

No endpoint meter (including AMI smart meters) can effectively detect pre-meter power theft.

This means thieves steal as much power as they want, and they steal it indefinitely without fear of detection.

LEGALIZED MARIJUANA

When jurisdictions legalize marijuana, significant unplanned loading hits the respective transformers and the grid.

Legalization permits, in some ways encourages residents to grow marijuana using power-intense hydroponic resources. This unanticipated reality then causes additional strain on the existing transformers and the grid.

AGING ASSETS

According to the US Department of Energy, the average age of existing distribution grid transformer is presently in the range of around 38 years.

The average projected life span of transformers is typically 25 years so many transformers have already eclipsed their intended life span, yet we demand more performance, reliability, and various unintended service capabilities.

AGING ASSETS

Intra-grid sensors proactively reveal over-burdened and failing transformer assets allowing operators to effectively enable preventive maintenance efforts.

This approach enables operators to transition away from costly and disruptive, reactive grid management practices.

POWER THEFT

Intra-grid sensors proactively reveal over-burdened and failing transformer assets allowing operators to effectively enable preventive maintenance efforts.

This approach enables operators to transition away from costly and disruptive, reactive grid management practices.

POWER THEFT

Despite significant Smart Meter penetration, power theft is a perpetual problem. Industry experts suggest that U.S. power theft is in excess of $6 Billion per year.

The locations of power theft is typically a mystery. If the affected overburdened transformers finally fail, utility operators then learn where the theft is occurring.

METER PROGRAMMING ISSUES

An incorrectly programmed meter can result in significant errors.

For example: a meter programmed for a 200:5 transformer but has a 400:5 transformer will significantly misreport usage.

What are System Losses?

Energy generated by Power Station does not match energy distributed to the consumers.

The difference between generated and distributed energy is known as Transmission and Distribution loss; aka system loss.

System loss is the energy that is generated but not paid for by users.

LINE LOSS

According to US Energy Information Administration reports, nearly 200 Billion unmetered kWh's are 'leaked' from US distribution grids annually.

This loss represents nearly $21 Billion that was unmetered but was amortized as electricity cost across rate payer's bills.

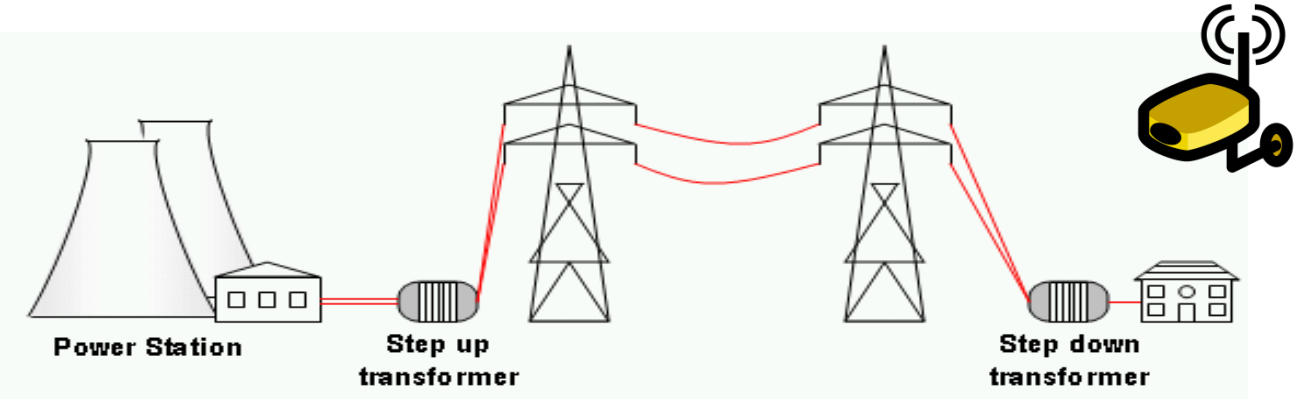
All of this while our government, utilities, and rate payers have been investing billions of dollars in 'smart meters', and other energy efficiency efforts.

