



2021

**Grid of the
Future**

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**Volt-VAR Optimization
GOTF Interoperability**

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Agenda

Introductions

Why VVO?

- Overview of benefits of VVO

What is VVO?

- Voltage and VAR Optimization

How VVO Works

- High level overview of how VVO works
- VVO Suppliers; Utilities using VVO

VVO Interoperability

- How does VVO work with other Grid Mod Initiatives?
- Interactions and Operation





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Why VVO?

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Why VVO?

Efficiency Supporting Reliability

Energy
Efficiency

System
Wide
Visibility

Improved
Reliability

DOE 6 Key Topics of Grid Mod

Resilience

Reliability

Security

Affordability

Flexibility

Sustainability

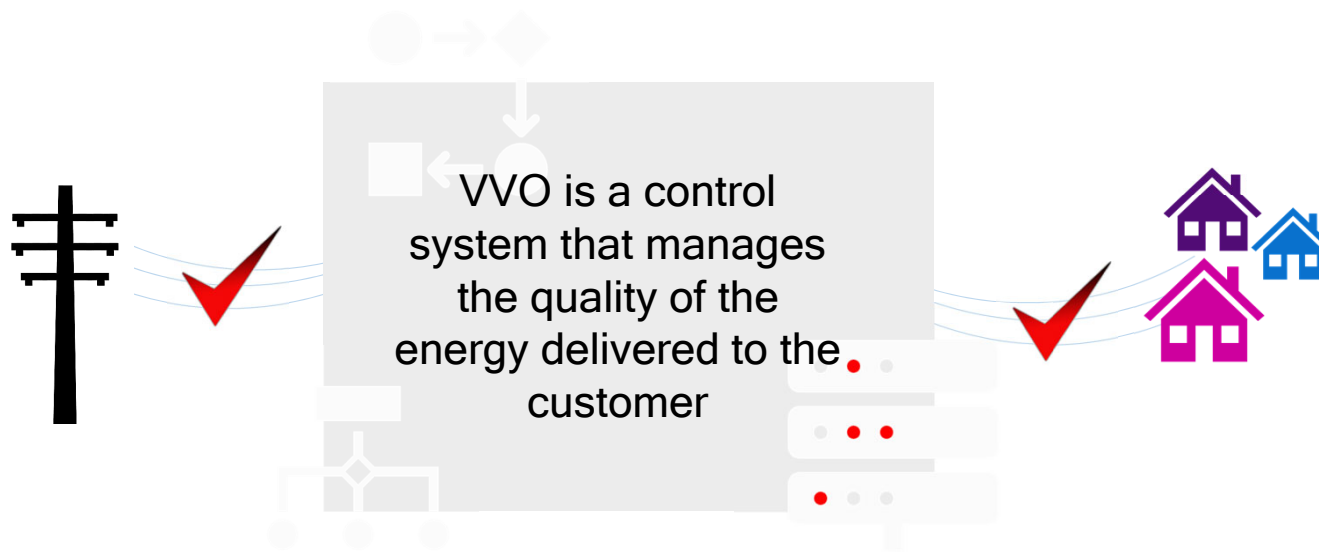


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What is VVO?

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What is VVO?



The Goal

By monitoring and controlling the voltage and VAR **from end to end**, we create a **unified** system that manages power flow and leads to Improved Efficiencies and Improved reliability.

Slide 6

GC6

Not sure how you would like to incorporate the Nest thermostat analogy. Maybe after the top part - then introduce it correlating the monitoring of temps, changes in weather, learning aspect of it to aspects of the grid/VVO, then we can summarize with the text on the lower half

Also - your narrative emphasized 'integration' of devices, assets, capacitors, regulators - capturing all data simultaneously...leading to a better signal, max power, lower voltage. I assume your narrative will still cover this and think this graphics will hold up but we may want to tweak the bottom text to mirror and flow with the narrative better

Gowland, Christopher, 11/12/2020

What is VVO?

