CAMUS
Zero Carbon Grid Orchestration

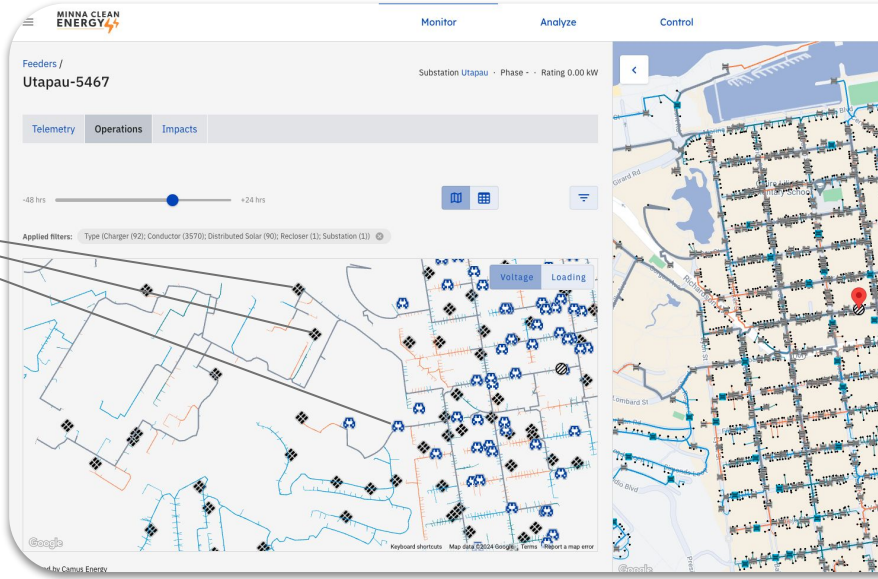
# Coordinating Aggregator Participation in Markets with the DSO for FERC Order 2222

FRAMING

# The Challenge

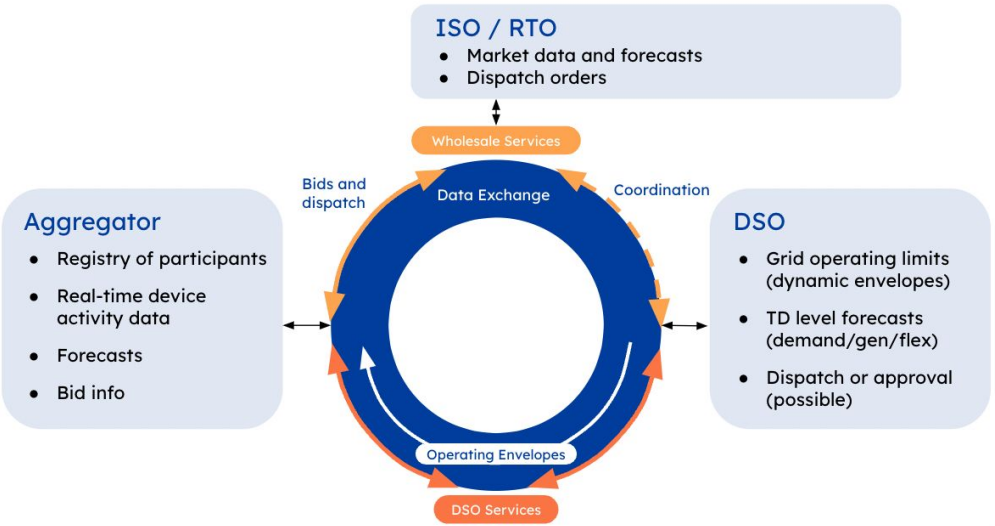
- Ensuring reliability and maintaining power quality in the distribution system
- While enabling effective participation in the ISO/RTO markets
- Requires new information, data exchanges, and additional interfaces


but what about the distribution system assets?

