

Visualization of Field Equipment

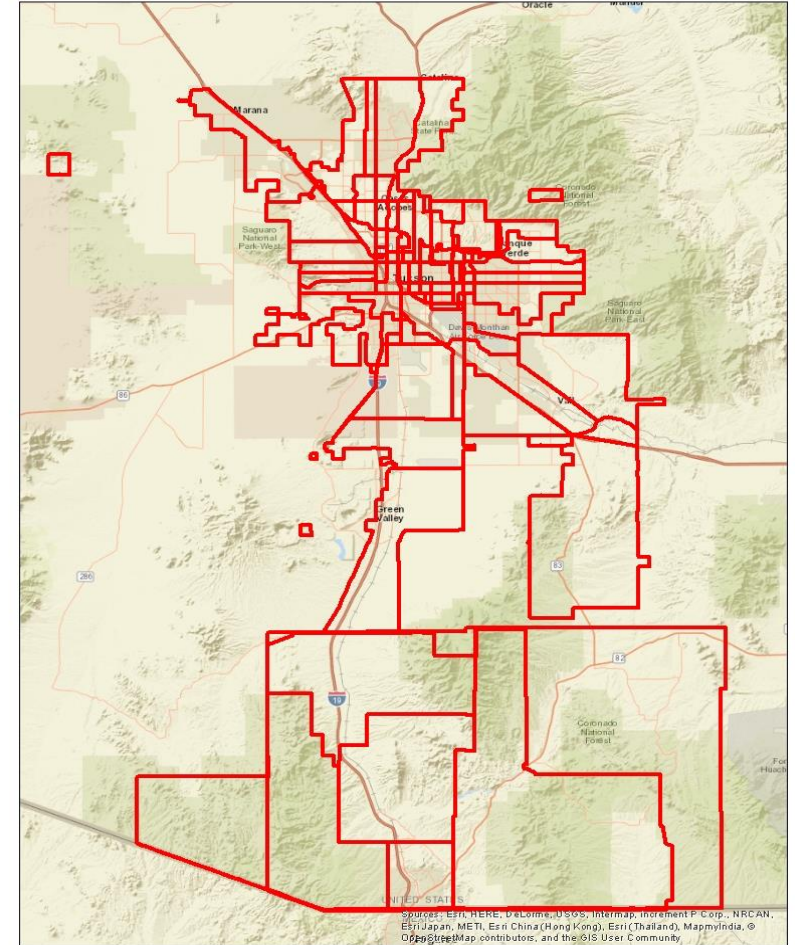
Doug Hood, Senior Associate Engineer

09/15/2016

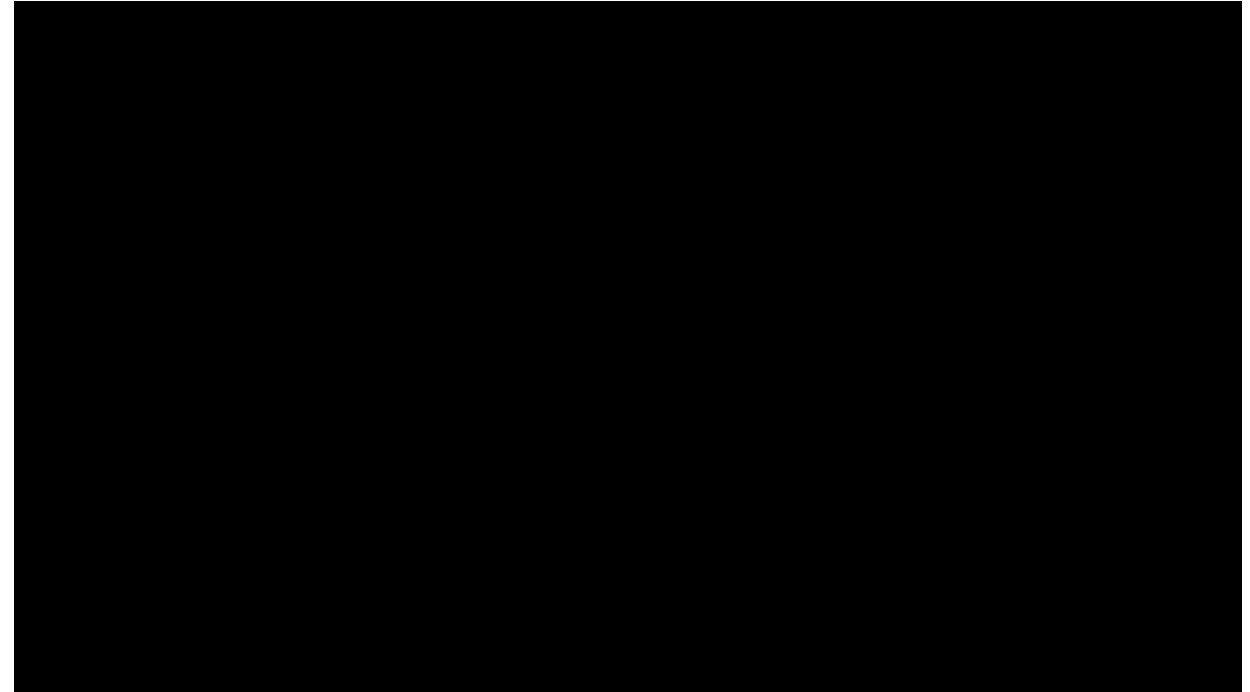
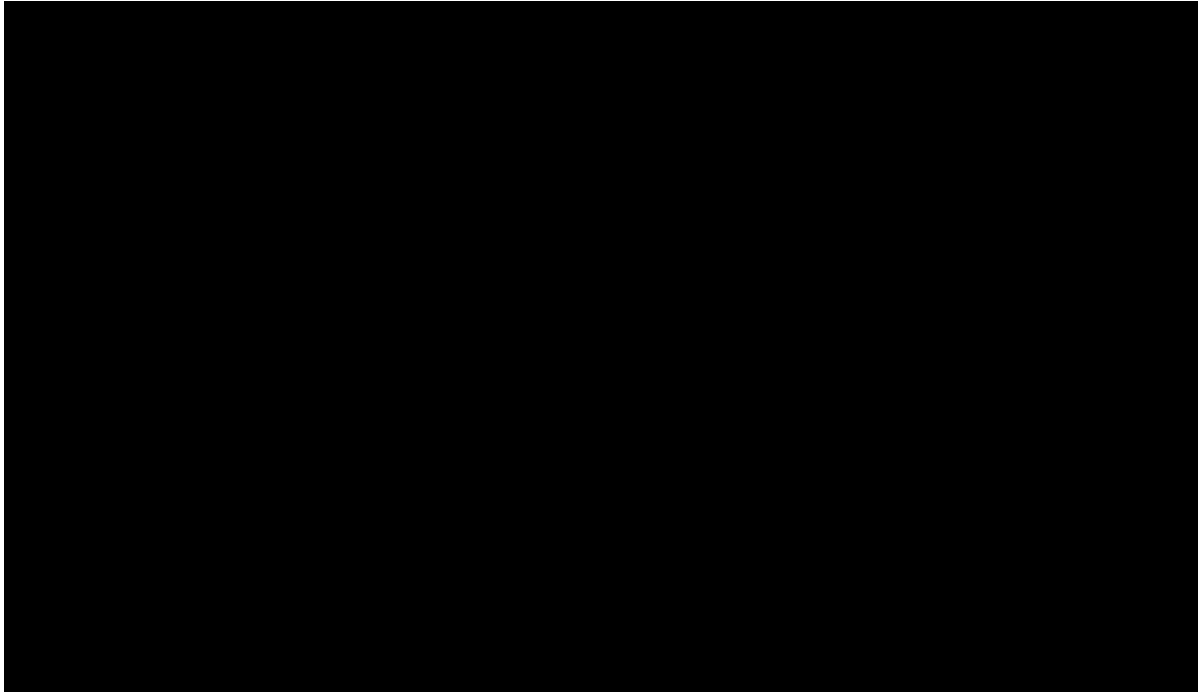


Tucson Electric Power

- Located in Tucson, AZ
- Over 420,000 customers
- Over 450 distribution circuits
- Transmission Voltages: 500kV, 345kV, and 138kV
- Distribution Voltages: 13.8kV and 4.2kV



Why should you visualize your data?



It's easier to see what is going on!