LINE LOSS

Electric distribution grids do not have adequate sensor technology and analytic capabilities to allow utilities to directly reduce system losses.

As a result, a blind spot exists between the substation SCADA and the AMI meter.

Intra-Grid Sensors can provide visibility into this critical area.



METERING LEADER SINCE 1904

TESCO

THE EASTERN SPECIALTY COMPANY

THE NEXT STEP IN GRID MODERNIZATION

Advanced Transformer Infrastructure (ATI)

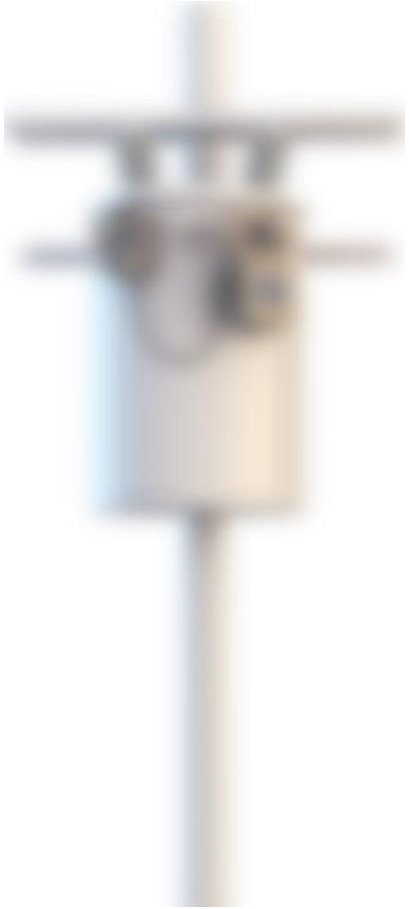
Reliability Improvements