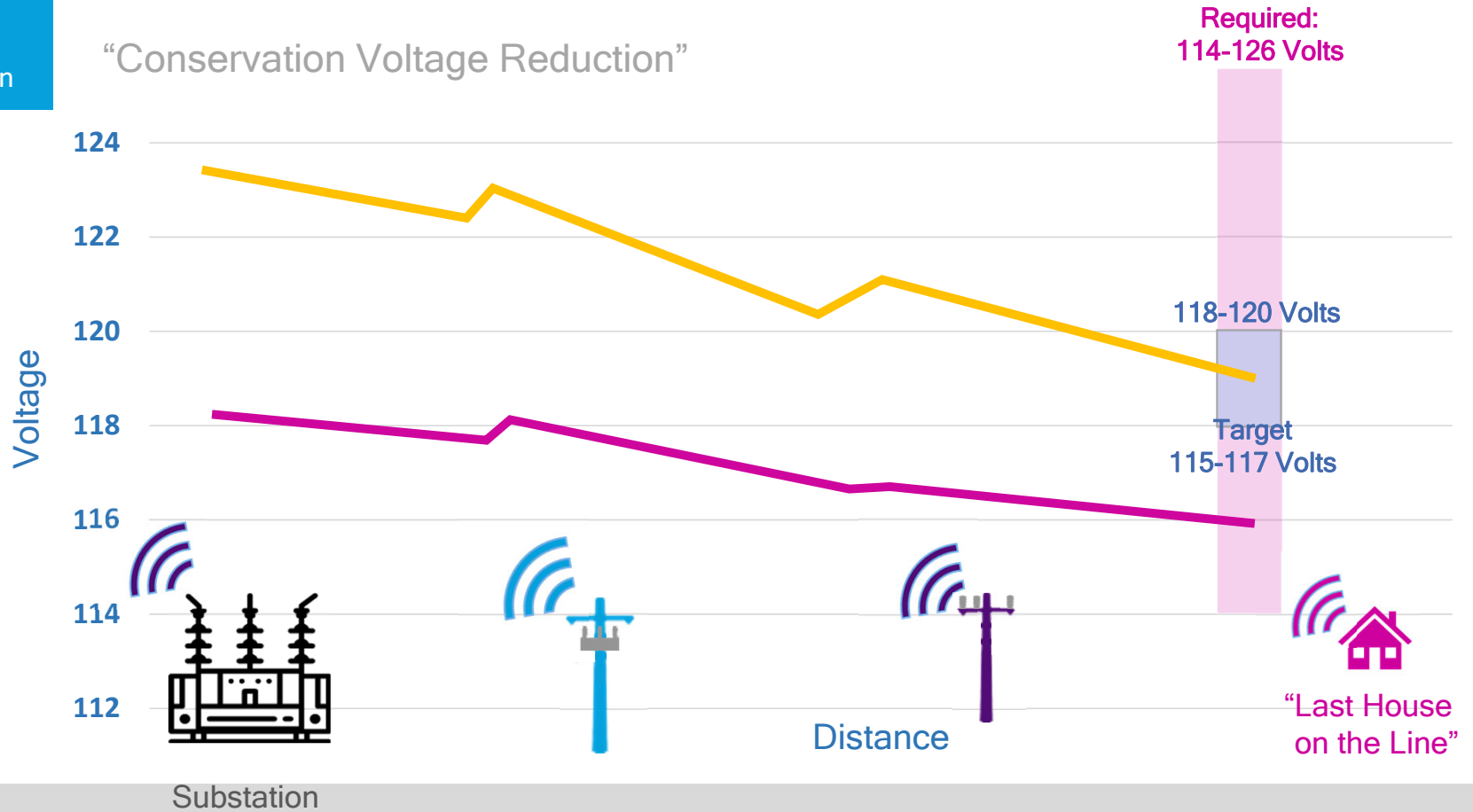
2 Components of VVO

Voltage
~~Optimization~~
Reduction

VAR
~~Optimization~~
Control

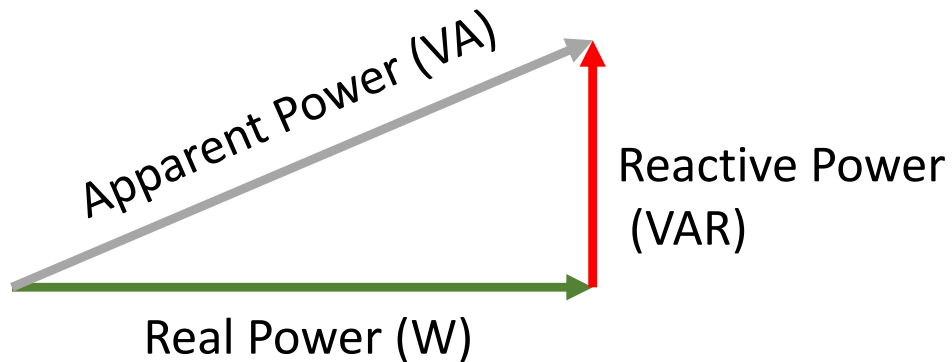
What is VVO?

Voltage Optimization



What is VVO?