FRAMING

# Coordinating Third-Party Aggregators & Virtual Power Plants

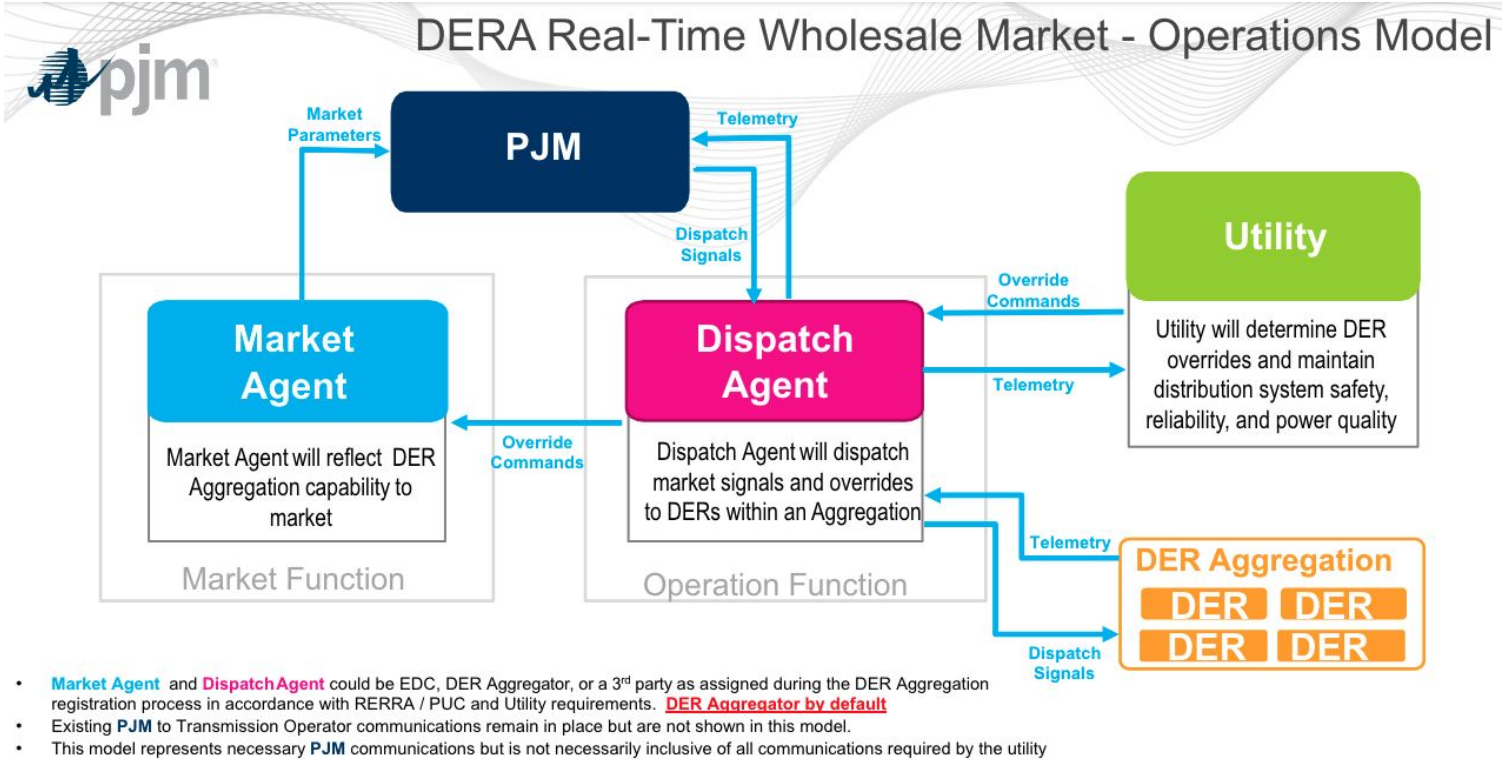



## Requirements

1. **Integrate DER registration, telemetry, and market activity** from participating aggregators/VPPs
2. **Communicate operating envelopes** to aggregators and execute overrides when/where necessary
3. **Coordinate market & grid services dispatch** for DERs between utility and transmission operator (ISO/RTO)
4. Provide a **standard data exchange** to support development of a robust ecosystem of DER aggregators