DER & EV Integration

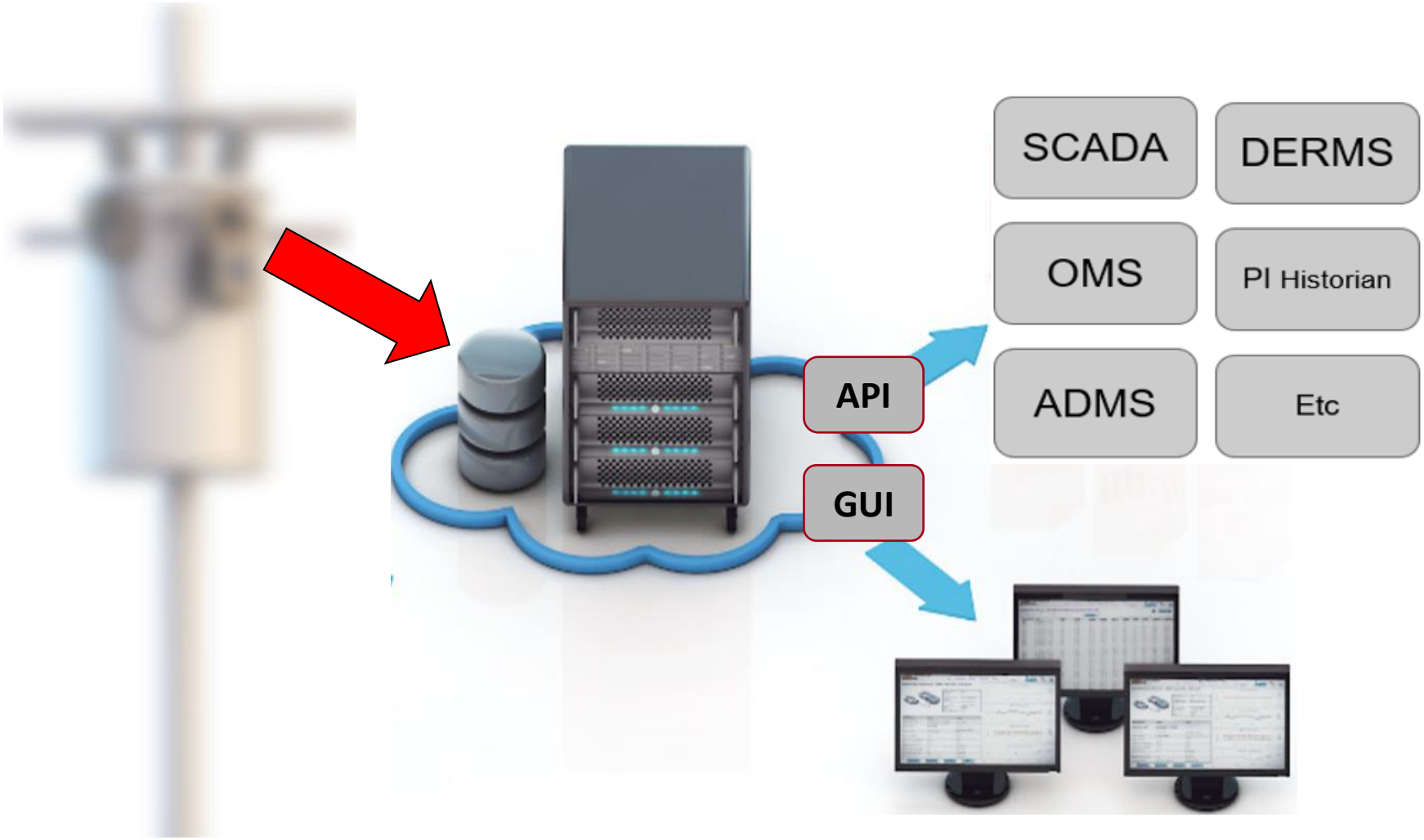
Fire Mitigation

Outage Notification

Voltage Optimization



ADVANCED TRANSFORMER INFRASTRUCTURE



ADVANCED TRANSFORMER INFRASTRUCTURE

ATI Data Value: HECO User Groups

OptaNODE®
HESS

GUI
Graphical User Interface

API
Application Programming Interface

Presently Available API Calls:
1. Transformer Asset Information
2. Transformer Historic Data
3. Outage Notification Data
4. Active Alerts Data
5. Critical Alerts Data
6. HESS API Version