VAR Optimization

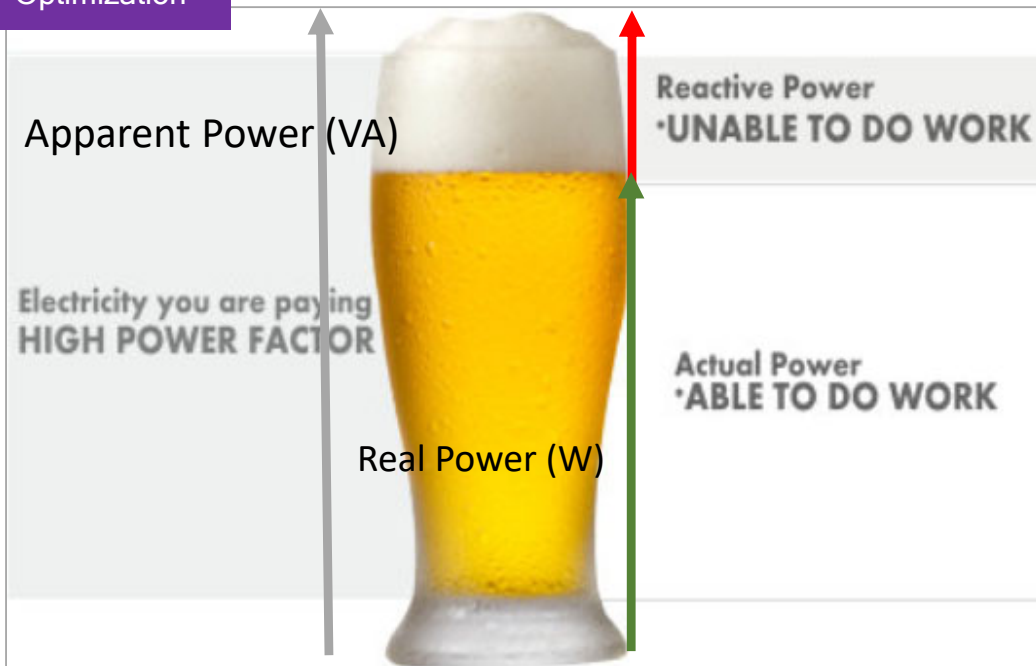


- Real (“Actual”) Power does the work
- **Reactive Power** is created by inductors
- **Real** and **Reactive** Power combined is Apparent Power

VAR Illustration

What is VVO?