Our Initial Problem

- Lack of visibility on the distribution system
- Lack of landscape on system operators desk
- Lack of situational awareness

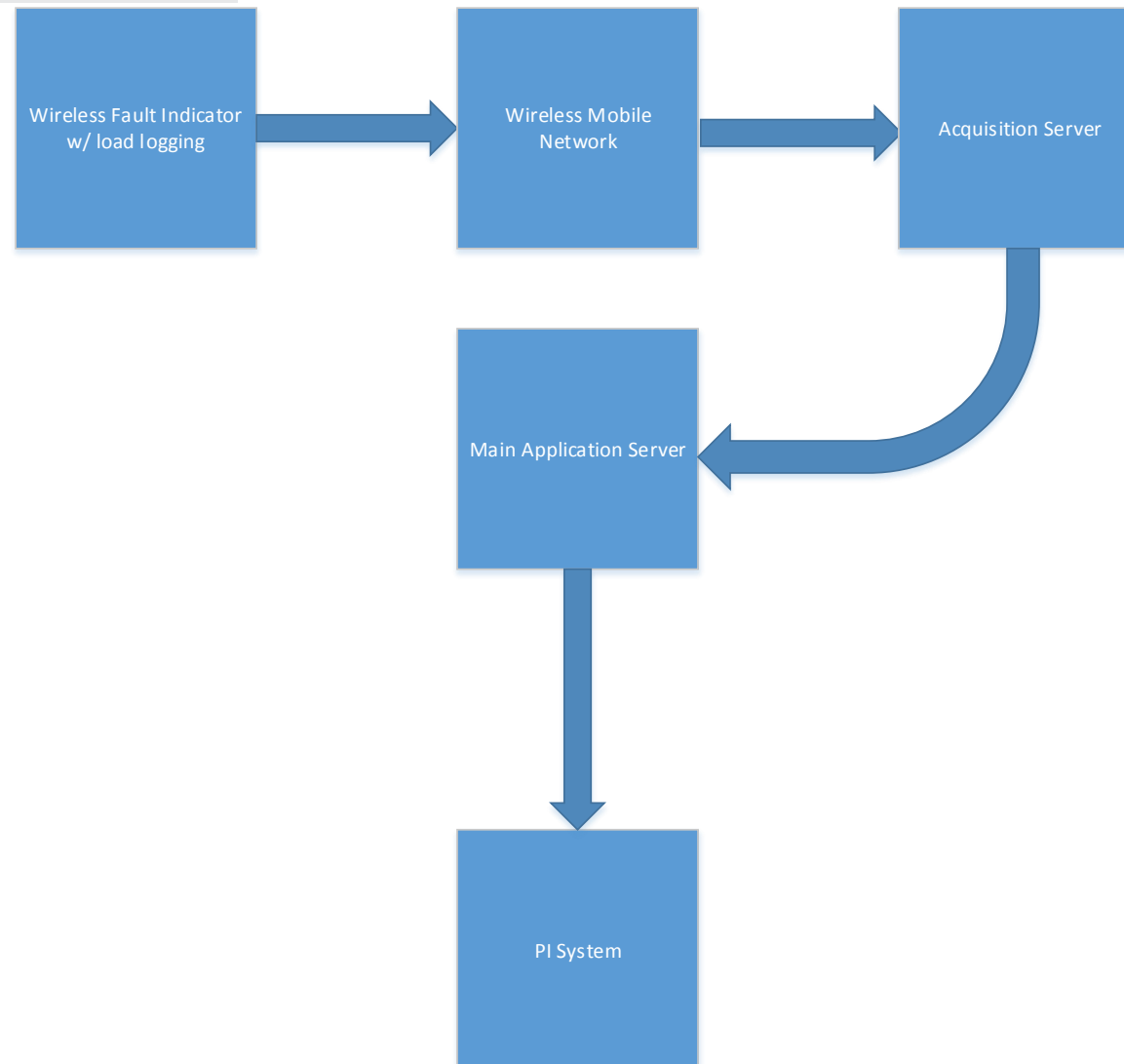


Implementation

- Procured wireless fault indicators with load logging capability
- First of its kind at Tucson Electric Power
 - No IT/IS roadmap on how to implement



Data Flow



Problem Solved? Nope.