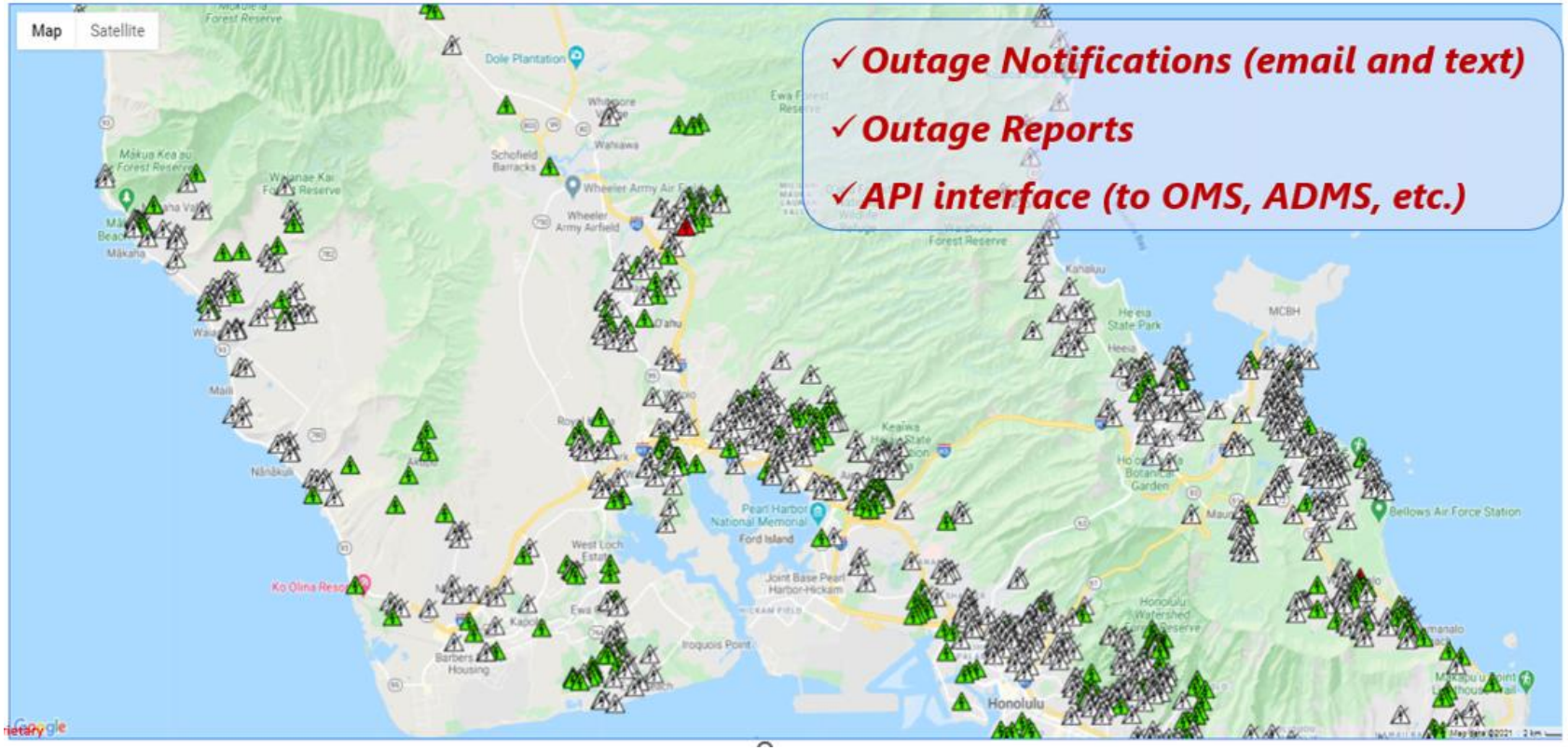
Hawaiian Electric

1. Operations Planning
2. Customer Service – small accounts
3. Customer Service – large accounts
4. Systems Operations
5. Asset Management
6. Distribution Planning
7. T&D Engineering
8. Primary Trouble Calls
9. Standards & Conceptual Engineering

ADVANCED TRANSFORMER INFRASTRUCTURE

ATI Data: Hawaiian Electric

Outage Notification



METERING LEADER SINCE 1904

TESCO

THE EASTERN SPECIALTY COMPANY

ADVANCED TRANSFORMER INFRASTRUCTURE

Forward & Reverse Energy Impacts

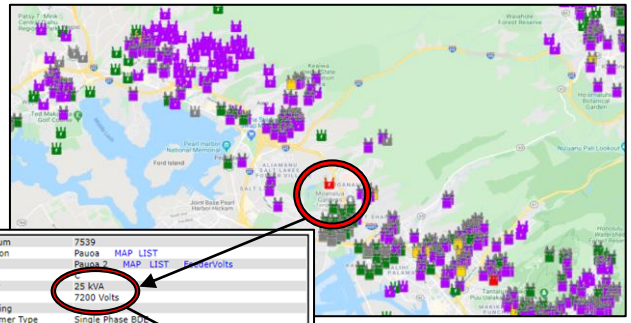
The combination of excessive Delivered & Received Energy can cause Transformer Overload and Premature Failure (i.e., accelerated End of Life & potential Asset Fires)

ATI Systems can also deliver:

