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Analytics in Action: Manage Your Grid with Smart Meter Data

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Make the most of your smart meter

Of the 26 utilities with AMI in place, only one — Portland General Electric in Oregon — was engaging in all of the AMI businesses cases defined by ACEEE as of late 2018. Those include residential and commercial customer web portals that offer near-real-time data, data disaggregation for key end uses, behavioral tools like goal-setting, and connections to energy-efficiency programs.

We've written at GTM Squared about PGE's innovation work tapping the "distributed flexibility" of its residential, small business and midsize commercial-industrial customers to for a key part of its future resource mix. These kind of capabilities are built on the data analysis and customer communications systems enabled by its 2011 AMI deployment.

PGE didn't get to this end state by accident. Gold noted. The utility created a new department to disseminate this data throughout the utility, she said, with "a couple of staff members whose responsibility is to the the AMI data as it comes in, make it clean, and present it to those who need it."

AMI Use Cases

Visibility

Reliability

Cost Saving

Security

Customer Relations

Control

Operations

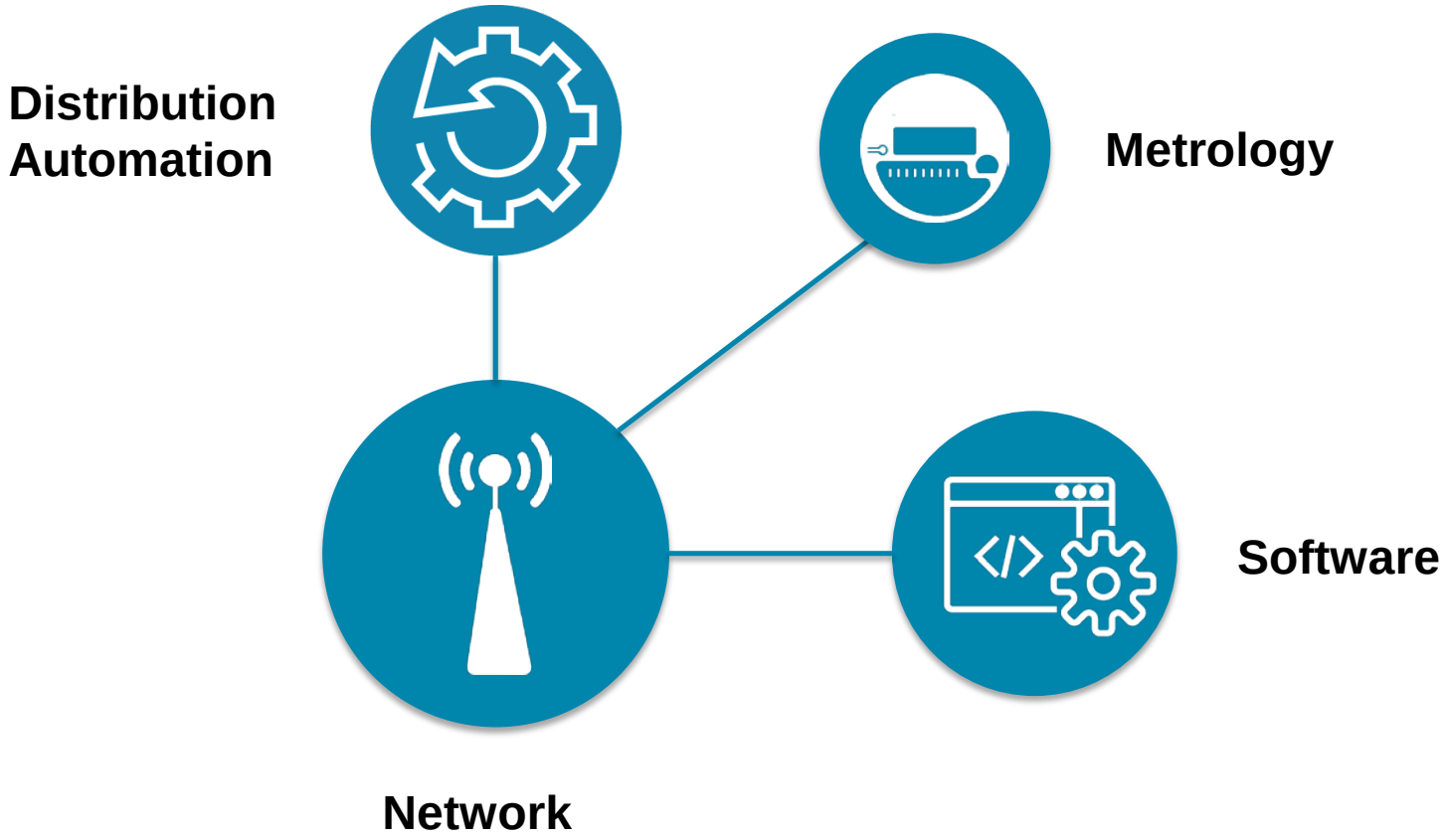
Safety

Agenda

Provide a better understanding of how smart meter data and analytics can be used to actively manage the grid.