VAR Optimization



VAR Illustration

- Real (“Actual”) Power does the work
- Reactive Power is created by inductors
- Real and Reactive Power combined is Apparent Power

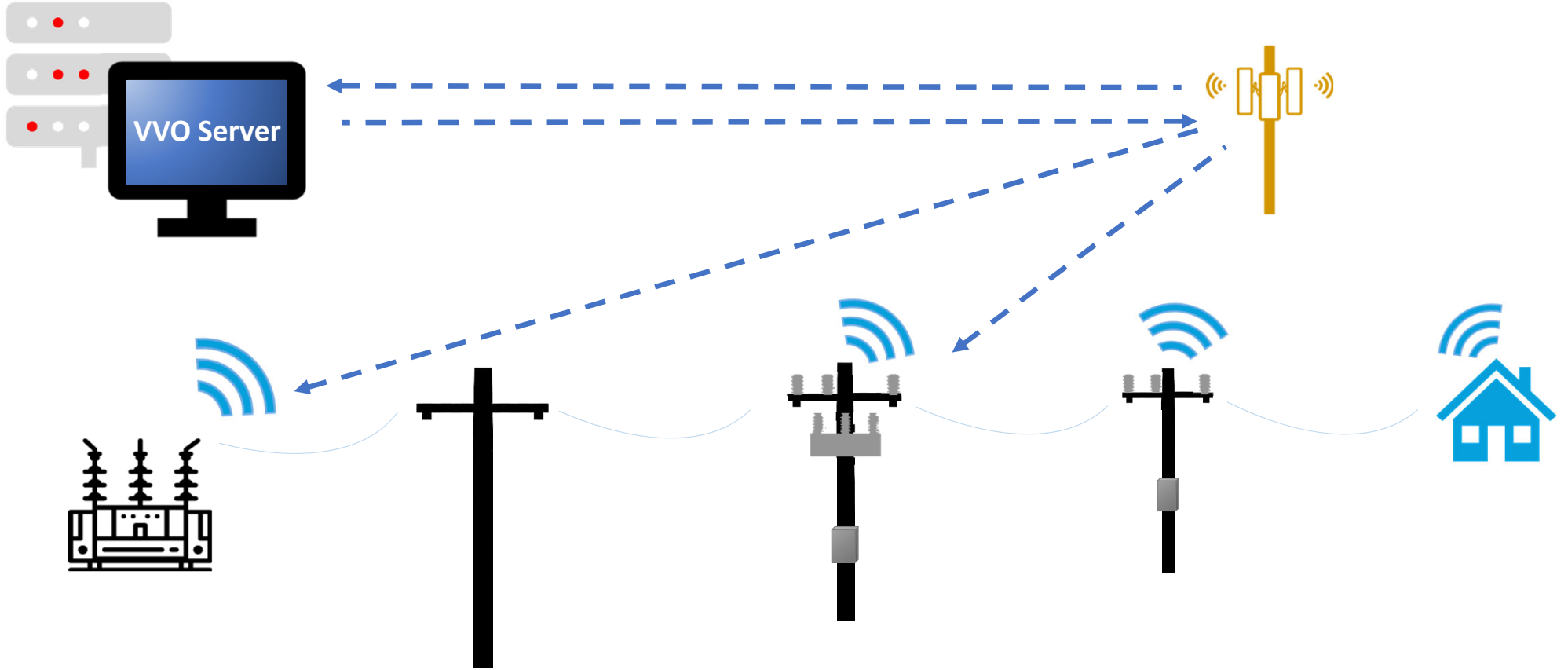


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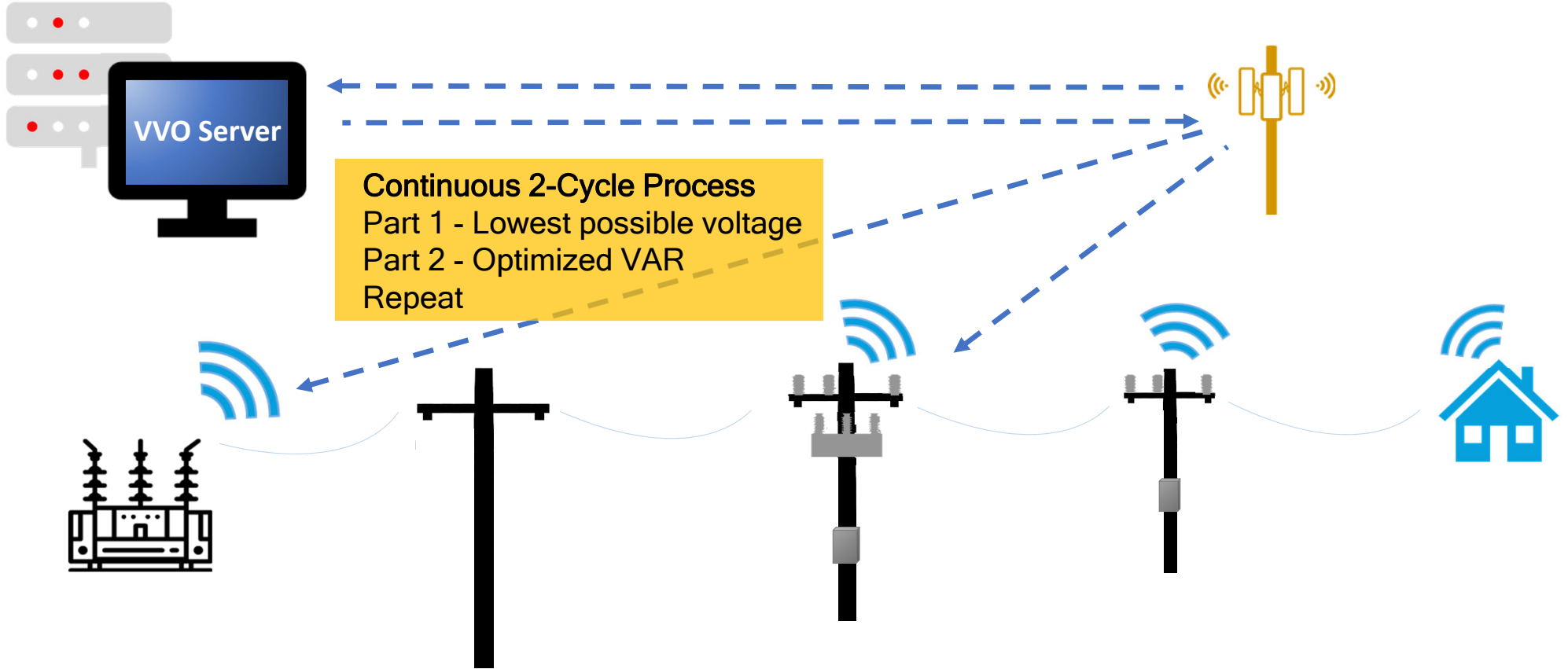
How VVO Works

