




DISTRIBUTION SYSTEM REAL TIME SIMULATION

FIFTH ANNUAL INTERNATIONAL WORKSHOP ON
GRID SIMULATOR TESTING

QUANTA TECHNOLOGY

Smart Solutions, Practical Results

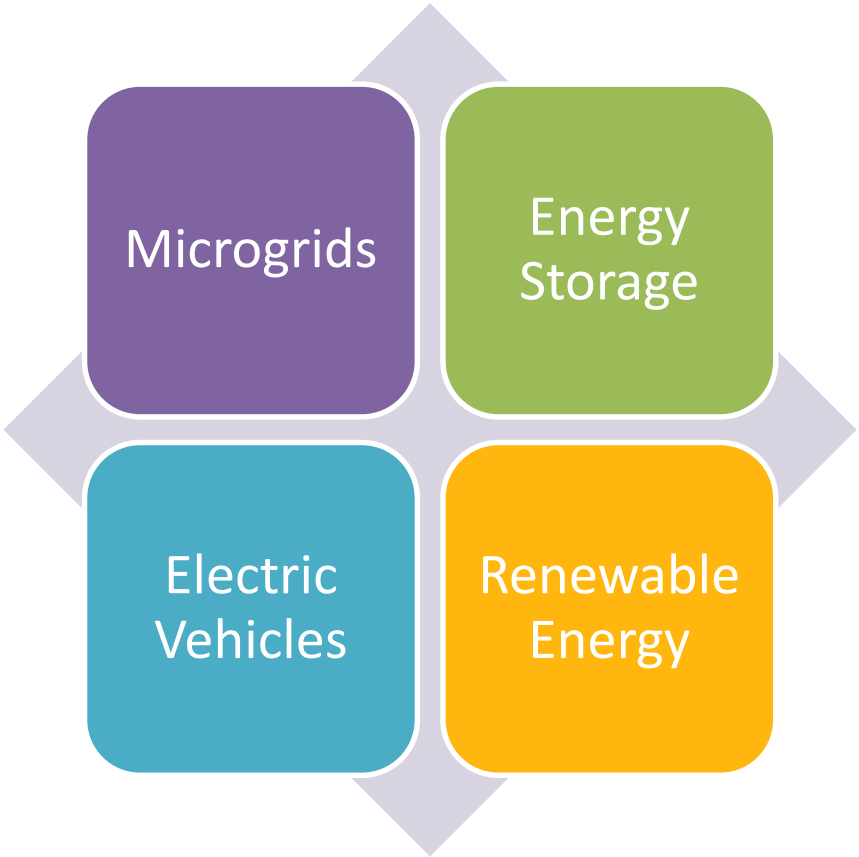
Nov. 2018

Outline

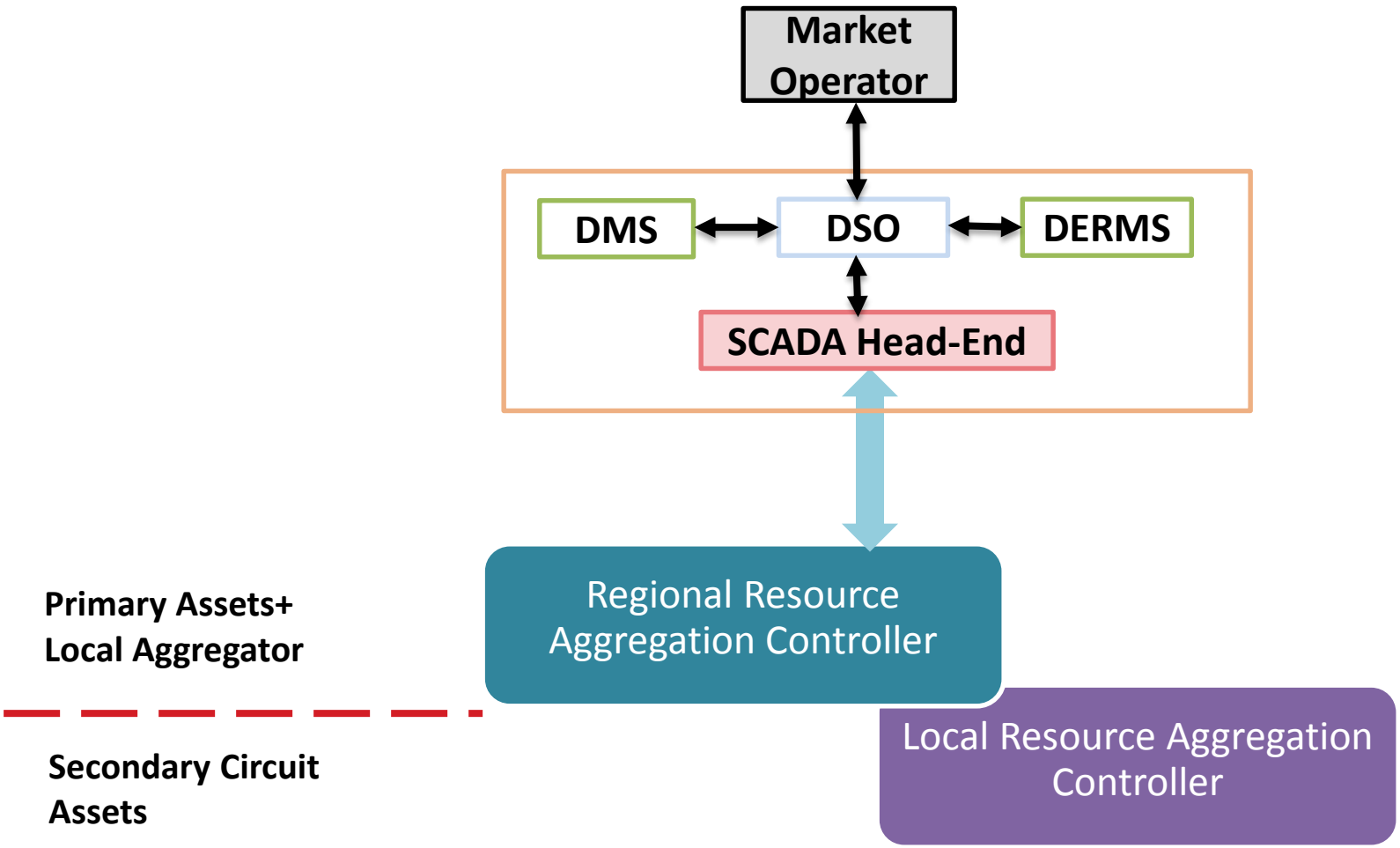
- Advancement in Distribution System Control operation
- Local Resource Aggregator concept
- Testing Local Resource Aggregator control
- Test Results
- Summary

Power Distribution System Transformation

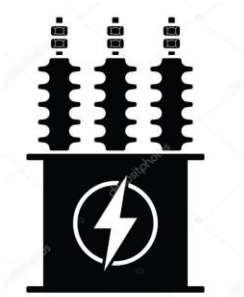
- Integration of Primary Renewable DER assets:
  - Grid-scale Energy Storage (ES)
  - Grid-scale PV site
- Integration of Secondary-circuit DERs and Controllable Load Assets:
  - Behind-the-meter ES, PV
  - Electric Vehicle (EVs)
  - Direct load control (DLC)



Advanced Distribution System Control Operation



Local Resource Aggregator Concept of Operation



Service XFMR (50 KVA)