Source: AEMO's Project Edge

# PJM's Response



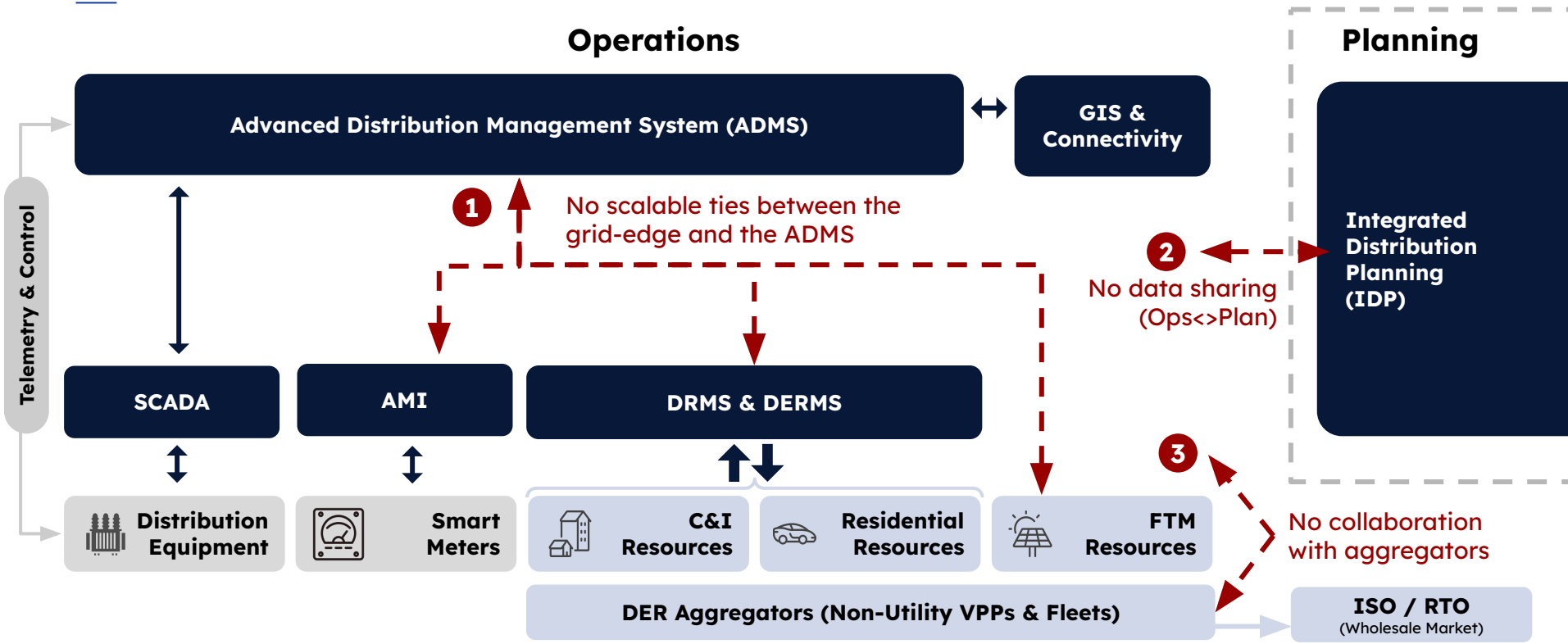

- Market Agent and DispatchAgent could be EDC, DER Aggregator, or a 3rd party as assigned during the DER Aggregation registration process in accordance with RERRA / PUC and Utility requirements. DER Aggregator by default
- Existing PJM to Transmission Operator communications remain in place but are not shown in this model.
- This model represents necessary PJM communications but is not necessarily inclusive of all communications required by the utility