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How VVO Works

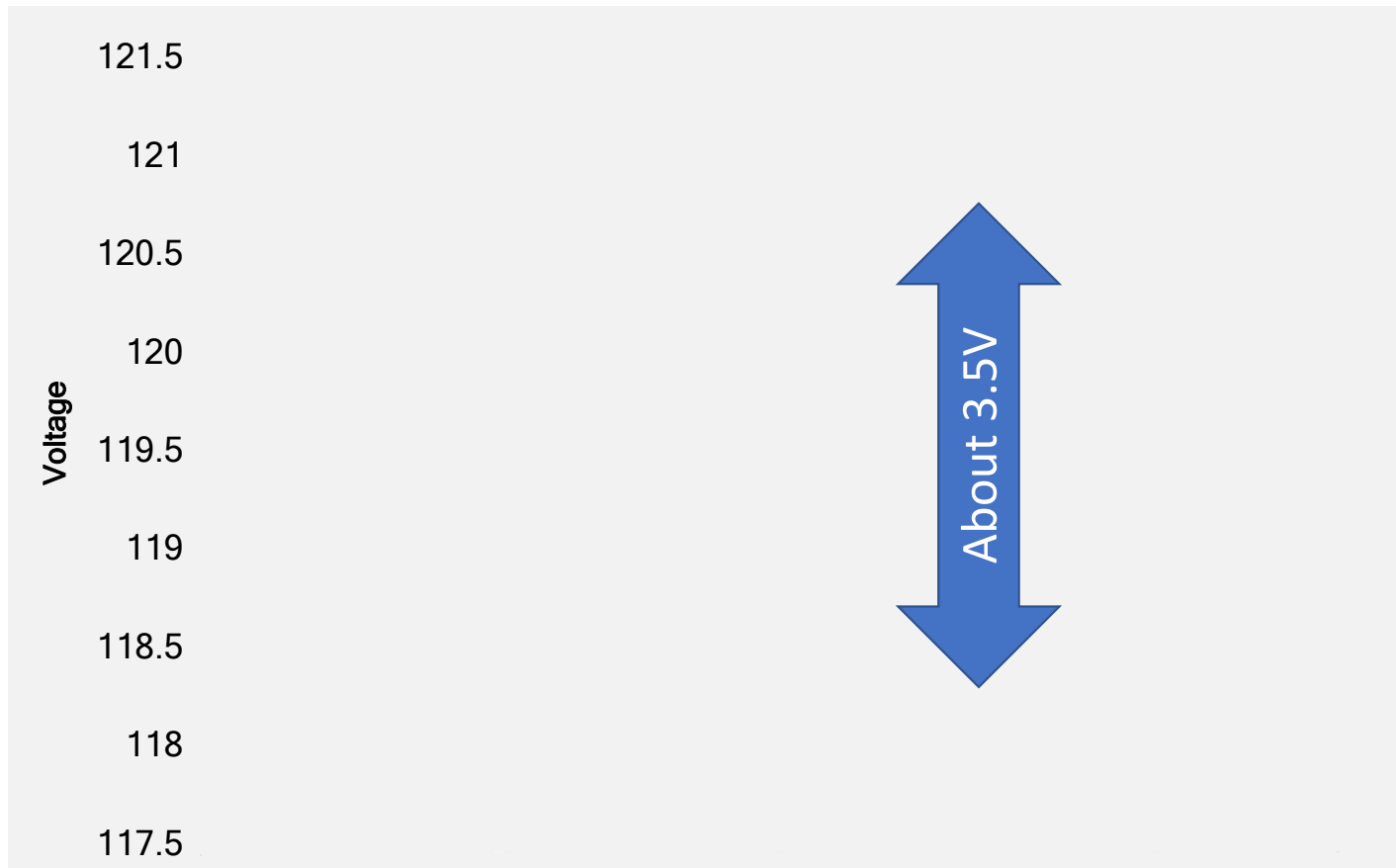


How VVO Works



VVO Impacts

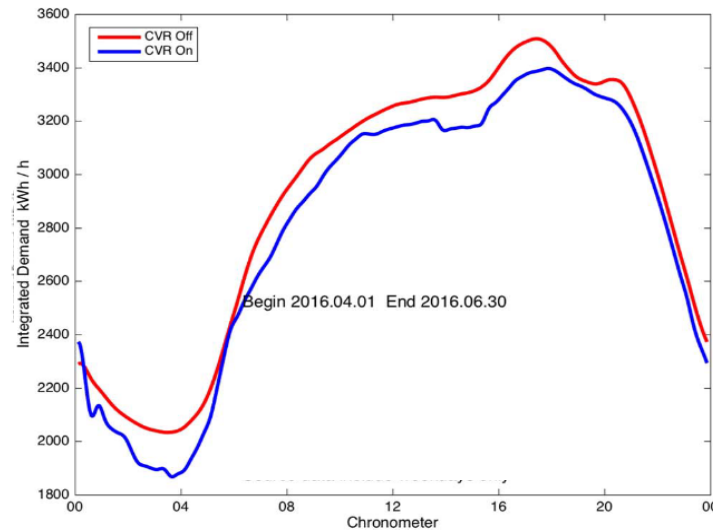
Actual Results:
Putnam Pike (RI)
Feeder equipped
with VVO



VVO Impacts

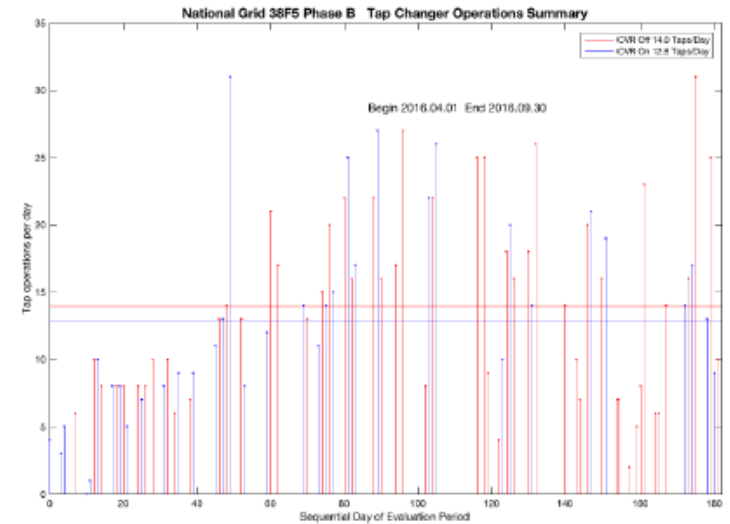
Actual Results:
Putnam Pike (RI)
Feeder equipped
with VVO

Average Demand Reduction > 3.0%



Feeder 38F3	
M&V Data	Data Value
Mean Demand Reduction	3.15%
Median Voltage Reduction	2.80 Basis Volts
Estimated Energy Conserved	2442 kWh/ day

