

# Operational Needs for a High DER Future



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# ESIG DER Integration Series



- DER Integration into Wholesale Markets and Operations
  - Structural participation models
  - Aggregation review
  - Operational coordination between key actors including outages, overrides
  - Communications and data sharing
  - Interconnection
- Lessons Learned for the US Context
  - UK
  - Australia
- Transition to a High DER Electricity System

<https://www.esig.energy/der-integration-series/>



A Report of the  
Energy Systems Integration Group's  
Distributed Energy Resources  
Task Force  
January 2022

The logo for the Energy Systems Integration Group (ESIG).

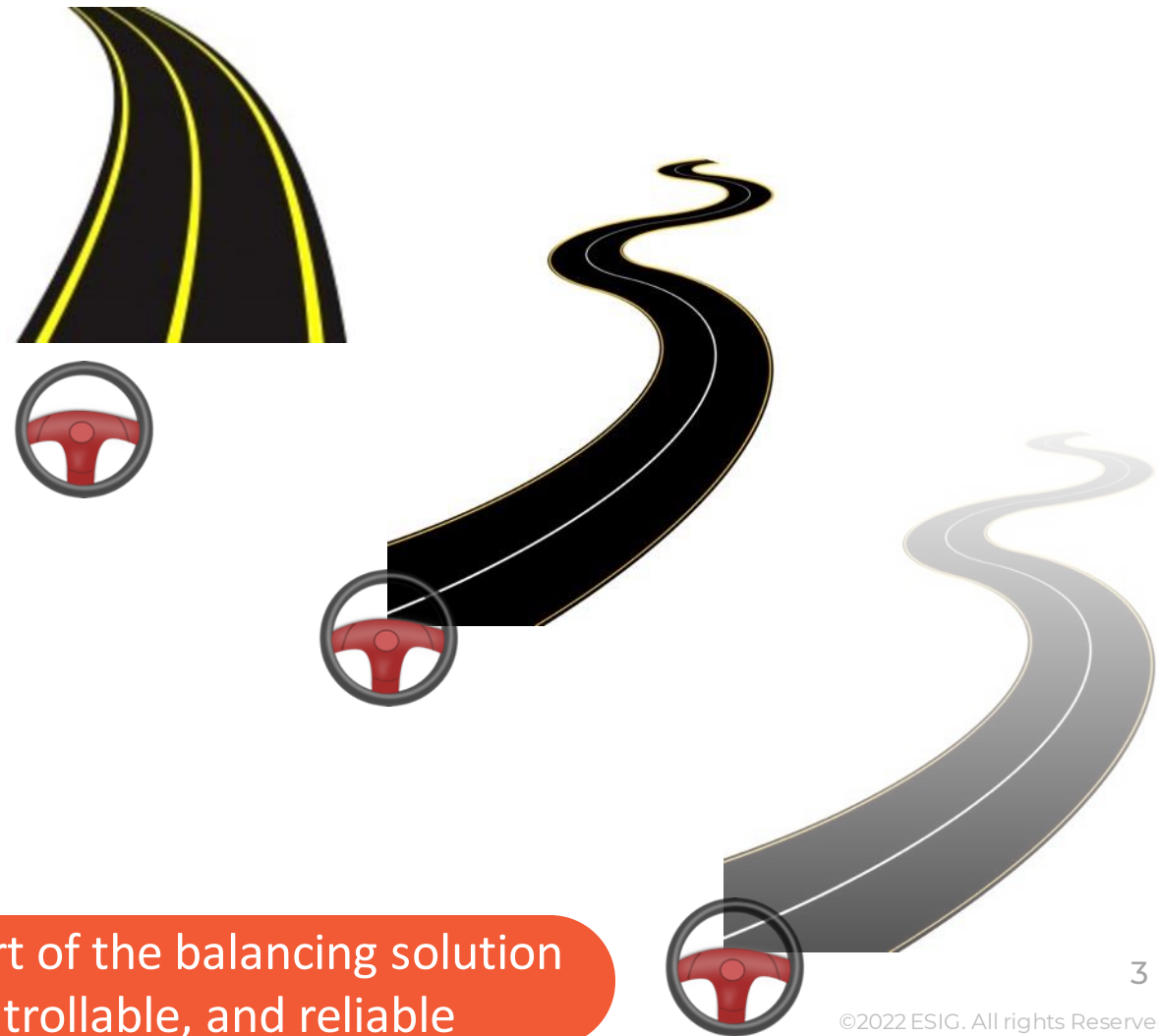
# Operational needs with DERs

The system operator needs to forecast loads and resources to position the system and then to balance the system in real-time.

We need visibility of high levels of DERs and to understand behavior of DERs in order to forecast their consumption/generation (if they are not being dispatched). This role doesn't need to be the ISO's.