Higher Level Controller

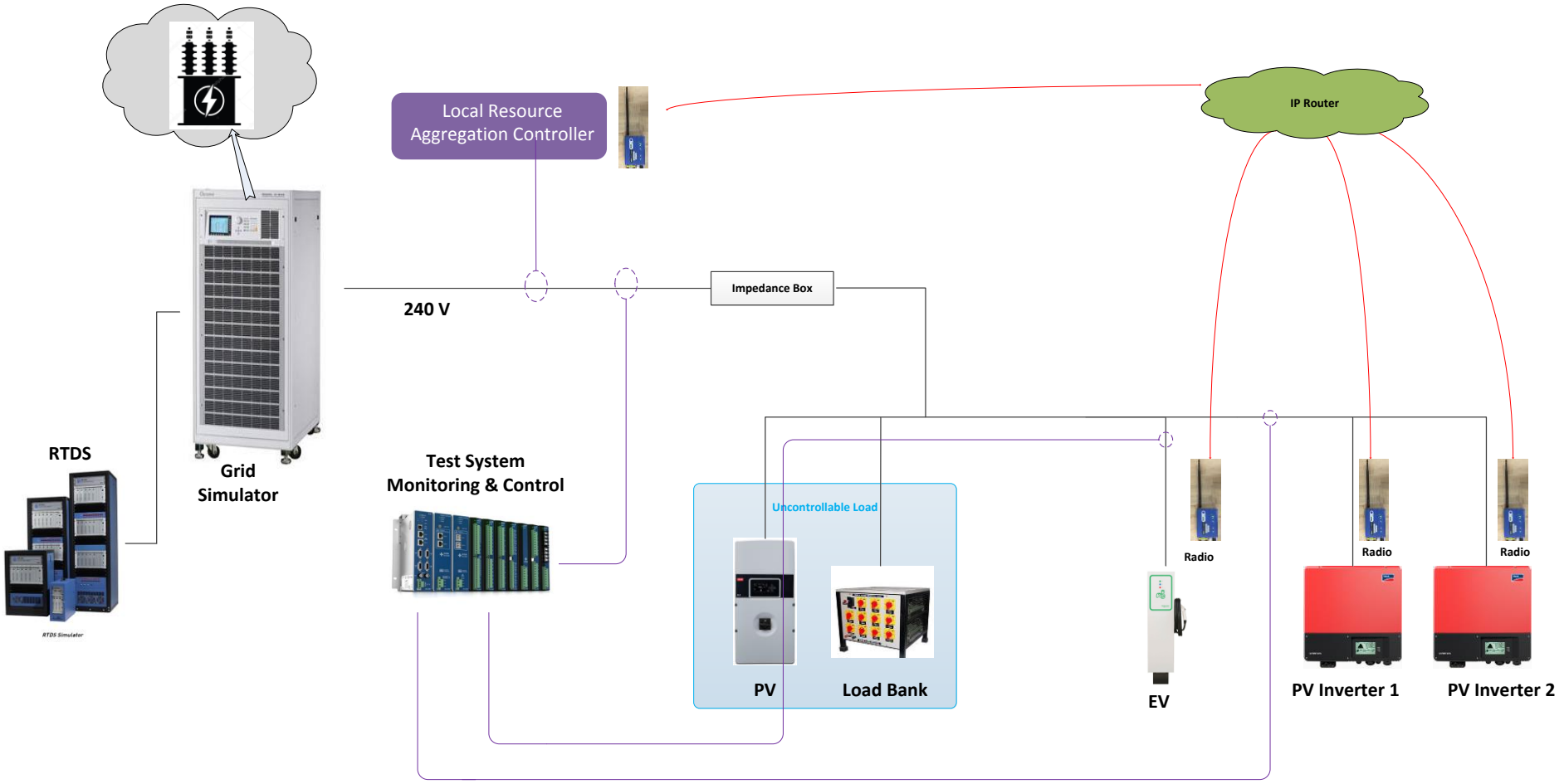
Local Resource Aggregation Controller

Secondary Circuit Assets

- Local Objective:
  - XFMR Thermal Limit- avoid overloading (Forward and Reverse)

- System-level Objective:
  - Power flow management in Primary
  - Market participation