- We have equipment deployed, but how do we solve our data problems?
 - Lack of visibility on the distribution system
 - Lack of landscape on system operators desk
 - Lack of situational awareness



PI To Save The Day!

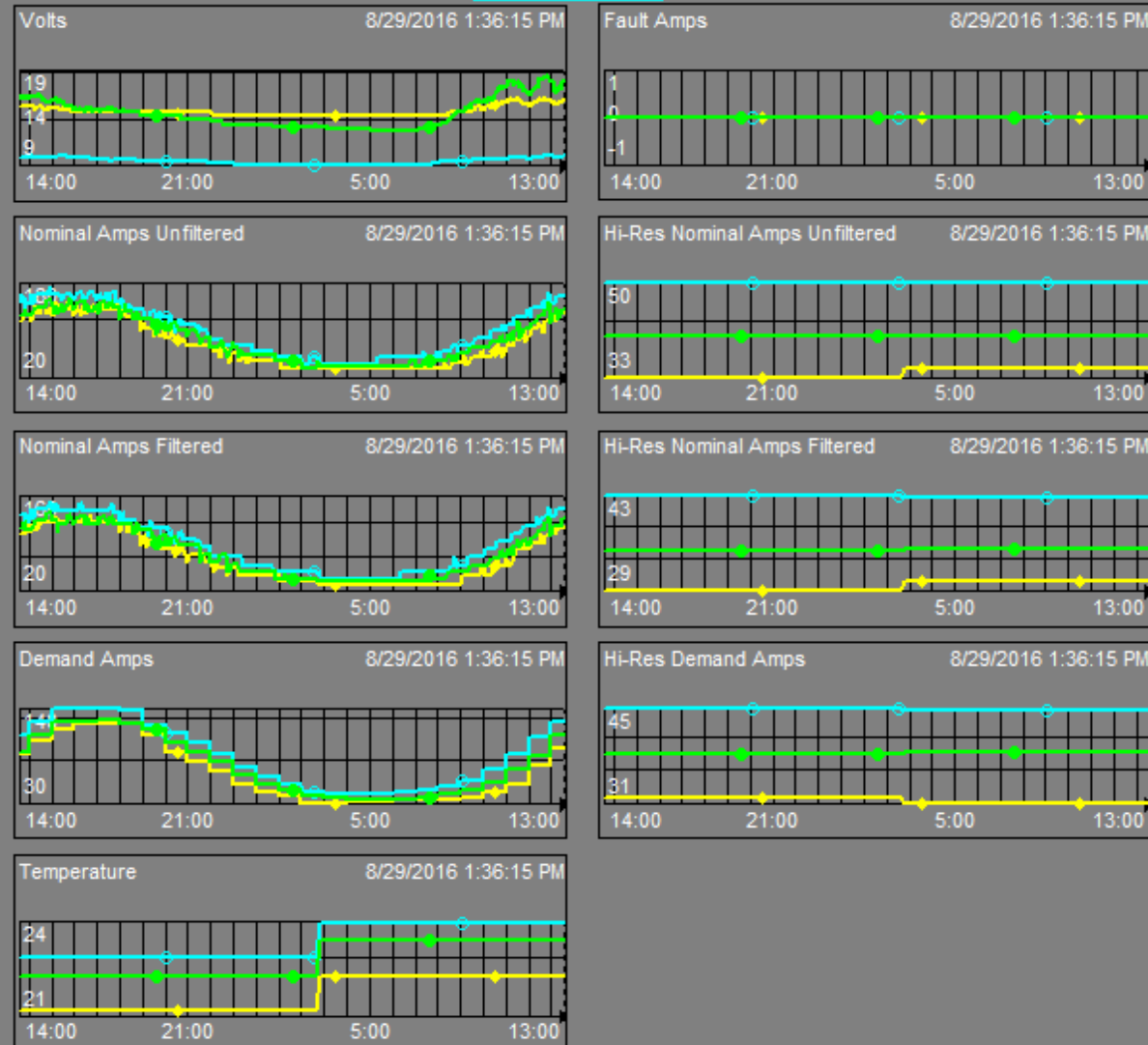
- Leverage existing system to increase distribution system visibility
- System Operators don't have to learn something new
- The PI system manages the data, so situational awareness is increased to users
 - Ability to **VISUALIZE** with PI Coresight and PI Processbook!

