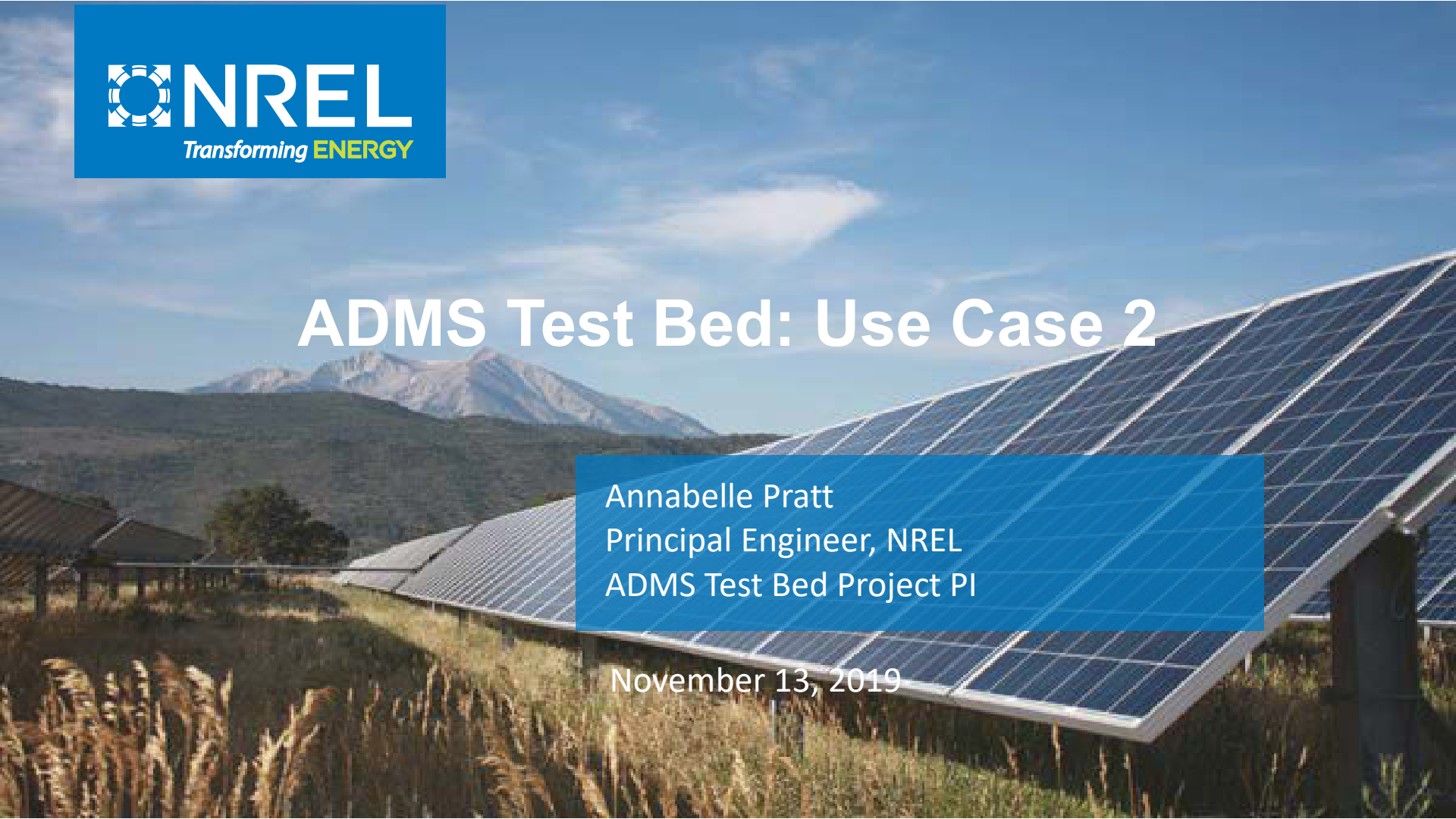

# ADMS Test Bed: Use Case 2

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Principal Engineer, NREL
ADMS Test Bed Project PI

November 13, 2019

- Motivation for coordination of ADMS and DERMS
- ADMS and DERMS coordination through MultiSpeak
- ADMS test bed setup for Use Case 2
- Transmission and distribution cosimulation
- Test plan
- Progress
- Summary