Local Resource Aggregator Test Setup



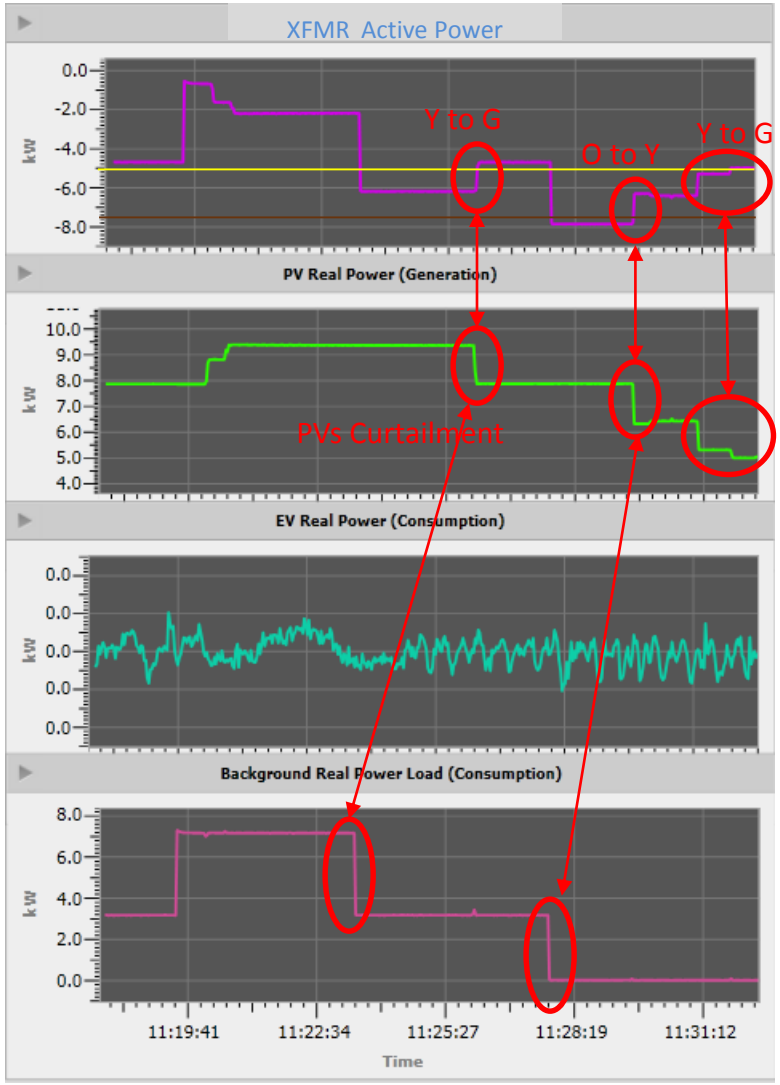
Test Case- Reverse Power Flow (Description)

- **Scenario**:
  - PVs+ no EV+ Uncontrollable resistive Load
  - Transformer reverse limit met

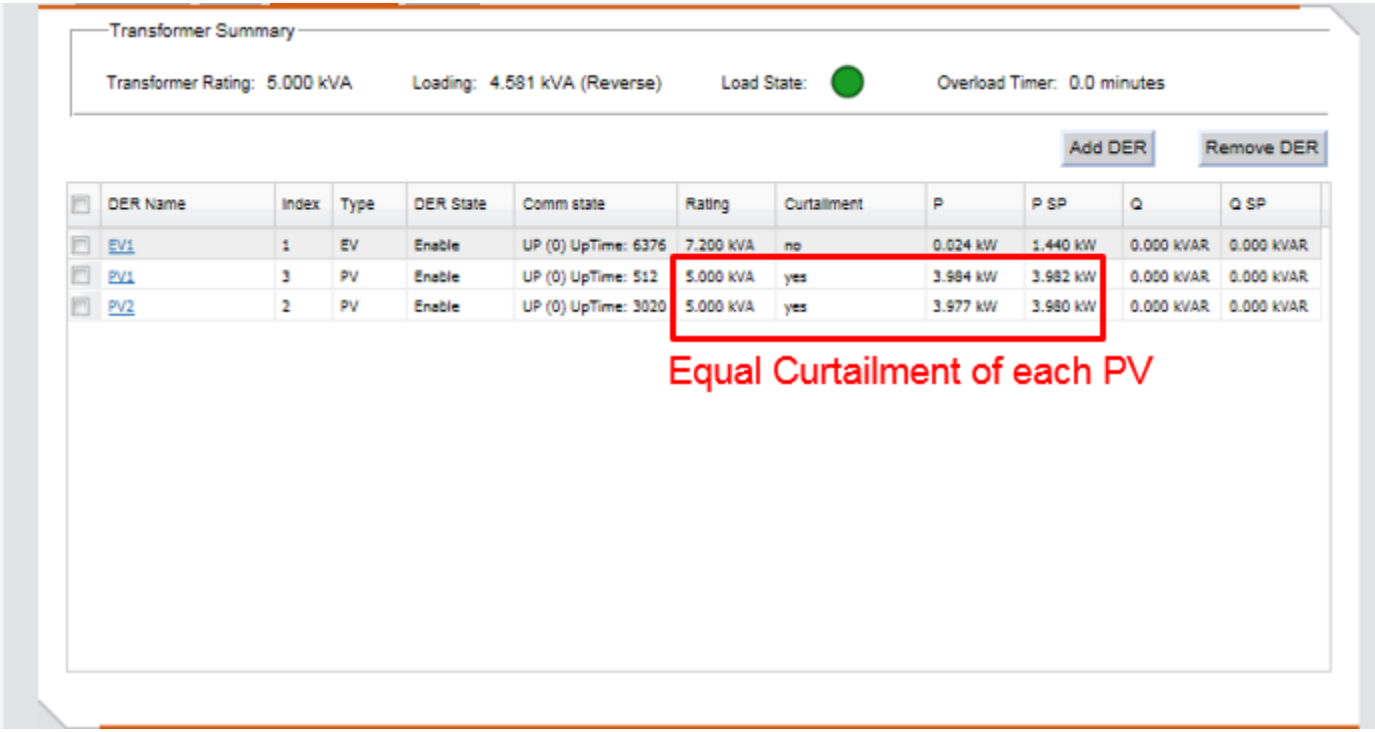
- **Procedure**:
  - Sunny conditions for two PVs
  - Uncontrollable Resistive Load variation (Load step-wise decrease)