- AMI Architecture
- Meter Data
- CVR (Fayetteville PWC exp.)
- Outage Management (FPWC)
- Asset Management
- Phase Detection

AMI Architecture



Meter Data

Data

Inst. Voltage
Inst. Current
Average Voltage
Switch Status
Active Power
Reactive Power
Power Status
Demand (Peak)
Alarms
Etc…

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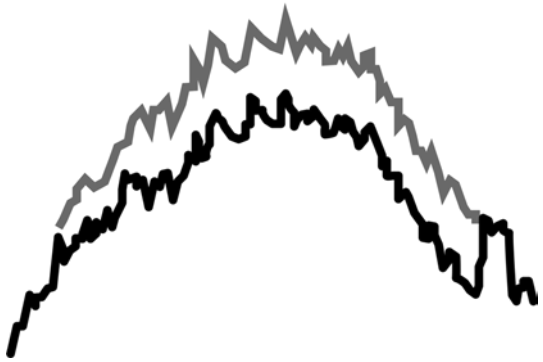
Conservation Voltage Reduction



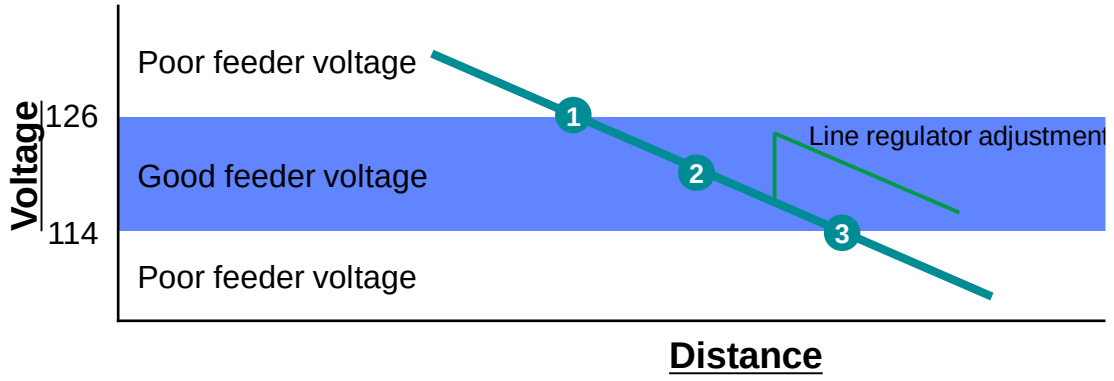
Conservation Voltage Reduction

Comments

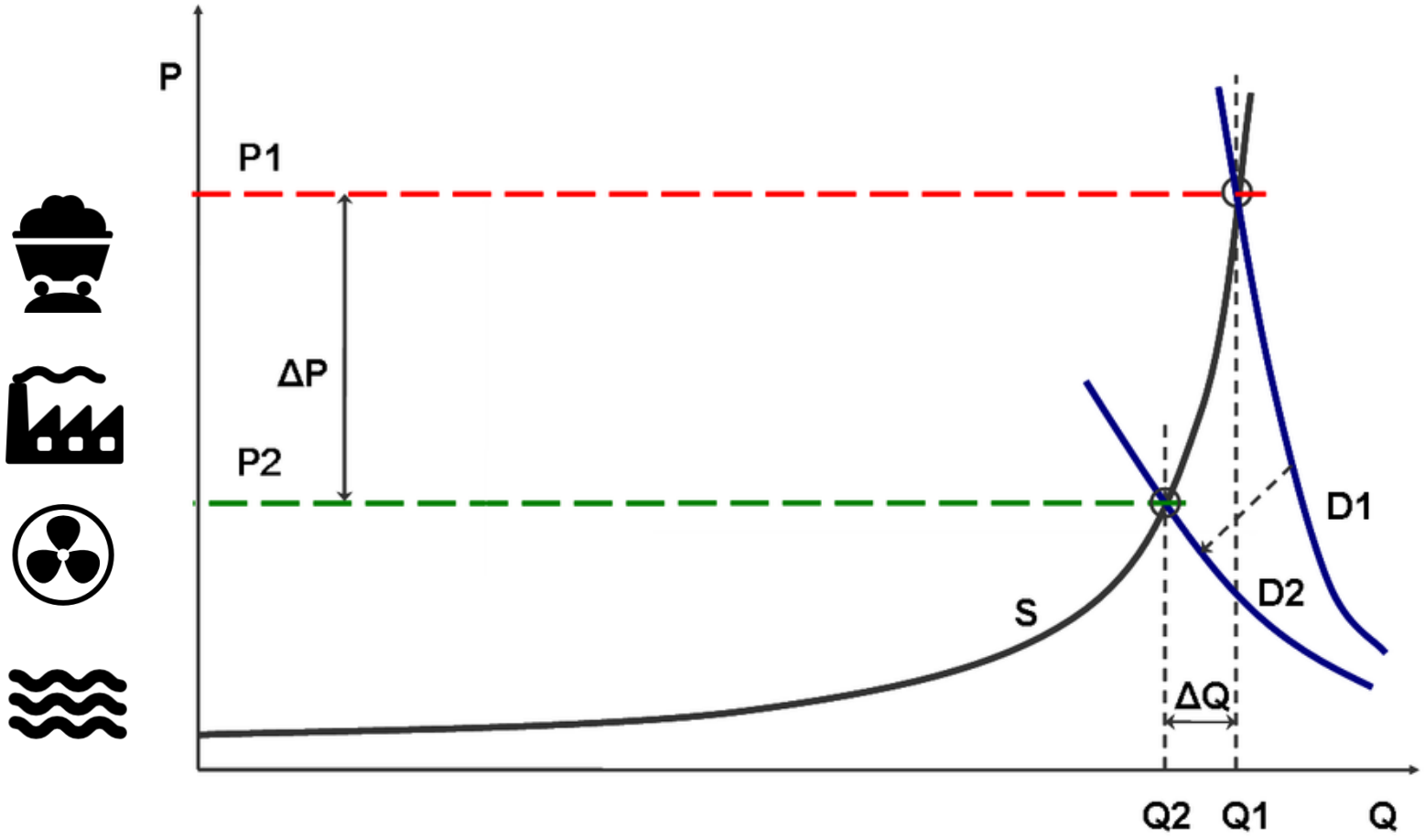
Same benefits as Demand Response without customer impact