PI Processbook

CIRCUIT 1

Main Menu

Bopp Donald



Loss of Current Detected

CIRCUIT 1	CIRCUIT 2	CIRCUIT 3
PHASE A <input checked="" type="checkbox"/>	PHASE A <input checked="" type="checkbox"/>	PHASE A <input checked="" type="checkbox"/>
PHASE B <input checked="" type="checkbox"/>	PHASE B <input checked="" type="checkbox"/>	PHASE B <input checked="" type="checkbox"/>
PHASE C <input checked="" type="checkbox"/>	PHASE C <input checked="" type="checkbox"/>	PHASE C <input checked="" type="checkbox"/>

Battery Charger

CIRCUIT 1	CIRCUIT 2	CIRCUIT 3
PHASE A <input checked="" type="checkbox"/>	PHASE A <input checked="" type="checkbox"/>	PHASE A <input checked="" type="checkbox"/>
PHASE B <input checked="" type="checkbox"/>	PHASE B <input checked="" type="checkbox"/>	PHASE B <input checked="" type="checkbox"/>
PHASE C <input checked="" type="checkbox"/>	PHASE C <input checked="" type="checkbox"/>	PHASE C <input checked="" type="checkbox"/>

Low Power Mode

CIRCUIT 1	CIRCUIT 2	CIRCUIT 3
PHASE A <input checked="" type="checkbox"/>	PHASE A <input checked="" type="checkbox"/>	PHASE A <input checked="" type="checkbox"/>
PHASE B <input checked="" type="checkbox"/>	PHASE B <input checked="" type="checkbox"/>	PHASE B <input checked="" type="checkbox"/>
PHASE C <input checked="" type="checkbox"/>	PHASE C <input checked="" type="checkbox"/>	PHASE C <input checked="" type="checkbox"/>

Normal Power Mode

CIRCUIT 1	CIRCUIT 2	CIRCUIT 3
PHASE A <input checked="" type="checkbox"/>	PHASE A <input checked="" type="checkbox"/>	PHASE A <input checked="" type="checkbox"/>
PHASE B <input checked="" type="checkbox"/>	PHASE B <input checked="" type="checkbox"/>	PHASE B <input checked="" type="checkbox"/>
PHASE C <input checked="" type="checkbox"/>	PHASE C <input checked="" type="checkbox"/>	PHASE C <input checked="" type="checkbox"/>

Momentary Fault Detected

CIRCUIT 1	CIRCUIT 2	CIRCUIT 3
PHASE A <input checked="" type="checkbox"/>	PHASE A <input checked="" type="checkbox"/>	PHASE A <input checked="" type="checkbox"/>
PHASE B <input checked="" type="checkbox"/>	PHASE B <input checked="" type="checkbox"/>	PHASE B <input checked="" type="checkbox"/>
PHASE C <input checked="" type="checkbox"/>	PHASE C <input checked="" type="checkbox"/>	PHASE C <input checked="" type="checkbox"/>

Sustained Fault Detected

CIRCUIT 1	CIRCUIT 2	CIRCUIT 3
PHASE A <input checked="" type="checkbox"/>	PHASE A <input checked="" type="checkbox"/>	PHASE A <input checked="" type="checkbox"/>
PHASE B <input checked="" type="checkbox"/>	PHASE B <input checked="" type="checkbox"/>	PHASE B <input checked="" type="checkbox"/>
PHASE C <input checked="" type="checkbox"/>	PHASE C <input checked="" type="checkbox"/>	PHASE C <input checked="" type="checkbox"/>

Total Fault Counts

CIRCUIT 1	CIRCUIT 2	CIRCUIT 3
PHASE A 1	PHASE A 0	PHASE A 2
PHASE B 0	PHASE B 1	PHASE B 0
PHASE C 0	PHASE C 1	PHASE C 1

Sustained Fault Counts

CIRCUIT 1	CIRCUIT 2	CIRCUIT 3
PHASE A 1	PHASE A 0	PHASE A 0
PHASE B 0	PHASE B 0	PHASE B 0
PHASE C 0	PHASE C 0	PHASE C 0

Momentary Fault Counts

CIRCUIT 1	CIRCUIT 2	CIRCUIT 3
PHASE A 0	PHASE A 0	PHASE A 2
PHASE B 0	PHASE B 1	PHASE B 0
PHASE C 0	PHASE C 1	PHASE C 1

AC Loss Counts

CIRCUIT 1	CIRCUIT 2	CIRCUIT 3
PHASE A 13	PHASE A 22	PHASE A 21
PHASE B 15	PHASE B 22	PHASE B 22
PHASE C 14	PHASE C 22	PHASE C 21