Transformer Overload Awareness = Preventive Intervention

Asset Fires/Wildfires Prevention = Reduces Liability Risk

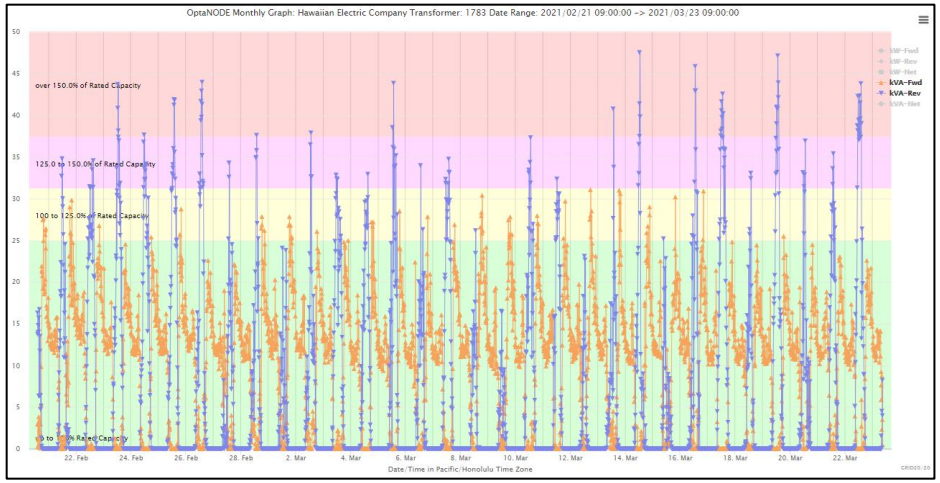
Improved Lineman & Public Safety = Reduces Liability Risk

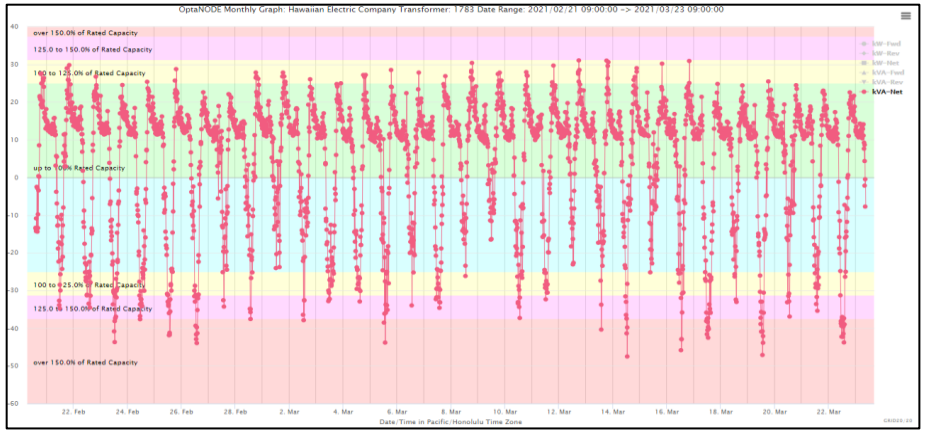


Serial Num	7539
Substation	Pauoa MAP LIST
Feeder	Pauoa 2 MAP LIST FeederVolts
Phase	3
Capacity	25 kVA
Primary	7200 Volts
Tap Setting	
Transformer Type	Single Phase PDE
Subtype	Split/Single Phase
Secondary	240 Volts Phase to Phase
Mount Type	Pole Mount
Priority Outage	Unsupported
OptaNODE DTM	DTM ID: 1603 DTMS000121151500201