Source: PJM

# But first, down into the DSO

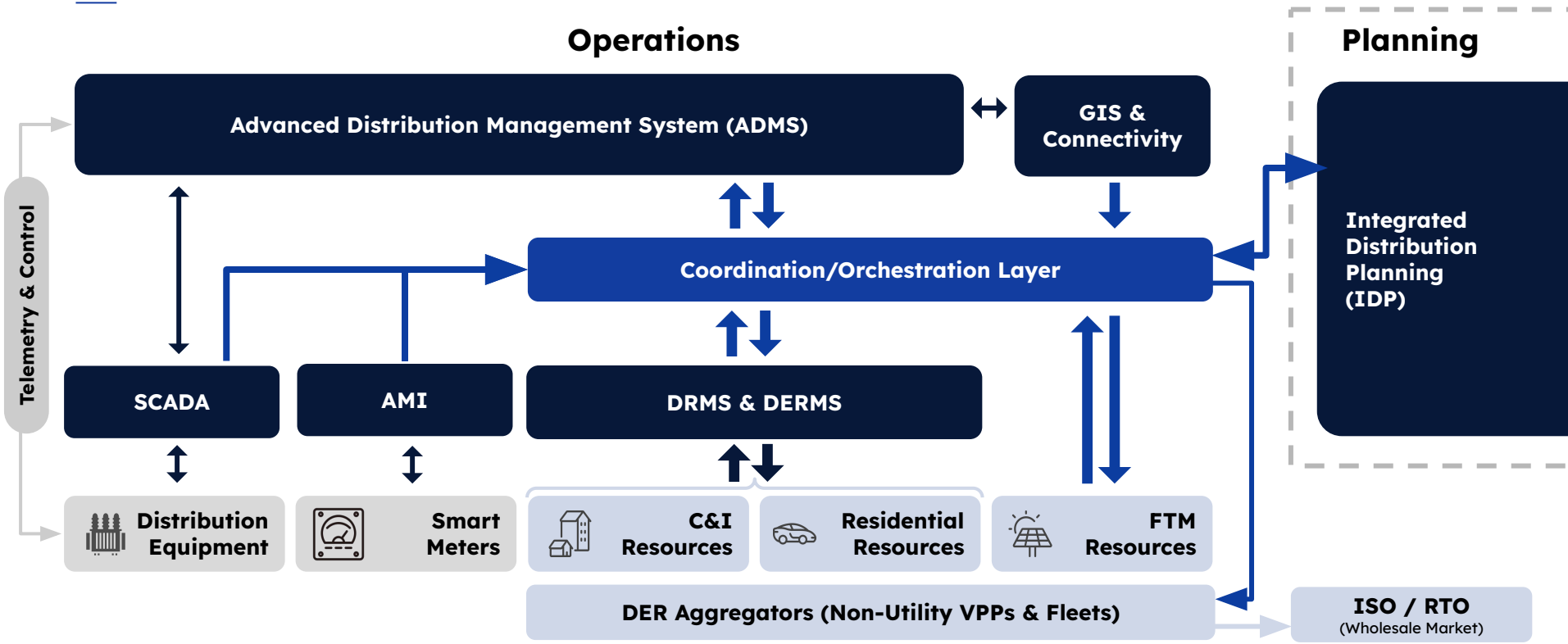
CURRENT STATE

# The existing DER management approach faces 3 key gaps



FILLING GAPS

# Increased data exchange and coordination



# So what does this actually look like?

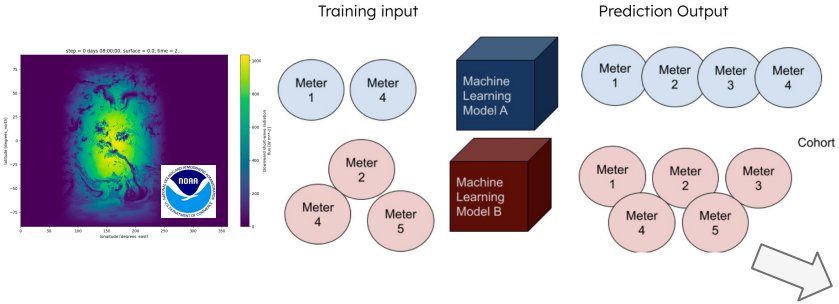
# Ingredients

**AMI**

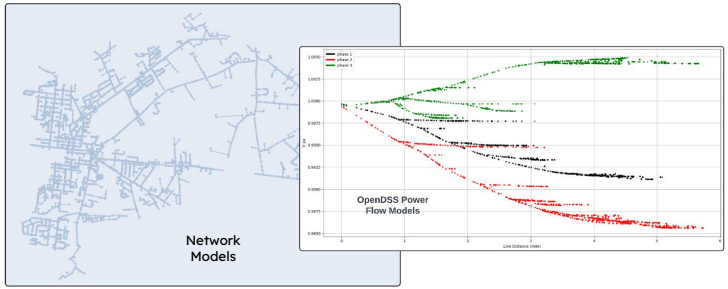
**GIS & Connectivity**

**SCADA**

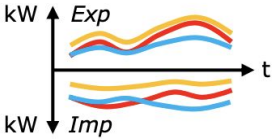