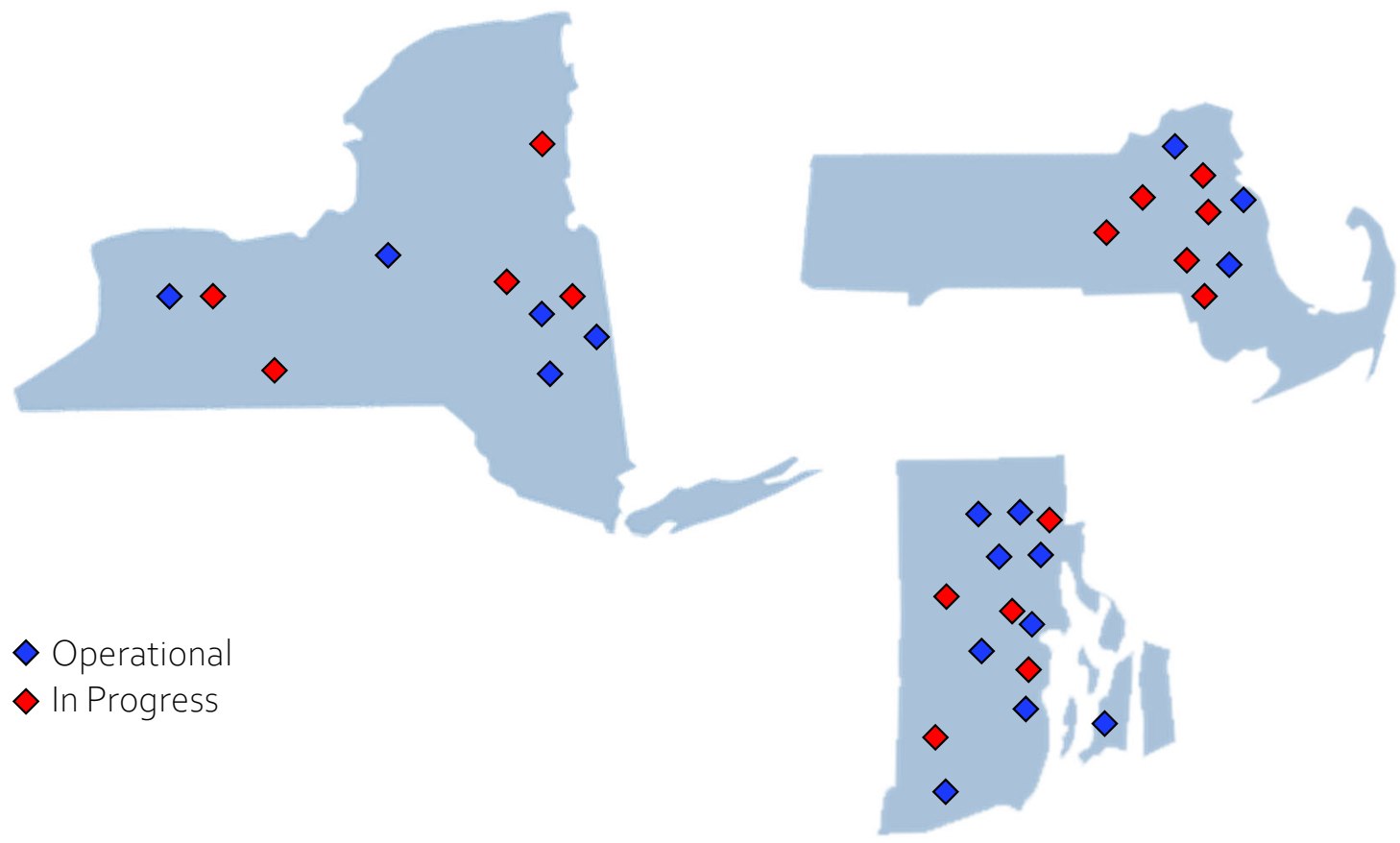
Reduction in Tap Operations > 10.0%



Feeder 38F3- Tap Operations		
Phase	VVO Off	VVO On
A	16.5	17.6
B	17.8	11.9
C	14.6	14.4
Average	16.3	14.6

891 MWh/yr

National Grid VVO Sites



◆ Operational
◆ In Progress

Some VVO Suppliers



SCHWEITZER
ENGINEERING
LABORATORIES

The Siemens logo, consisting of the word 'SIEMENS' in white capital letters centered within a teal-to-blue gradient square.

SIEMENS



Some VVO Users



Ref [2], [3]



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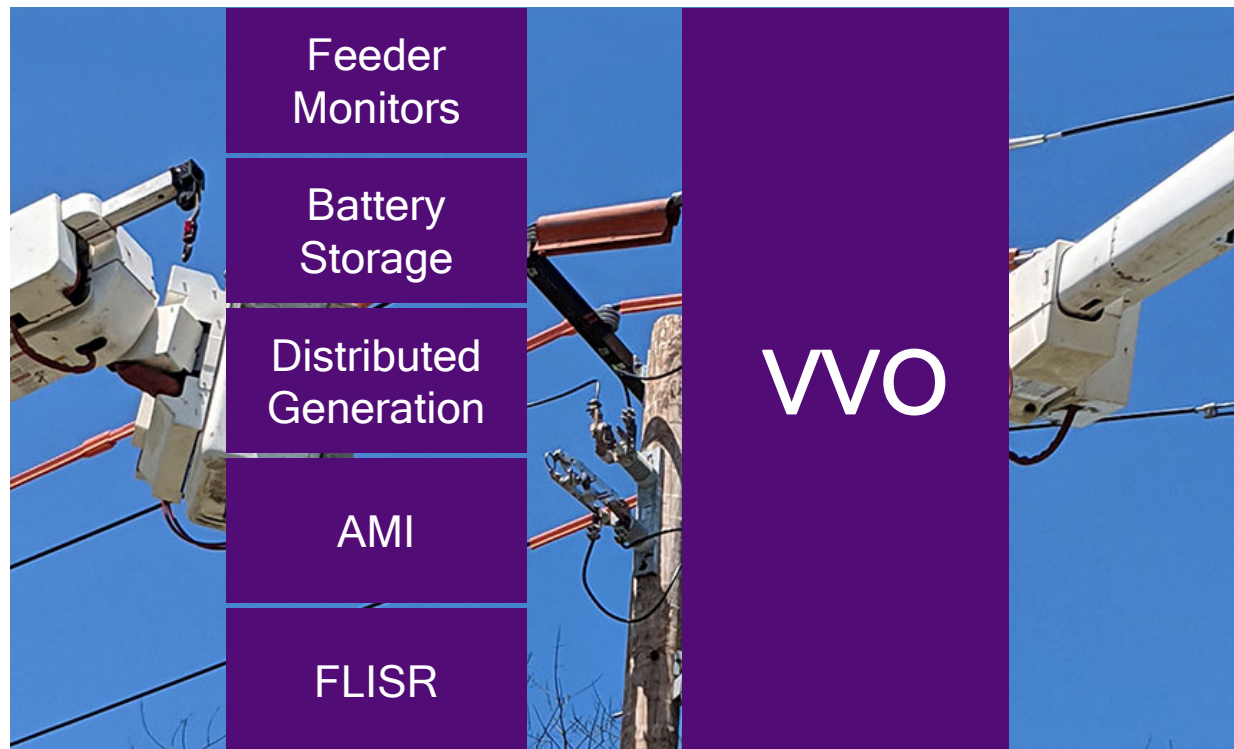
VVO Interoperability