# ADMS Test Bed: Use Case 2

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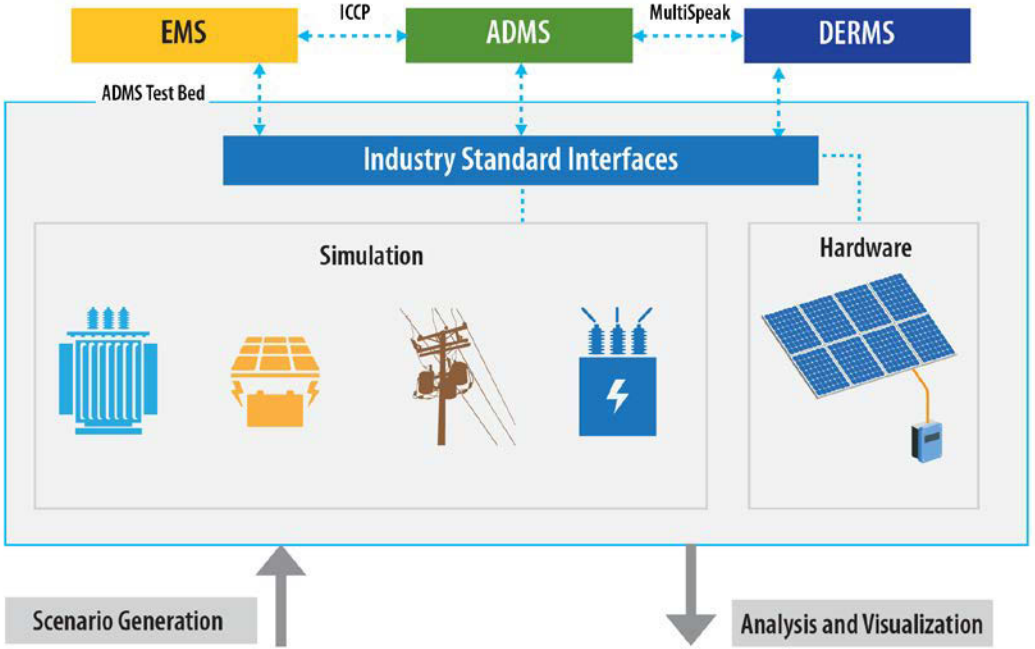
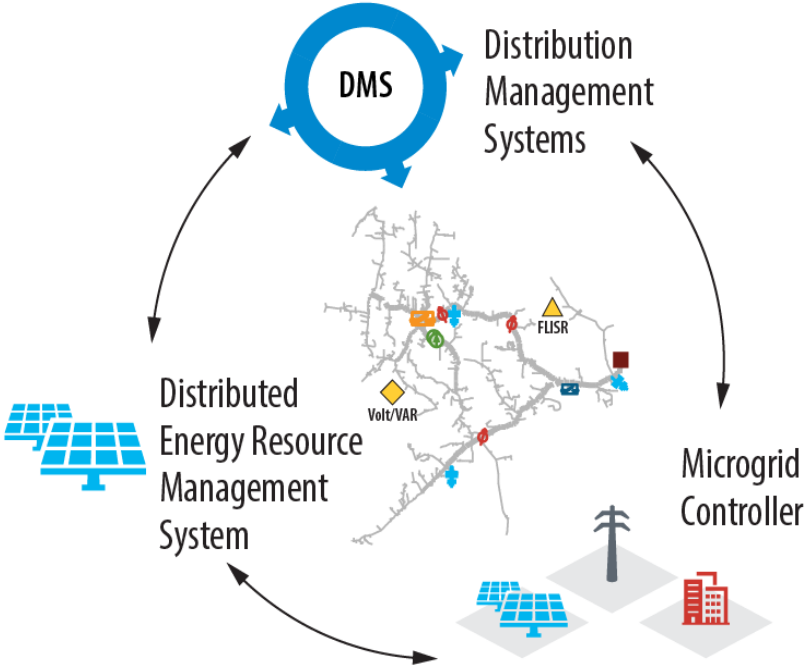
*Evaluate performance of peak load management use case coordinated across ADMS, distributed energy resource management system (DERMS), and energy management system (EMS):*

- Effectiveness of DERMS in complementing ADMS operations
- Communications interface between ADMS and DERMS
- Focus on municipal and cooperative utilities.