Substantial Utility Savings

CVR Overview



Conservation Voltage Reduction

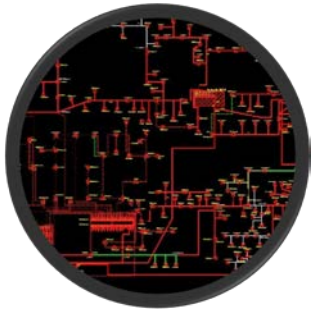


CVR Components

Meter

CVR Algorithm

Voltage Insight



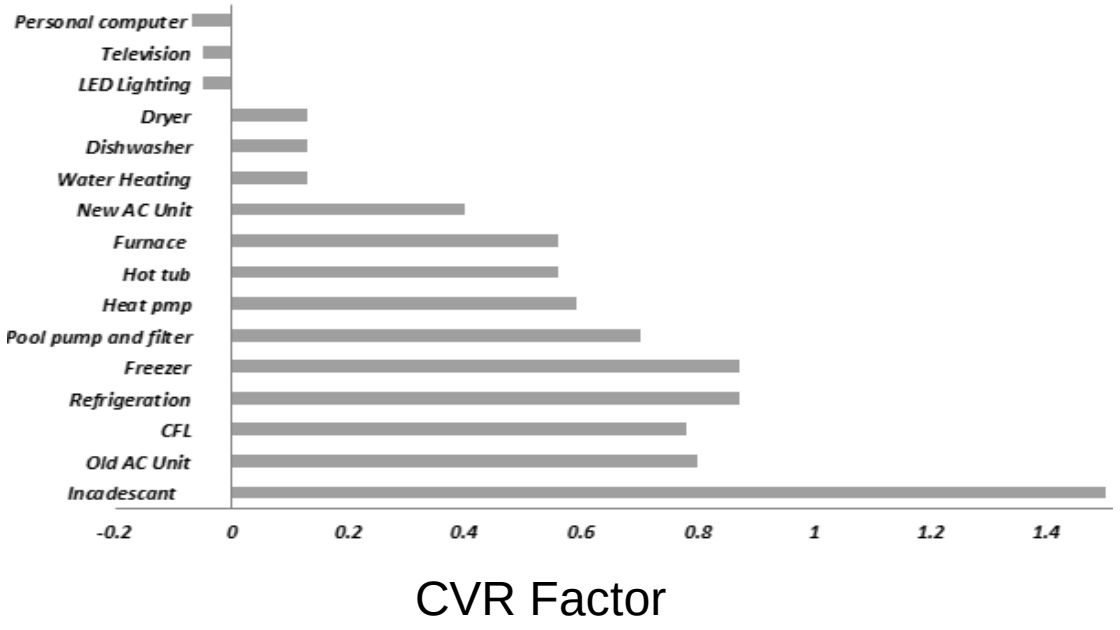
SCADA

DA Comms

Distribution Equipment

FPWC Approach

- Initiate a CVR study
  - Determine eligibility based on CVR factor (.8 factor from University of Arkansas study)
  - Identify the lowest bus sending voltage
- Everything is bus regulated (no assets down the feeder)
- Average feeder length is 3 miles
- Remote access via fiber to the LTC
- Run CVR from SCADA
  - Calls a script which sends out the appropriate set points
  - LTC set for 118V to 116V with most at 117.5V
- Been doing this for 5 years
  - Started leveraging the meters in past 7-8 months



So why AMI?