## Forecasting Service




## System Models




## Envelopes




**DRMS & DERMS**

**DER Aggregators (Non-Utility VPPs & Fleets)**

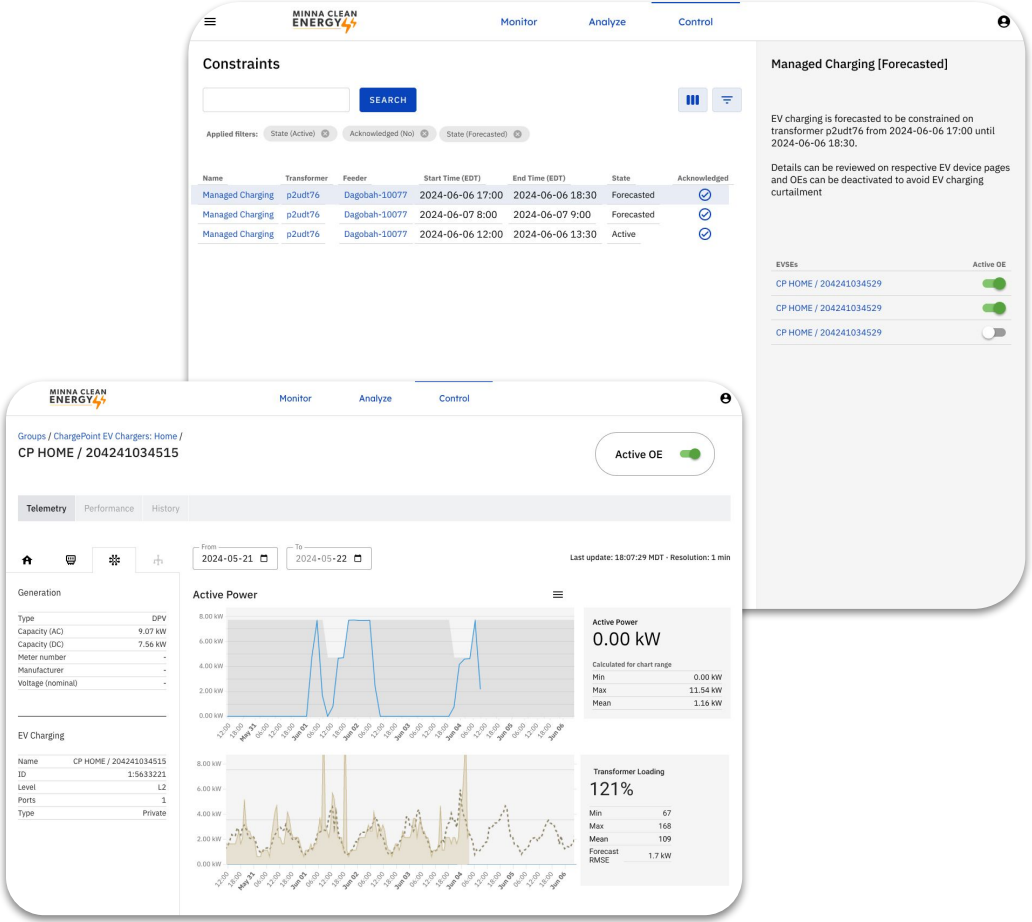
**FTM Resources**

USE CASE

# Deferral for Distribution Transformers

Drives value to the utility through deferral of transformer replacements & decreased O&M costs

- Aggregate meter-level forecasting to transformer level
- Generate operating envelopes (OEs) and curtail EV charging when required
- Alarming dashboard notifies DER operations team
- OEs can be evaluated, deactivated as needed