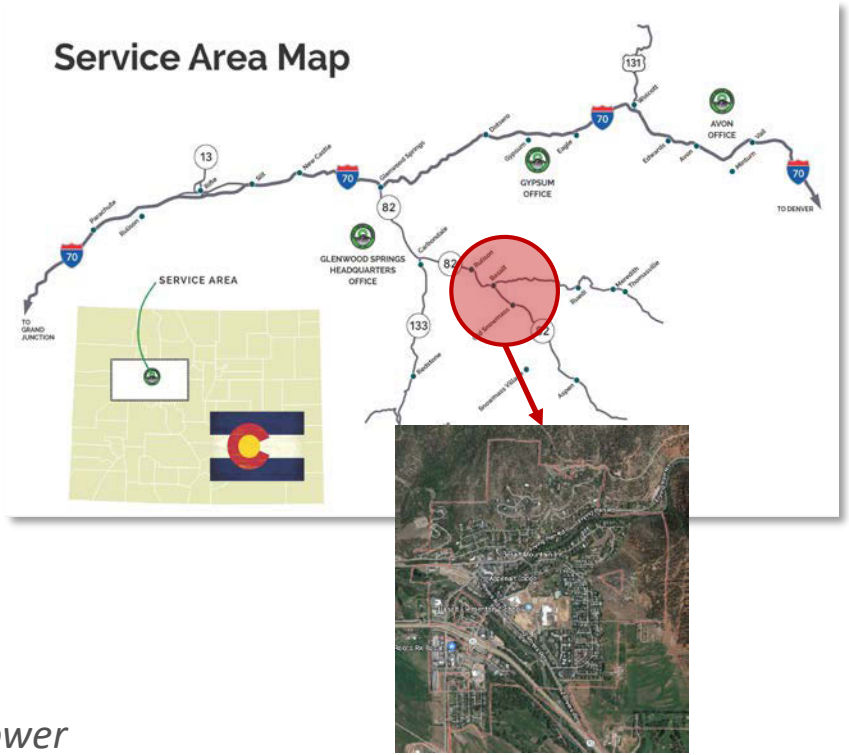
# Why Coordinate ADMS and DERMS Operations?

- Penetration level of DERs is increasing.
- DERs can have a significant effect on distribution system operations:
  - E.g., voltage profiles.
- ADMS needs—at a minimum—visibility of DERs.
- DERs may be managed by a DERMS rather than directly by ADMS.
- Uncoordinated DERMS operations may be counter to ADMS objectives:
  - E.g., VVO drops voltage, but DERs boost voltages through VAR support.



# Coordinated Peak Load Management Project

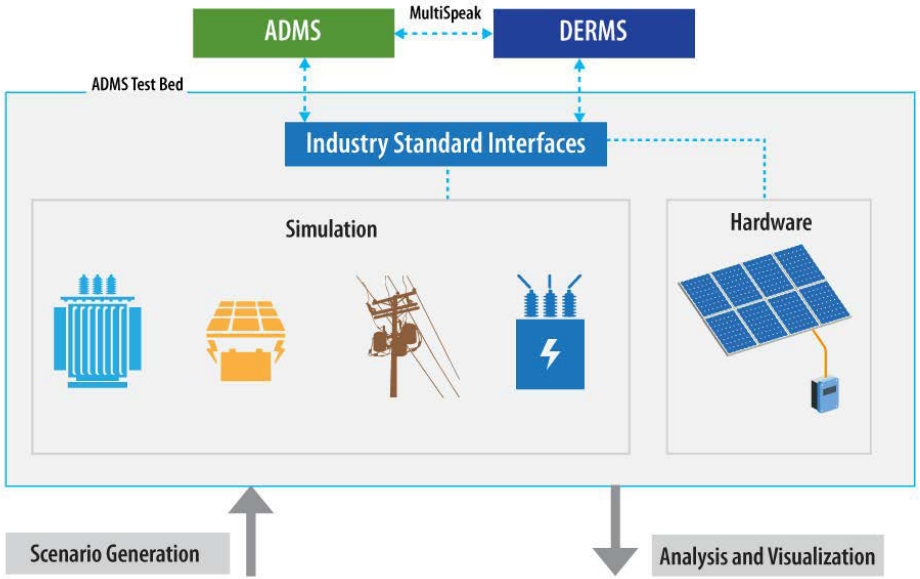
- Demonstrate coordinated ADMS and DERMS operation at NREL's Energy Systems Integration Facility using the AMDS test bed
- Using same feeder as for Holy Cross Energy nonwires solution project:
  - Aim to reduce peak demand charges.
- Coordinate Survalent's dynamic voltage regulation (DVR) and NREL's real-time optimal power flow (RT-OPF) prototype DERMS.
- MultiSpeak communications interface.