FPWC Approach

- The data from the meter it is helping to identify if they can still maintain without violating ANSI limits.
- Meters allow you to fine tune your set points across different periods of time.
- 1 Minute voltage averages sent every 5 minutes
- Voltage thresholds for alarming

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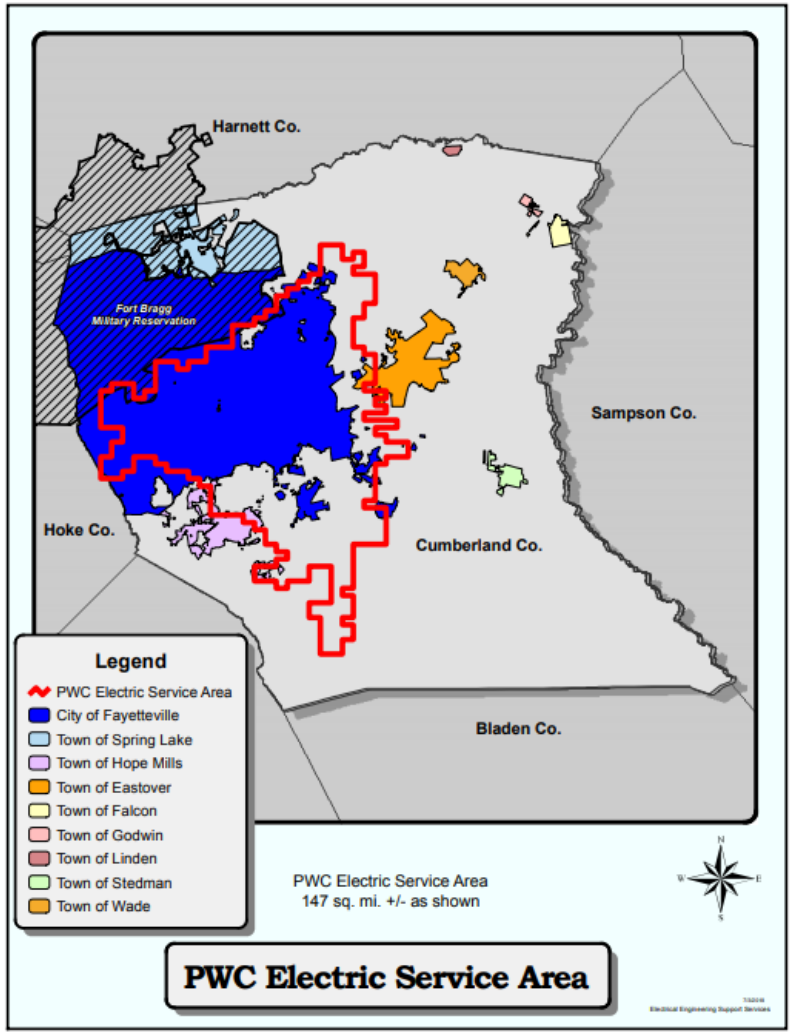
FPWC Approach

- Reduces the demand charge that they pay to Duke. Shaving 10MW from 400MW peak at $20kW is $200k.
  - This savings can be rolled back into the utility.
  - CVR is not tied to the rate structure and if you can keep it that way you can use the money to Invest into other technology.
- Unless they know the system is near normal condition they will not go into voltage reduction.
- They will consistently monitor and update based on what they discover as the run the tool. Don't typically change scripts/set points until after the event is complete.
- Continuously monitor to make sure you are in bounds. Meters have the brownout alarms to help with that.
- Run it on a monthly basis
- When they get the signal from electricities they take action
  - Signal typically sent out 24 hours in advance but may only be 3-4 hours