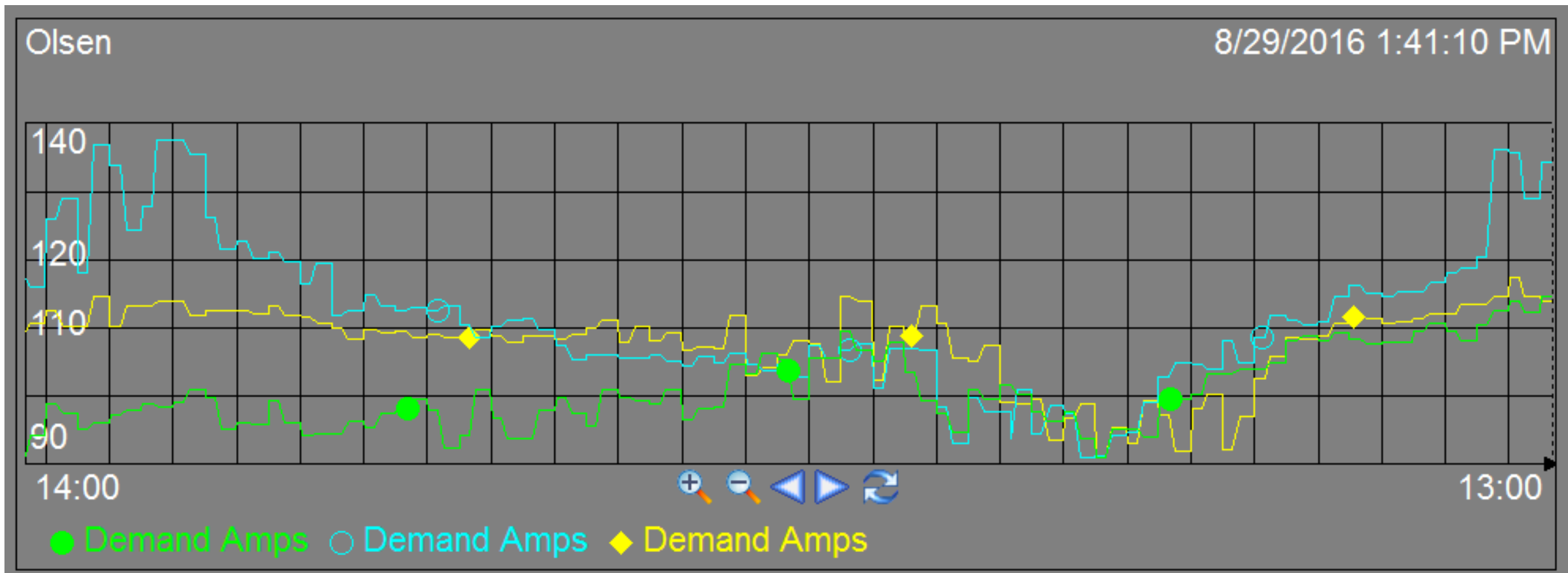
AC Restore Counts

CIRCUIT 1	CIRCUIT 2	CIRCUIT 3
PHASE A 18	PHASE A 25	PHASE A 22
PHASE B 19	PHASE B 29	PHASE B 24
PHASE C 17	PHASE C 26	PHASE C 25