*Partners: Holy Cross Energy, Survalent, the Electric Power Research Institute (EPRI), Opal-RT, and the National Rural Electric Cooperative Association*

# ADMS and DERMS Coordination with MultiSpeak

1. Voltages and feeder head powers
2. Load management request and *feeder head power references*
3. DER group capacity.



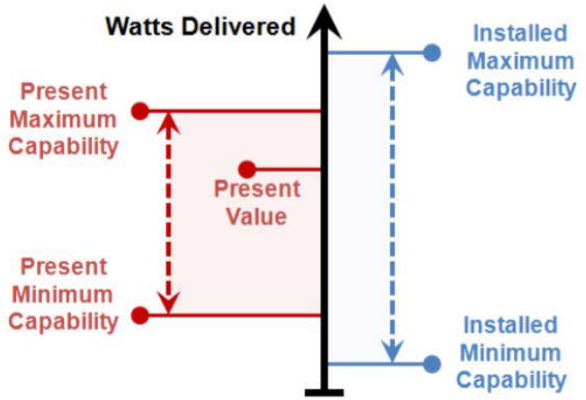
# DERMS Capacity and Status Monitoring

The National Rural Electric Cooperative Association has defined a method in MultiSpeak to communicate DER capacity:

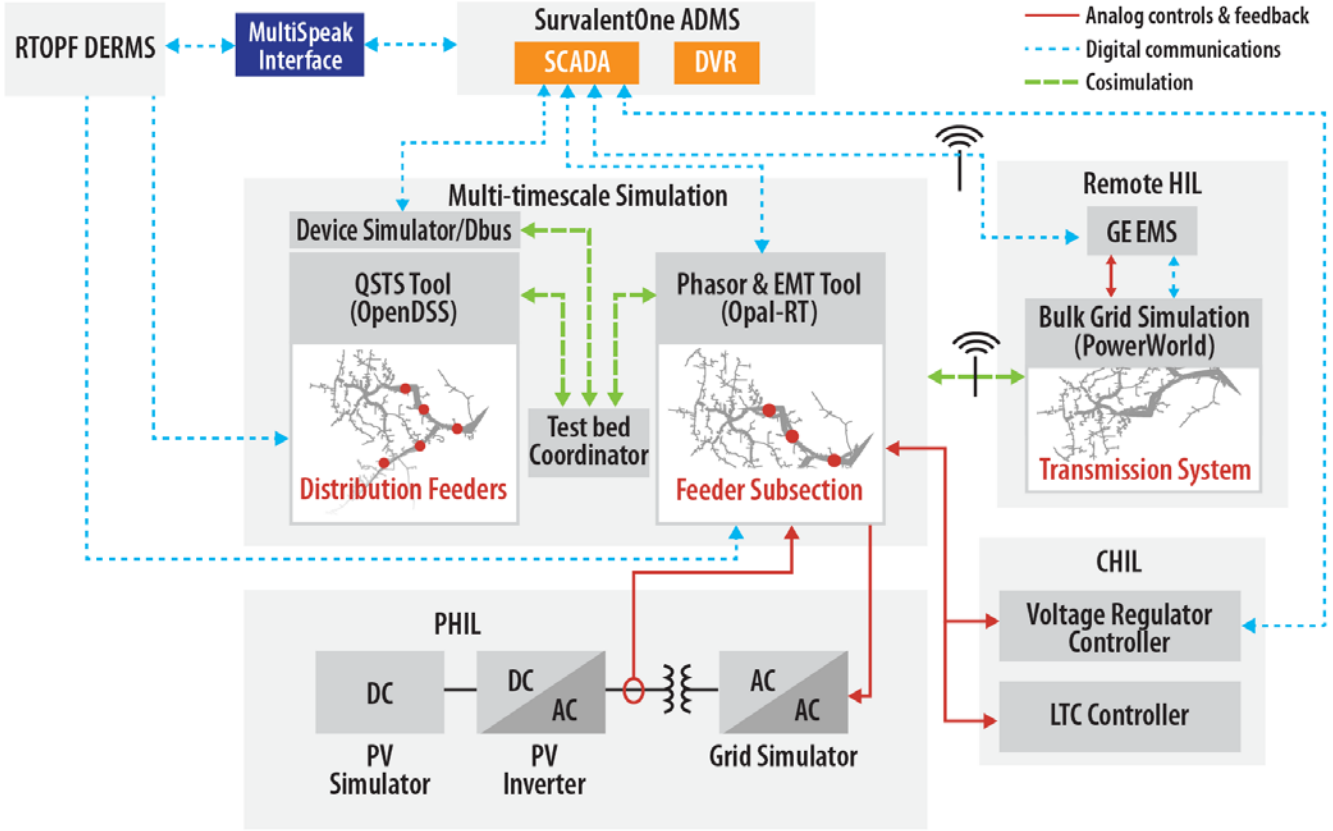
- Made available in MultiSpeak sandbox for the project.
- ADMS can use this to determine DERMS power set points.
- Based on EPRI's *Common Functions for DER Group Management, 3rd Ed.*