Outage Management Solution

Leverage power fail/restore alarms

View current outages

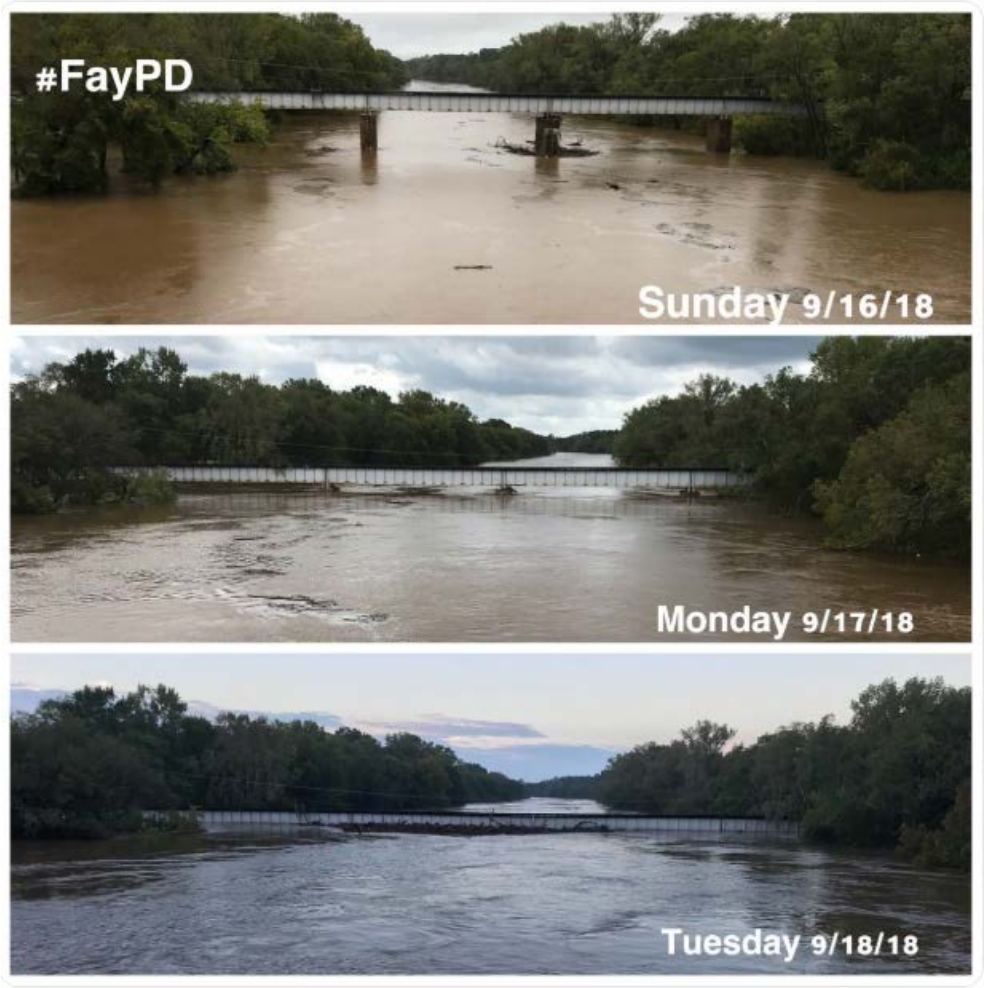
Prioritize where crews are sent

Verify that services are restored

Reduce outage time with better information

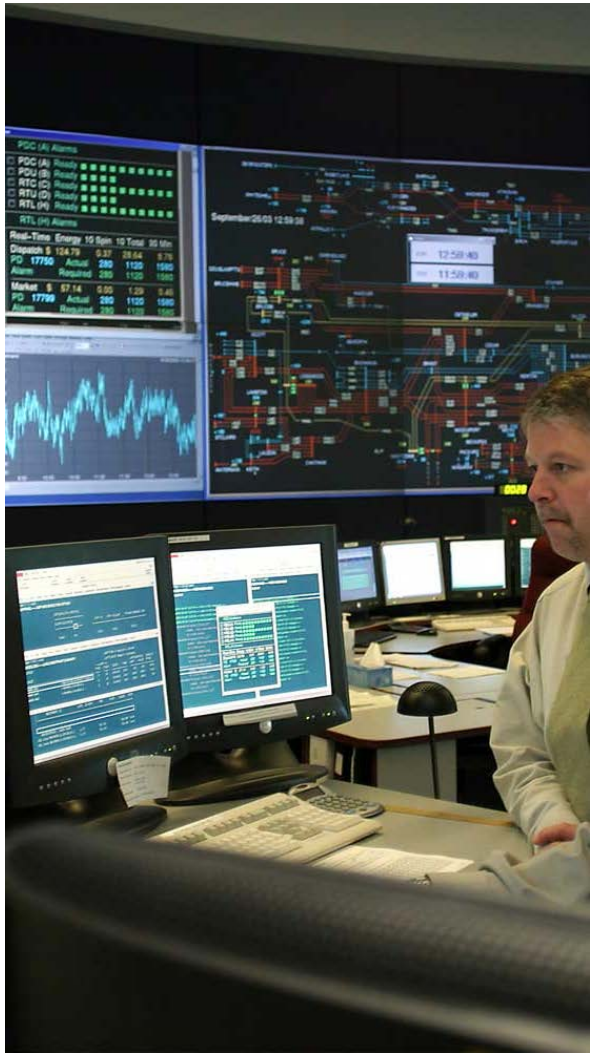
Hurricane Florence

- 15 of 35 substations lost service.
- Mutual aid workers from Alabama, Georgia and Tennessee offered additional help with downed powerlines and trees toppled on homes.
- 97% of customers who had lost power were back up-and-running within 96 hours.
- Fayetteville PWC was also able to keep the damage of Florence from impacting public safety during relief efforts thanks to the accuracy of the system. Utility crews completed the restoration process with no reports of injuries.