-10:00 Last Reading: 2021/03/22 03:45 -10:00

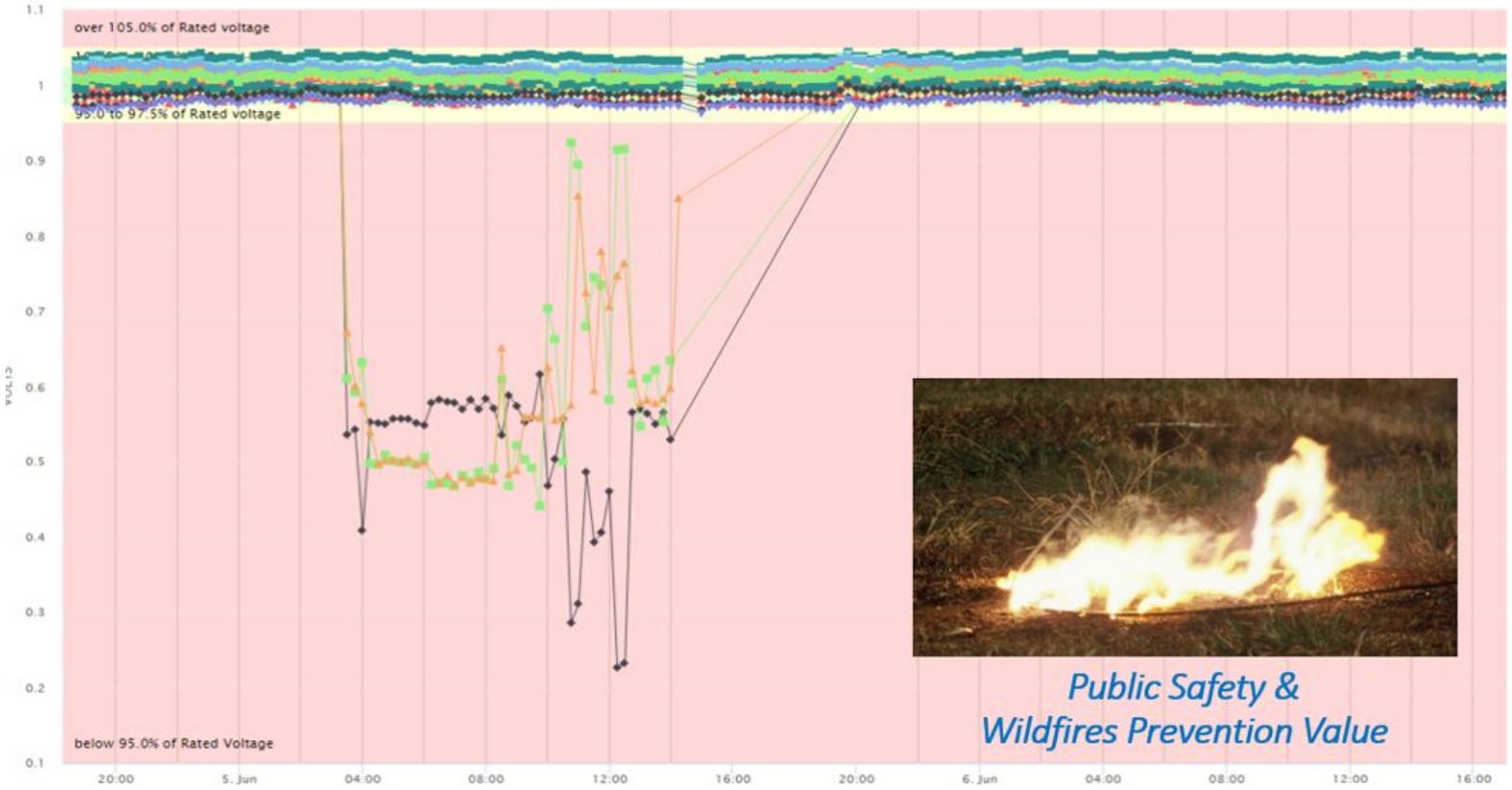
Interval Peak Demand	Now: 9.548 KW	Day: 22.024 KW	Month: 30.236 KW
Apparent Power	Register Total: 465163.111 KVAH		
Interval Consumption	Now: 3.113 KVAH	Day: 205.133 KVAH	Month: 6090.866 KVAH
Interval Peak Demand	Now: 12.452 KVA	Day: 23.048 KVA	Month: 31.072 KVA
Real Power Reverse	Register Total: 200201.950 KWH-REV		
Interval Consumption	Now: 0.000 KWH-REV	Day: 133.594 KWH-REV	Month: 3783.565 KWH-REV
Interval Peak Demand	Now: 0.000 KW-REV	Day: 35.188 KW-REV	Month: 47.284 KW-REV
Apparent Power Reverse	Register Total: 214727.607 KVAH-REV		
Interval Consumption	Now: 0.000 KVAH-REV	Day: 141.099 KVAH-REV	Month: 4107.582 KVAH-REV
Interval Peak Demand	Now: 0.000 KVA-REV	Day: 35.396 KVA-REV	Month: 47.524 KVA-REV
Reactive Power	Now: 1.998 KVARH	Day: 139.559 KVARH	Month: 4359.507 KVARH
Interval Peak Demand	Now: 7.993 KVAR	Day: 9.139 KVAR	Month: 10.559 KVAR
Power Factor	Now: 0.767	Day: 0.648	Month: 0.450
Average Voltage	241.9 V		
Maximum Voltage	Now: 242.4 V	Day: 247.7 V	Month: 248.7 V
Minimum Voltage	Now: 241.4 V	Day: 238.3 V	Month: 213.8 V
Average Current	51.2 A		
Maximum Current	Now: 63.1 A	Day: 211.9 A	Month: 221.0 A
Minimum Current	Now: 41.4 A	Day: 17.4 A	Month: 14.8 A
Temperature	33 °C / 91.4 °F		
Frequency	59.952Hz		
Power Failures	0 over the past 30 days		