**The purpose of this function is to read/report the present status of a DER group:**

- Present value
- Maximum value to which it can presently be adjusted
- Minimum value to which it can presently be adjusted.



# Use Case 2 Lab Setup

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# MultiSpeak Interface for DERMS

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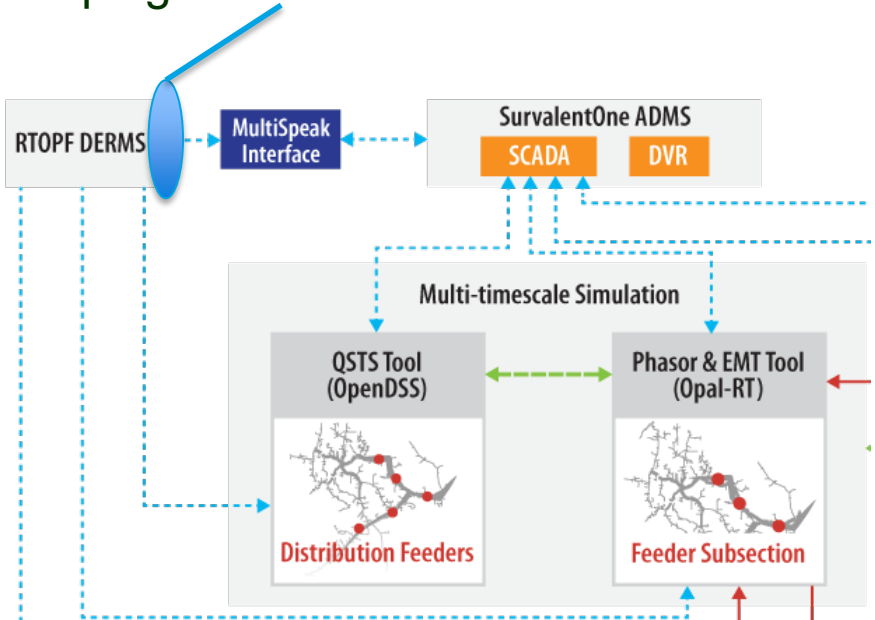
- Need a MultiSpeak interface to RT-OPF code:
  - RT-OPF algorithms are implemented on a laptop, in Python.
  - EPRI is developing interface code.