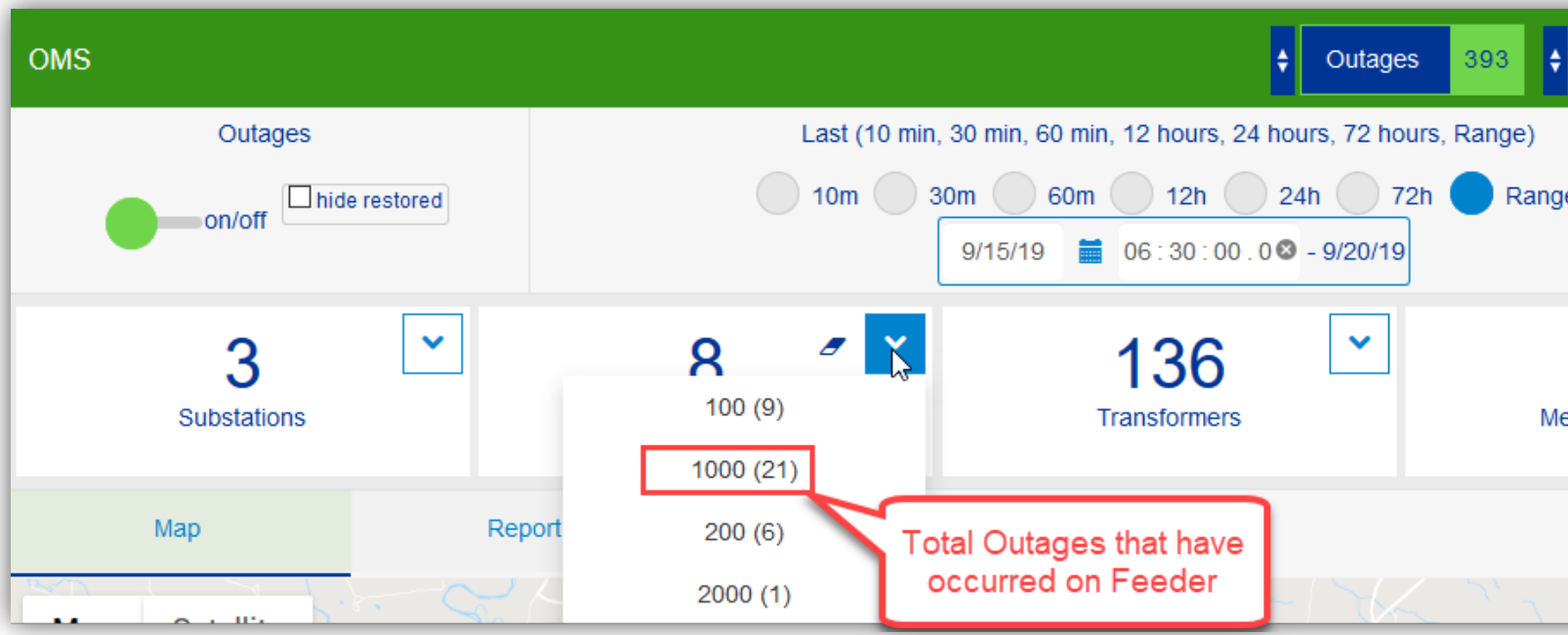
FPWC Outage Strategy

- Use meters to pinpoint where they need to go.
- One person acts as bird dog ands perform damage assessment.
- Individual in control room is reviewing multiple screens, looking at OMS light, checking out the SCADA screen, and taking in feedback from the field and helping to coordinate.
- Fiber to all the subs and distribution breakers, fiber to reclosers as well as some critical switches. All breakers (100%), reclosers (25%), switches (25%)
  - Meters give insight into the DA equipment that you don’t have eyes on.
  - Meters help fill the gap where fiber hasn’t been run.



AMI Outage Considerations

- Fuse save or fuse blow?
  - FWPC is a fuse save utility. Need to program meter outage times to coordinate with recloser sequence to avoid false outage notifications. The meters are programmed for 120S.
- Connectivity models
- Restoral messages