- **Expectation**:
  - PVs are curtailed evenly to mitigate reverse power flow overload

Test Case- Reverse Power Flow (Plots)



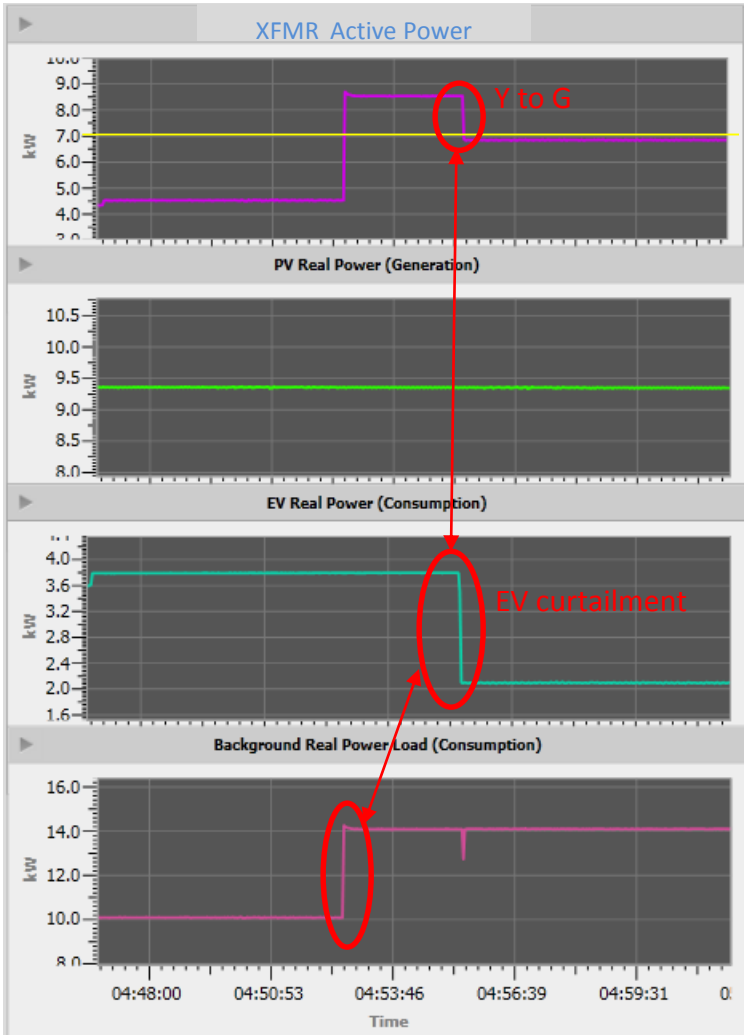
Test Case- Reverse Power Flow (controller UI)