ADVANCED TRANSFORMER INFRASTRUCTURE

Primary-side **Downed Conductor Detection**

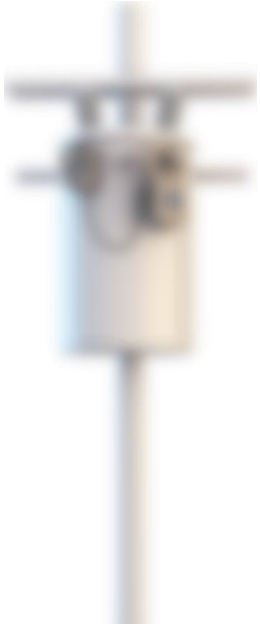


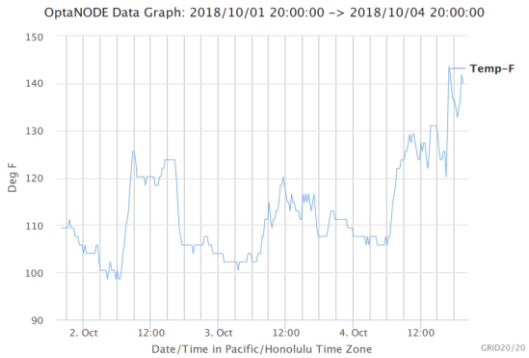
METERING LEADER SINCE 1904

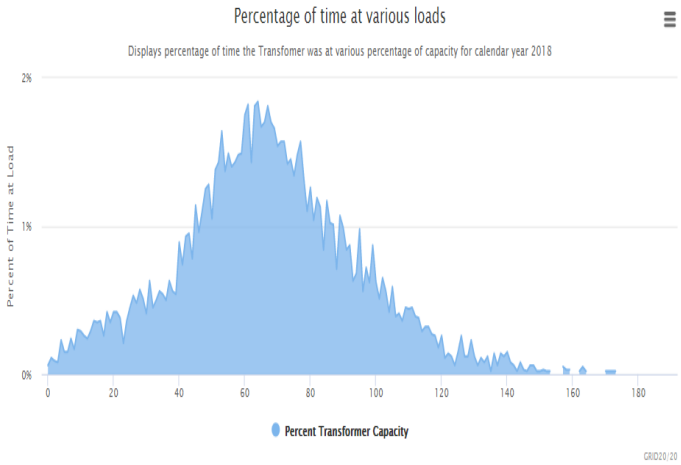
TESCO

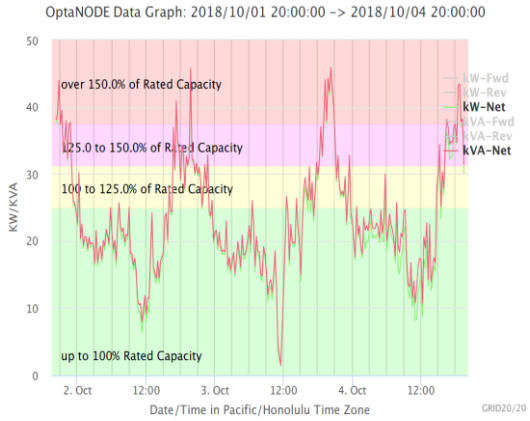
THE EASTERN SPECIALTY COMPANY

ADVANCED TRANSFORMER INFRASTRUCTURE







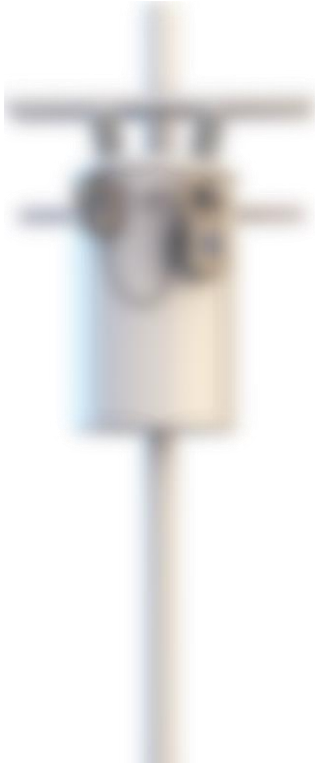


METERING LEADER SINCE 1904

TESCO

THE EASTERN SPECIALTY COMPANY

ADVANCED TRANSFORMER INFRASTRUCTURE



***Achieve Reliability Improvement**

*Provide Outage Notifications to Accelerate Restoration

***Reveal Unplanned Loading/Overloading**

*Facilitate Improved Fire/Wildfire Mitigation

***Identify Downed Conductor Events**

*Proactively Identify Failing Assets

***Reveal DER-Induced Voltage Fluctuations**

*Reveal & Document Reverse Energy Entering the Grid