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Asset Management

Estimate load with interval data

Identify overloaded assets

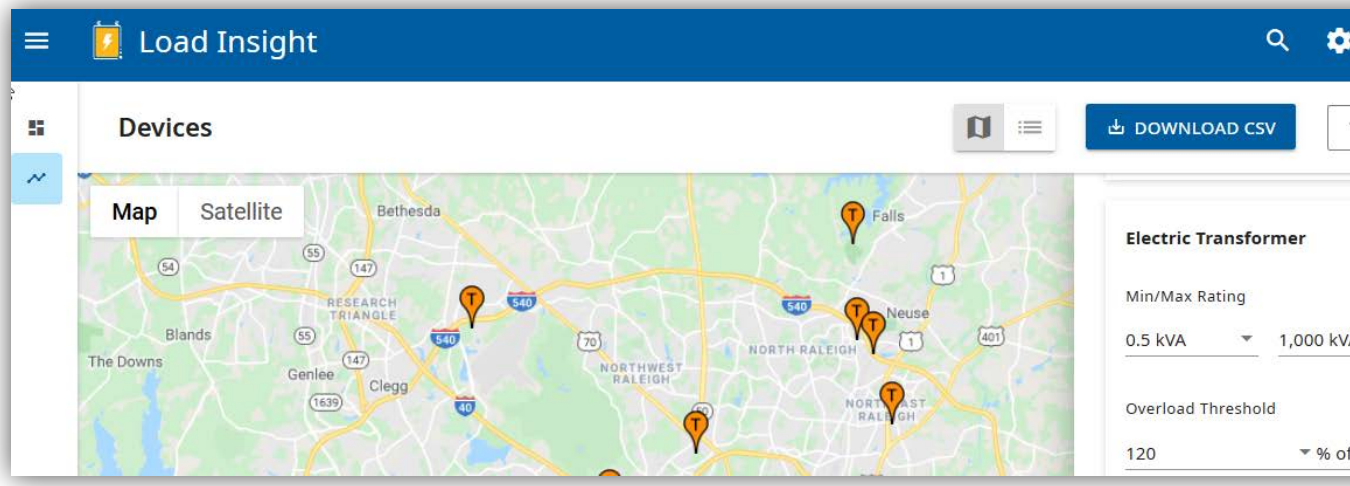
Avoid outages

Prioritize investments

Monitor assets without any new infrastructure

Key Considerations

- No additional infrastructure
- Reliable connectivity models
- Need reliable data
- Need long horizons for evaluating underloaded assets



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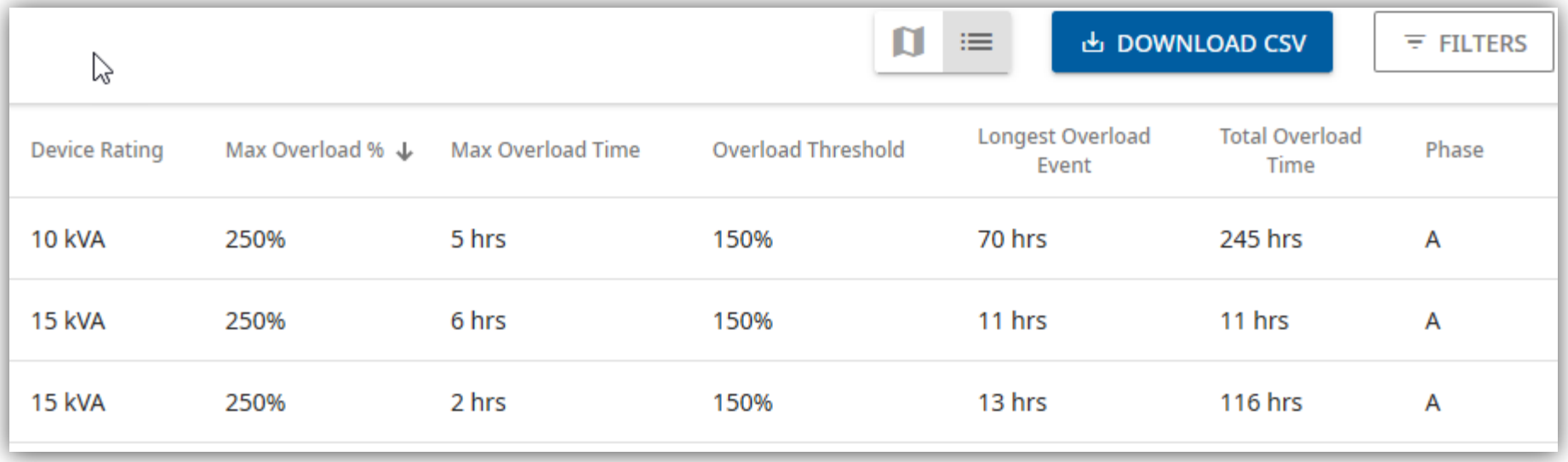
Example: Overloaded Transformers Report