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VVO is a “Blue Sky” system

- It is designed to operate when all systems are running under normal conditions

VVO Interoperability



VVO Interoperability

Feeder Monitors

Battery Storage

Distributed Generation

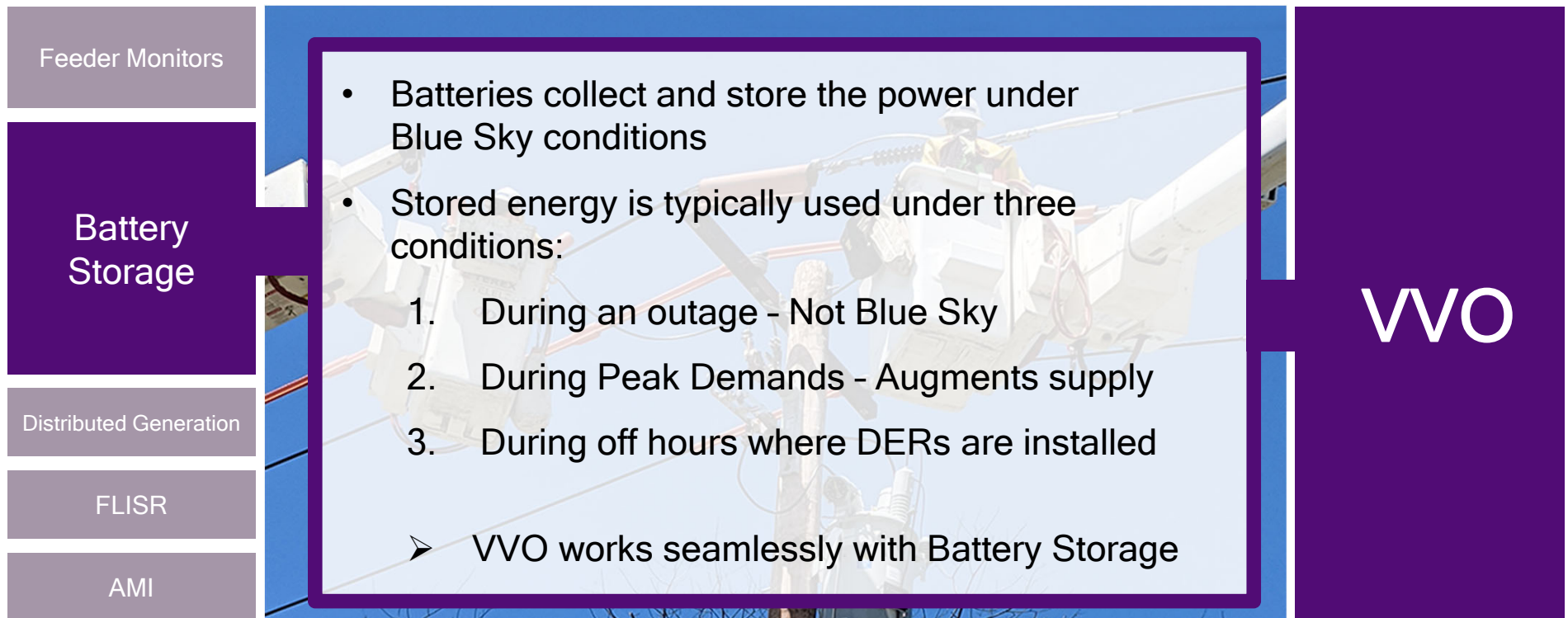
FLISR

AMI

- Sensors that collect voltage and power data
- Feeder Monitors are typically installed where there is no VVO
- VVO works seamlessly with Feeder Monitors