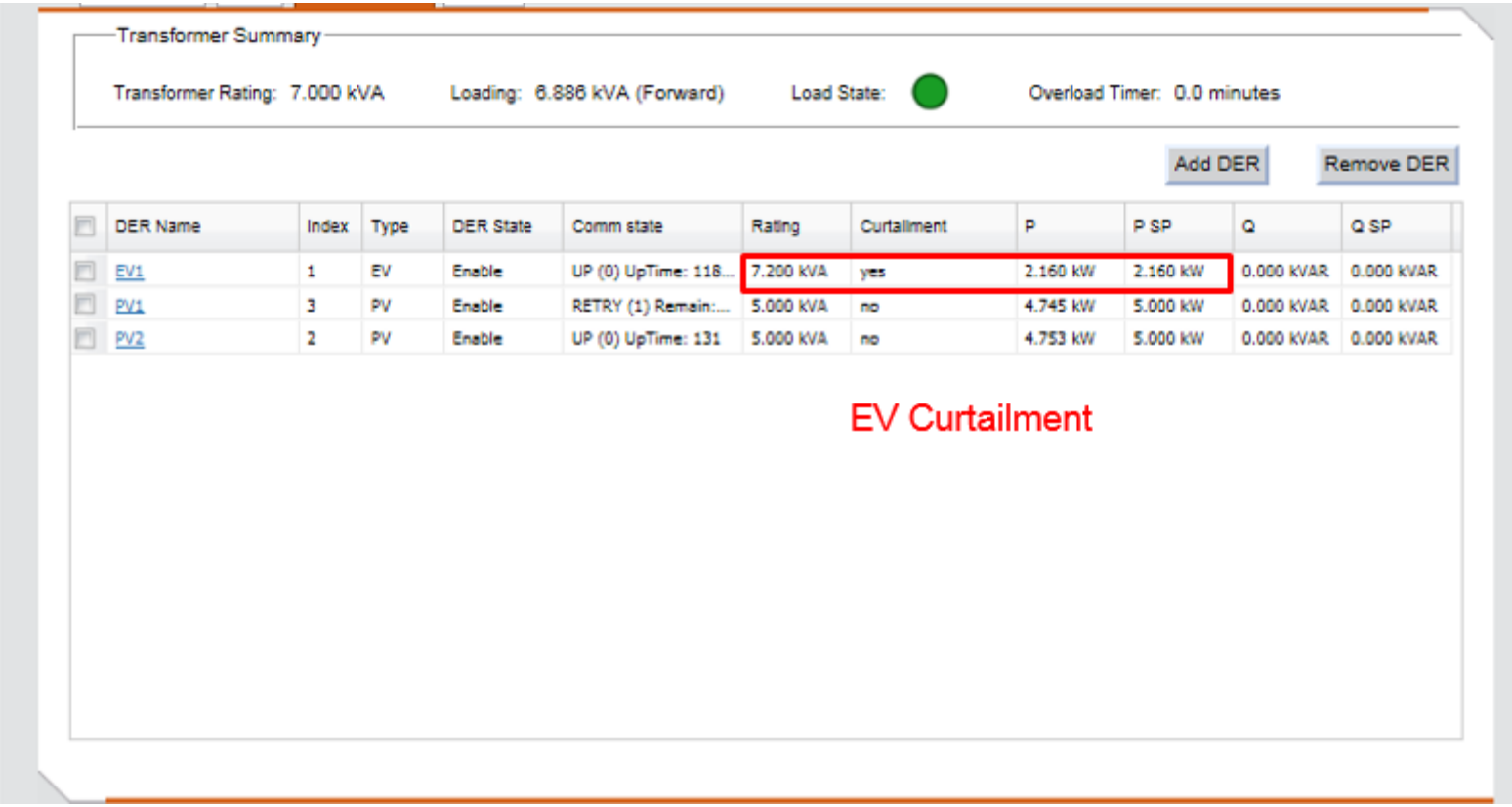
Test Case- Forward Power Flow (Description)

- **Scenario**:
  - PVs+ EV+ Uncontrollable resistive Load
  - Transformer forward limit met
- **Procedure**:
  - EV is not close to full charge
  - Sunny conditions for two PVs
  - Uncontrollable Resistive Load variation (Load increase)
- **Expectation**:
  - EV is curtailed to mitigate forward power flow overload

Test Case- Forward Power Flow (Plots)



Test Case- Forward Power Flow (controller UI)



Summary

- Hierarchy of resource aggregation and management in the advanced distribution system was discussed.
- Local Resource Aggregation control concept and objectives was described.
- Testing of Local Resource Aggregator through grid simulator and real-time digital simulation was discussed.
- Selected test results for Local Resource Aggregator functionality were presented.

Thank you!

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