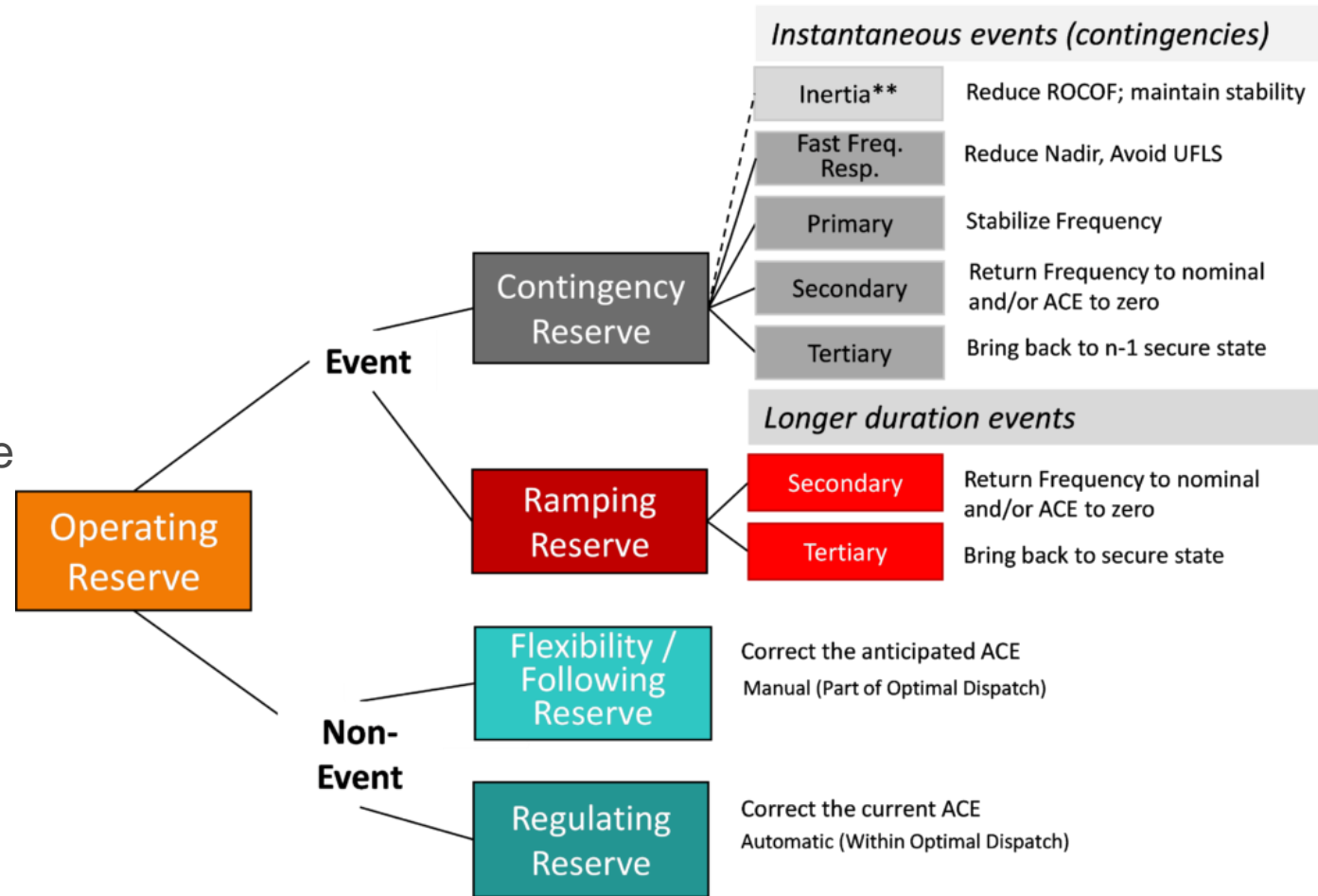
We need to be careful of high levels of DERs that in aggregate act as a large resource because that can increase regulation reserve needs, or cause stability issues.

A resource that is a large part of the balancing solution needs to be visible, controllable, and reliable