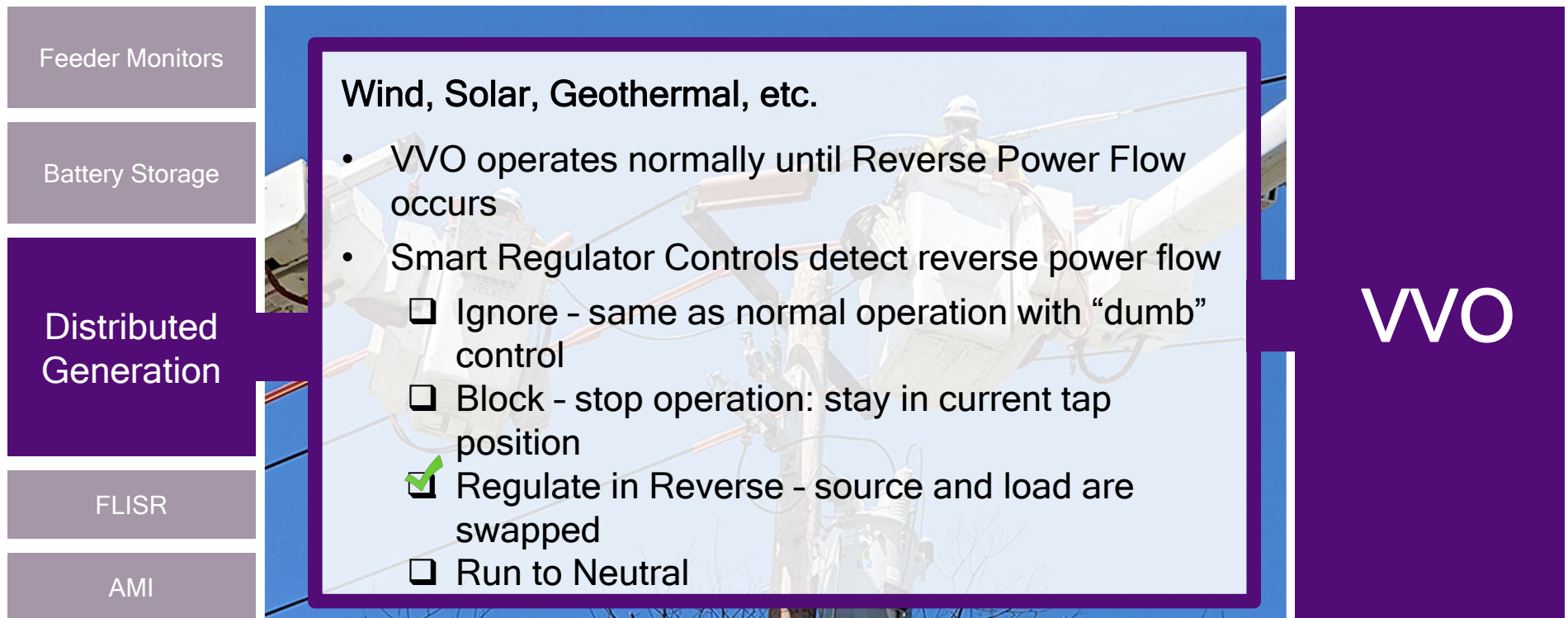
VVO

VVO Interoperability



VVO

VVO Interoperability



VVO Interoperability

Fault Location, Isolation & System Restoration

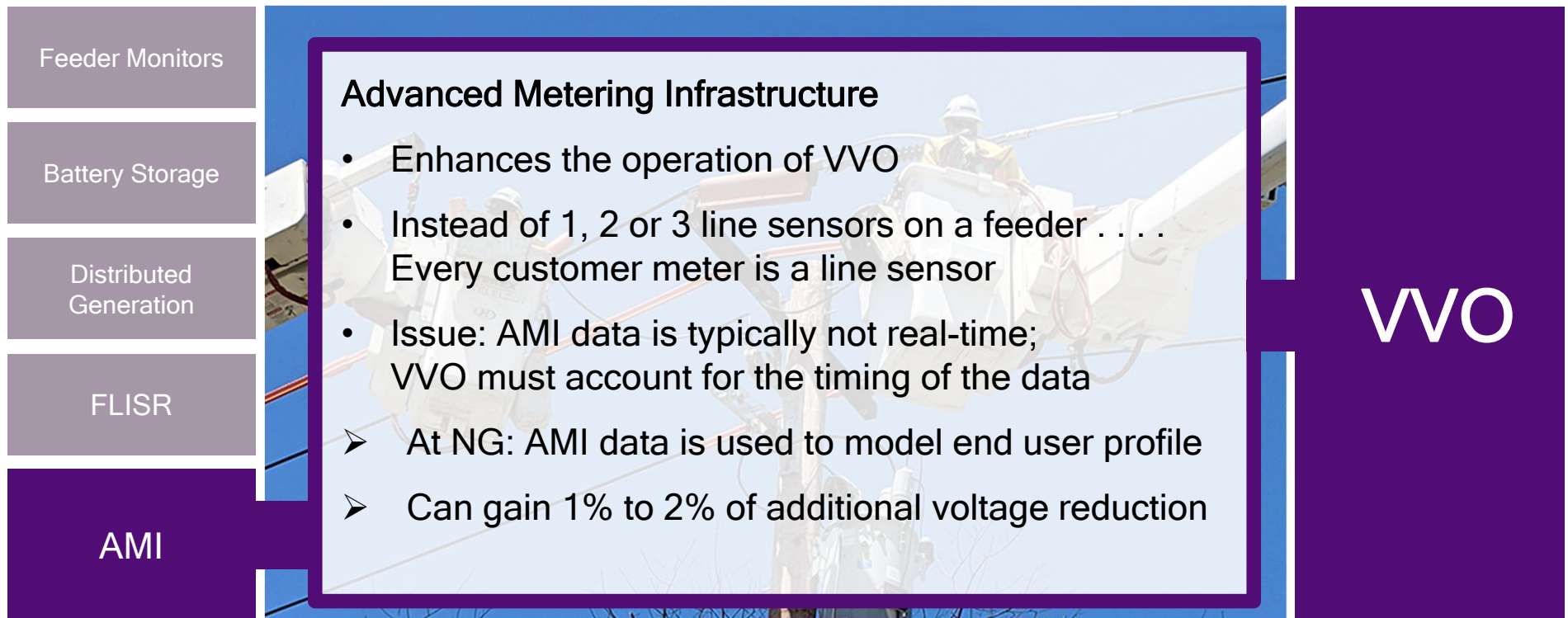
- Multiple reclosers working in unison to isolate and minimize the impact of a fault.
- Black Sky Event (Fault)
- Scheduled maintenance or repair

➤ Reclosers are programmed into the VVO system

- VVO algorithm adjusts to the new configuration and continues operation
- VVO system disables

VVO

VVO Interoperability





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It's not a Pilot . . .
It's the way we're doing business

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For additional information:

Massachusetts Department of Public Utilities
Grid Modernization

You can learn about the DPU's grid modernization-related activities, including grid-facing grid modernization investments, performance metrics and evaluation, annual reports, and phase II investigation

<https://www.mass.gov/info-details/grid-modernization#2018-grid-modernization-order->

Thank you for attending