Loading summary over weeks, months, or years

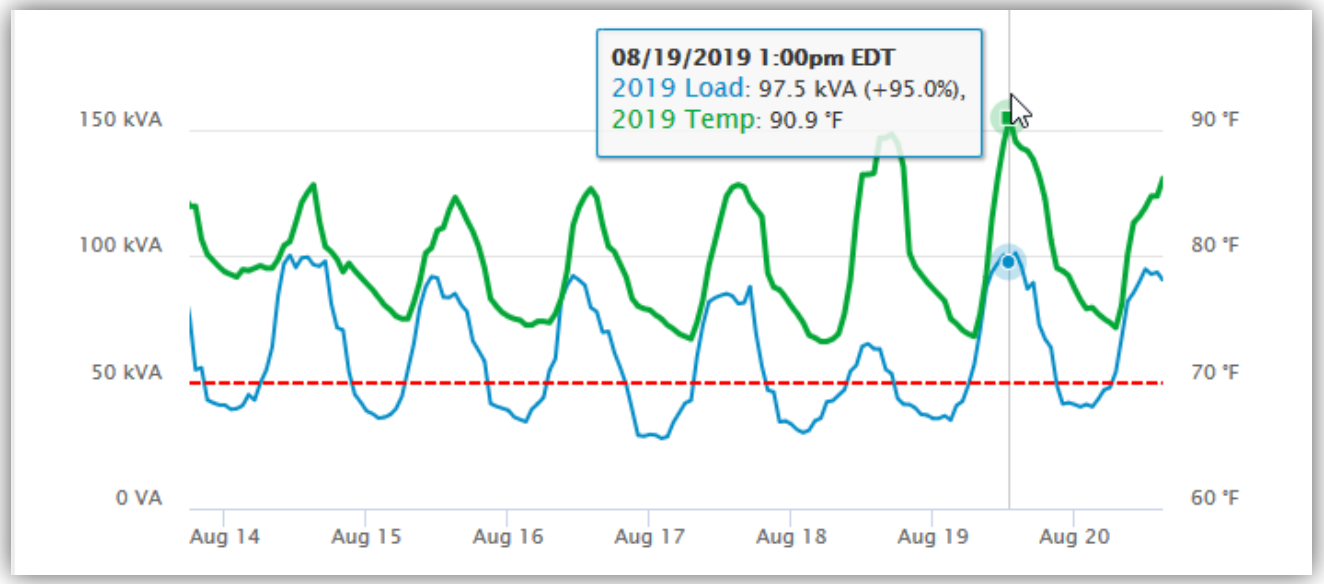
Sort assets with highest risk of aging or failure



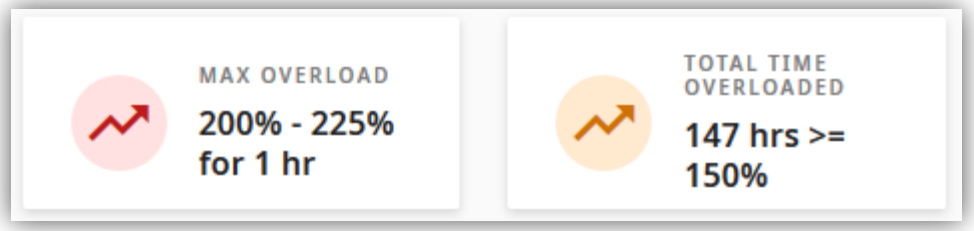
Device Rating	Max Overload % ↓	Max Overload Time	Overload Threshold	Longest Overload Event	Total Overload Time	Phase
10 kVA	250%	5 hrs	150%	70 hrs	245 hrs	A
15 kVA	250%	6 hrs	150%	11 hrs	11 hrs	A
15 kVA	250%	2 hrs	150%	13 hrs	116 hrs	A

Example: View Loading History

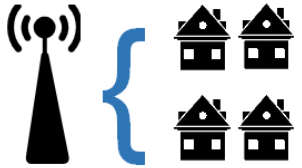
Load graph with temperature



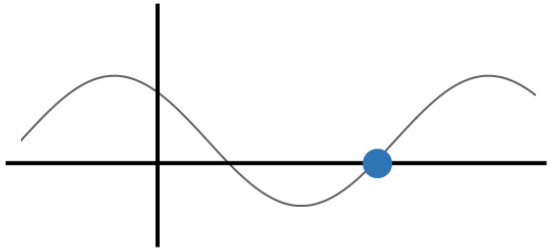
Loading summary



Phase Detection

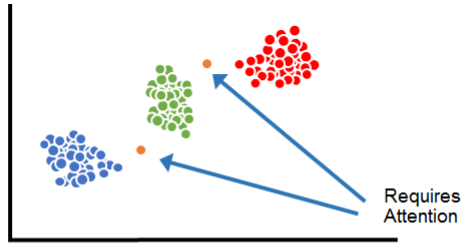


1 Tower Sends Synch Byte to Meters



2 Meter Measures to Next Zero Crossing

3 Meter Transmits Data Back to Tower



4 Group Like Items, Align Phase Offsets, Compare Against Reference Meter

Utility Benefits

Asset Management
CVR
Phase Balancing
System Planning
Outage Management

Key Considerations

Time to identify
Maintain system of record

Questions

Questions?