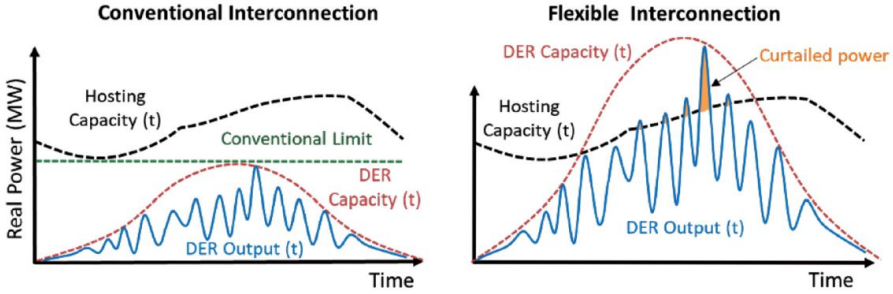

Source: EPRI

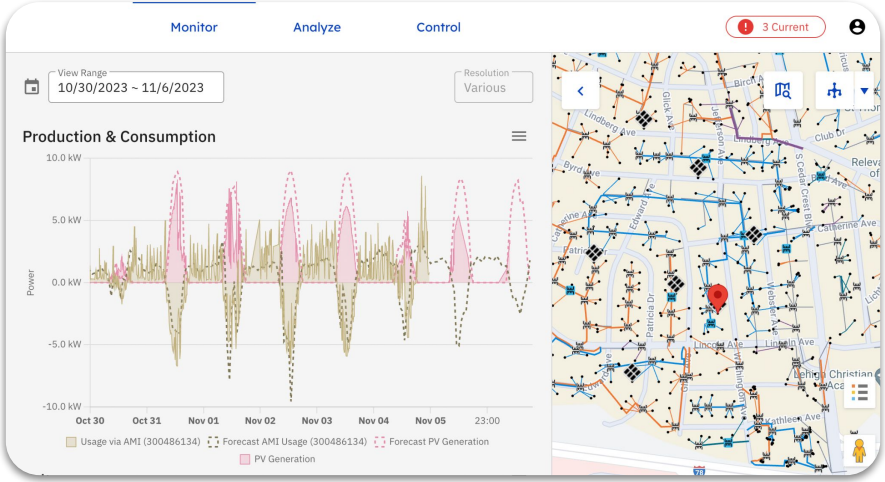
USE CASE

# Flexible Interconnections & Grid-Aware Control

Enables increased utilization of existing infrastructure, while interconnecting more DERs

- Leverage GIS/connectivity, conductor attributes, asset ratings
- Establish system models
- Evaluate network at min/max DER dispatch
- Generate OEs and manage inverter settings as required to avoid voltage/loading violations