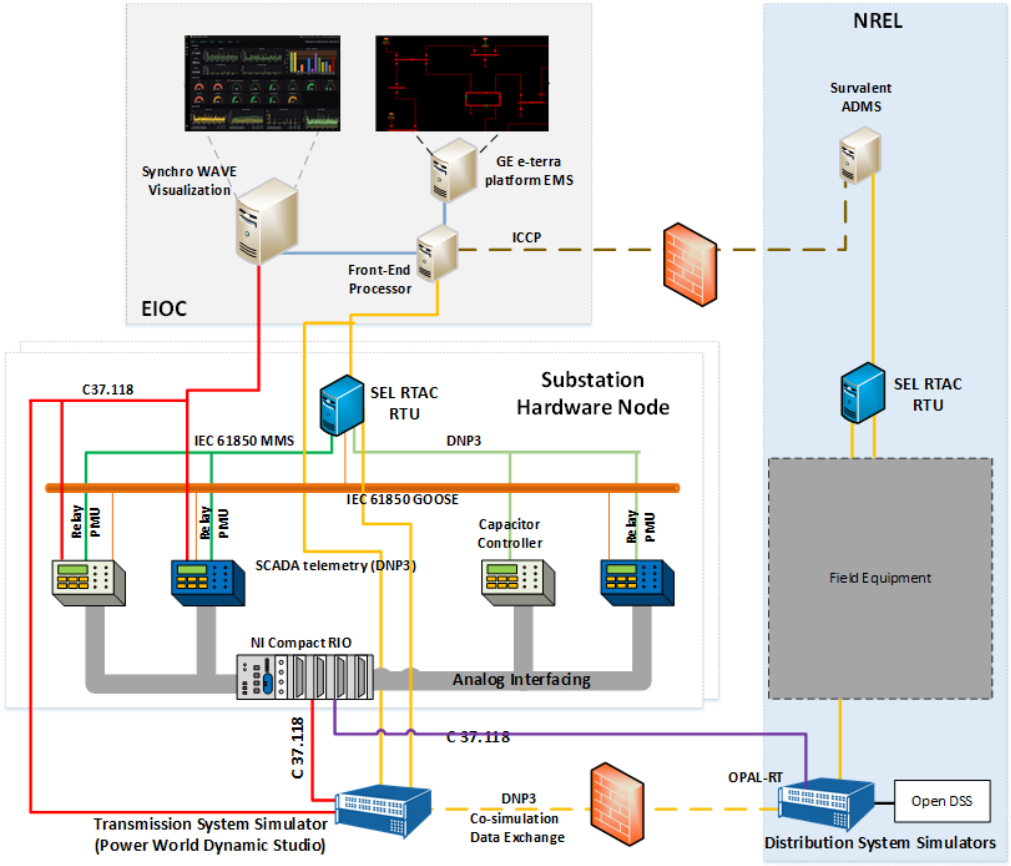
# ADMS Testbed – Use Case 2: T&D Co-simulation

Power World Dynamic Studio (PWDS) model development completed

PWDS to e-terra control FEP and e-terra platform EMS interface completed and tested.

ICCP communication between Survalent ADMS and e-terra control completed at PNNL.

Remote ICCP communications and T&D co-simulation between PWDS and OPAL-RT to be established and tested.




*PNNL slide and logo published with permission*

# Test Plan

- Evaluate the contributions of the DERMS and ADMS to reduce the load on the feeder:
  - Under at least two different load conditions.
- For each load condition, run three scenarios:
  - Scenario 1: no load management
  - Scenario 2: activate DVR in the ADMS
  - Scenario 3: send a load management request from the ADMS to the DERMS for active power reference following
  - Scenario 3: activate DVR in the ADMS and send a load management request from the ADMS to the DERMS for active power reference following.
- For remote testing, send a load management request from the EMS to the ADMS via the ICCP communications interface to initiate load reduction.

# Progress

- Use Case 2 lab setup integration started mid-October
- Builds on Holy Cross Energy project, re-using:
  - RT-OPF DERMS code, but on laptop vs. Heila
  - Survalent SCADA.
- Adding:
  - Survalent DVR
  - Line VR and LTC controller HIL
  - PV inverter PHIL to emulate 200-kW system
  - Remote EMS and cosimulation with transmission system at PNNL
  - MultiSpeak communications with new method for DERMS status:
    - Survalent DERMS status implementation by mid-February
    - Can test with preprogrammed power references before then.

# Summary and Thoughts on Future Directions

- DER penetration is expected to increase
- DERs will have an increased influence on power system operations.
- DERMS/aggregator functionality is emerging to manage DERs.
- DERMS functions may be included in ADMS or be external.
- Need to coordinate ADMS operation with external DERMS.
- Need standardized interfaces to support integration cost-effectively.

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# Example for Pref Calculation

- E.g., Pfh = 1 MW

- DERMS send Ppresent, Pmax, Pmin (DER net total power)
  - Ppresent = 200 kW; Pmax = 300 kW; Pmin = 100 kW

- ADMS: Pref,min = Pfh – (Ppresent – Pmin)
  - Pref sent to DERMS as part of business process #2