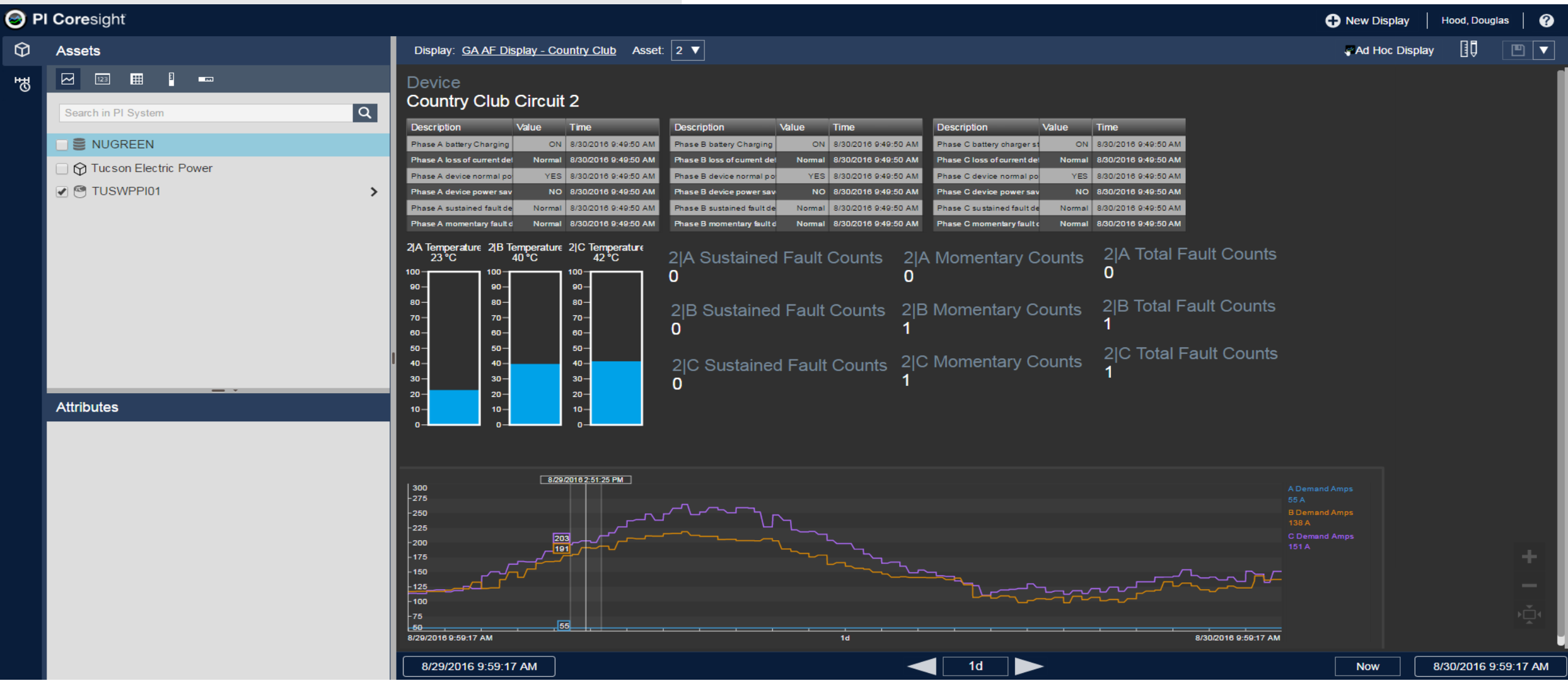
Di/Dt Counts

CIRCUIT 1	CIRCUIT 2	CIRCUIT 3
PHASE A 3	PHASE A 0	PHASE A 2
PHASE B 0	PHASE B 1	PHASE B 0
PHASE C 0	PHASE C 1	PHASE C 1

PI Processbook



PI Coresight



Enhancing Data Visualization from Field Equipment

“There is a magic in graphs. The profile of a curve reveals in a flash a whole situation — the life history of an epidemic, a panic, or an era of prosperity. The curve informs the mind, awakens the imagination, convinces.” – Henry D. Hubbard

Doug Hood, Tucson Electric Power



CHALLENGES

TEP had a **lack of visibility** on our 4kV system. The lack of visibility on utility systems lead to **the lack of situational awareness** which impacts system operations, short and long term planning. Though with the addition of systems to fill gaps, system operators can be inundated with the **lack of computer landscape**.

SOLUTION

Leverage the existing PI System via DNP connections to store the data flowing into our system. Since data is being stored in the PI System, we can now **visualize and monitor using PI Processbook and PI Coresight**. System Operators and Planners now have a **robust tool** for system operation.

RESULTS

Improved system planning and monitoring of distribution system.

Improved data analysis as visualization improves the understanding of situational awareness.

Improved quality of life for System Operators.

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Tucson Electric Power



Thank You



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