***Facilitate Conservation Voltage Reduction**

*Identify Power Theft, Meter Inaccuracies & Bad Multipliers

***Facilitate Safe EV Charging Station & DER Adoption**

*Identify Improper Tap Settings

ADVANCED TRANSFORMER INFRASTRUCTURE

***Identify Harmful Phase Imbalances**

*Identify Energy Inefficiencies

***Assist with Clean Energy/Battery Storage Planning**

*Reveal GIS Mapping Errors

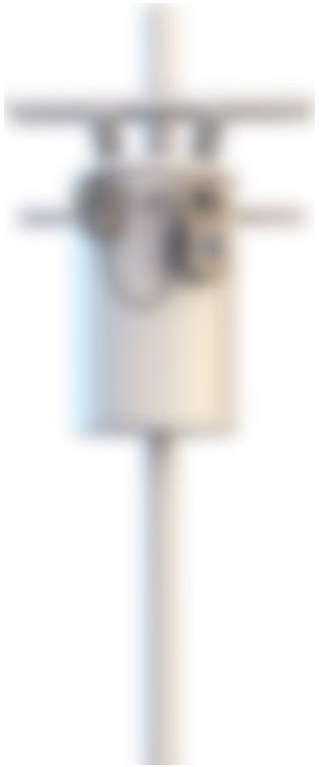
***Provide Automated Alerts = Hands Free Remote Grid Monitoring**

*Support API Calls

***Enhance Microgrids Monitoring**

*Facilitate Clean Energy Mandates = Reduce GHG Emissions

***Reduce Corporate Liability Risk**



QUESTIONS?

John Kretzschmar

SAMSCO

Spartan Armstrong Metering Supply Company

Boiling Springs, SC 29316

john@samscometering.com

864.590.2883

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