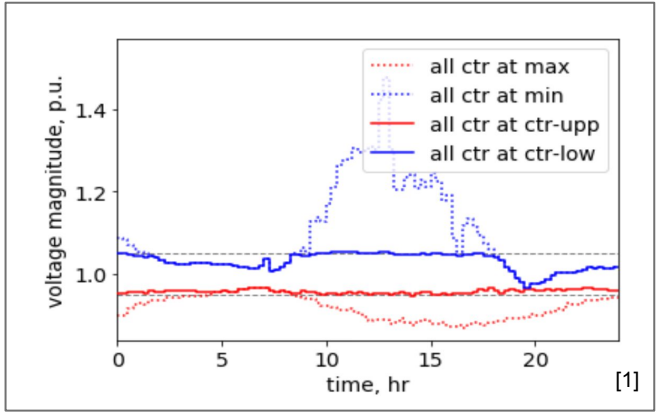



Source: EPRI

# What are Operating Envelopes?

Frees up aggregators/VPPs to optimize for market participation while abiding by network constraints

- Bounds on the allowable import or export of power at a given time & location
- Accounting for constraints (device capacity, line capacity, voltage) in the network
- Expressed as a time series of min & max kW limits (and eventually, kVar)
- Defined at each controllable asset, or group thereof
- Computed dynamically, based on the state of the network now for a forecasted time horizon (e.g. 24 hours)



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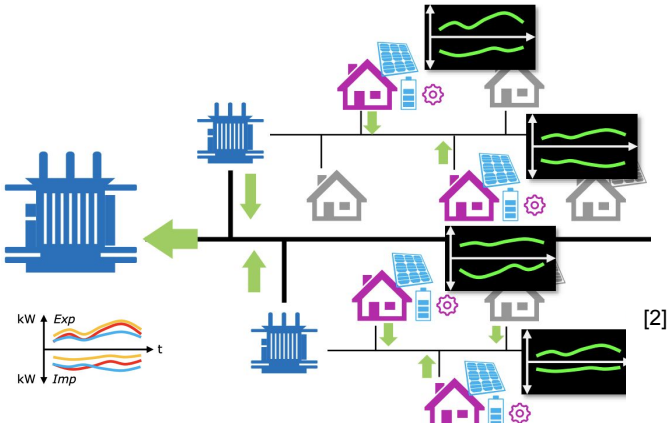

[2]

[1] Comden et al, Secure Control Regions for Distributed Stochastic Systems with Application to Distributed Energy Resource Dispatch. *2022 American Control Conference (ACC)*.
[2] Ochoa and Mancarella, Making operating envelopes a reality: Project EDGE, 2023

# Next Steps

# Enabling data exchanges

We need to enable effective communication between parties to support the DSO understanding:

- Which aggregators are planning to participate?
- What assets are registered in their aggregations?
- What are the capabilities of those assets to bid into various classes of grid services?
- Where are those assets located on the distribution grid?
- What are those assets currently doing, how have they behaved in the past, and what might they do in the future? (e.g., telemetry from the assets)

and the ability for the aggregator to receive the OEs and continuously optimize with that information of the distribution system

What standards will enable this communication to scale across the industry and encourage adoption?

# Business Model and Regulatory Frameworks

So we have:

- The mechanism in place to characterize grid requirements and constraints.
- Communication between relevant actors: DSO, aggregators, ISO/RTO, & end customers

Now **what are the rules they have to play by** and **how do they all get paid?**

- Are aggregators required to observe the OEs by the regulators?
- Does the observation of OEs deliver firm capacity to the DSO?
  - How is firm capacity procured at the distribution system level?
- If distribution limits are imposed on aggregators, should they be made whole?
  - Or should this be a cost of participating under 2222 (preserving equity across the rate base)
- Can end consumers move in/out of wholesale participation and local market participation frequently (daily/hourly) so as to avoid double counting, but also maximize value?

# CAMUS

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THANKS!

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