# Reserve requirements

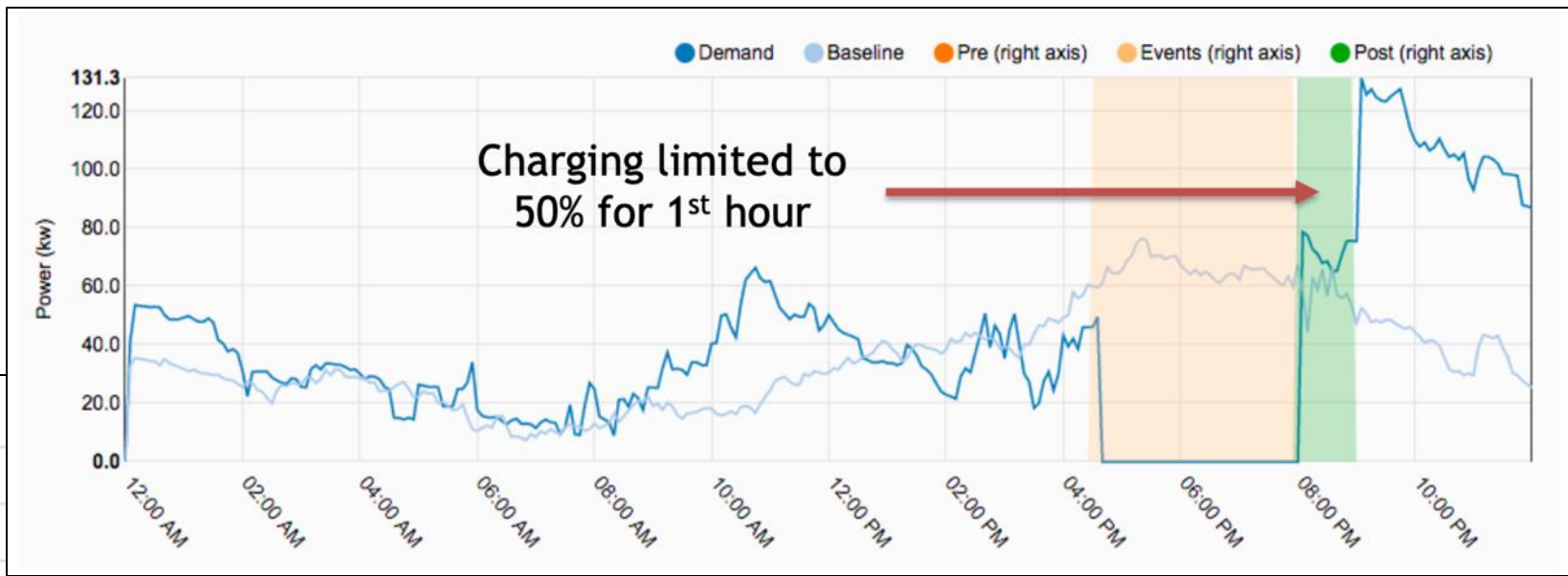
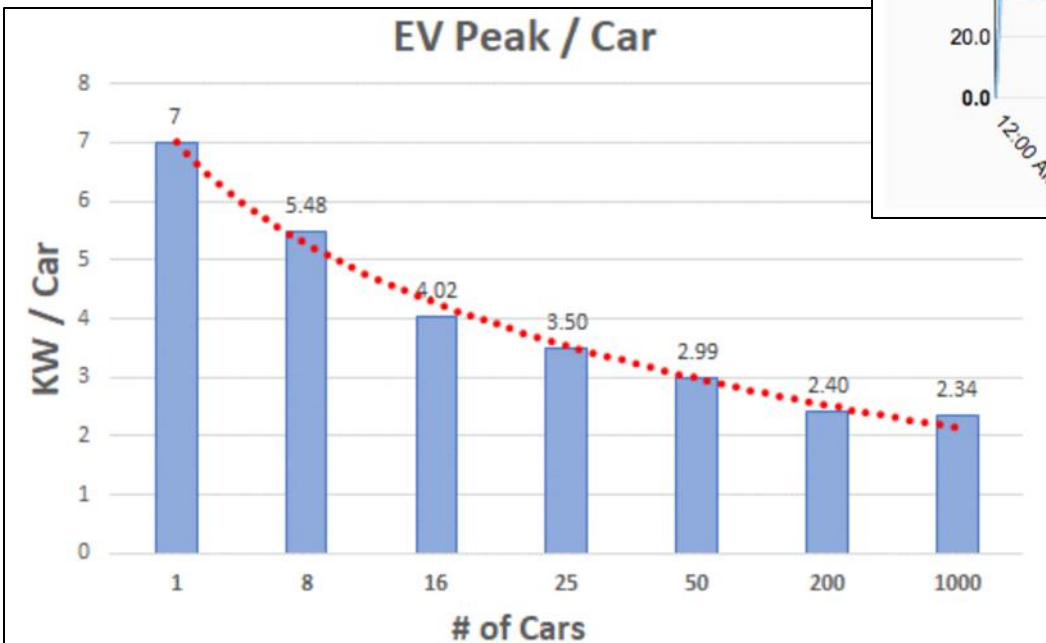
- We hold reserves to protect against contingency events – eg loss of largest generator
- We hold operating reserves to control the supply/demand balance and to meet reliability standards - variability and uncertainty of load, wind, solar to determine reserve requirements
- Reserve requirements balance cost and reliability
- DER aggregations that move in a common way, for example to a price signal or a transmission fault, can be larger than the largest generator, which could cause issues



# Step change effects of managed DERs

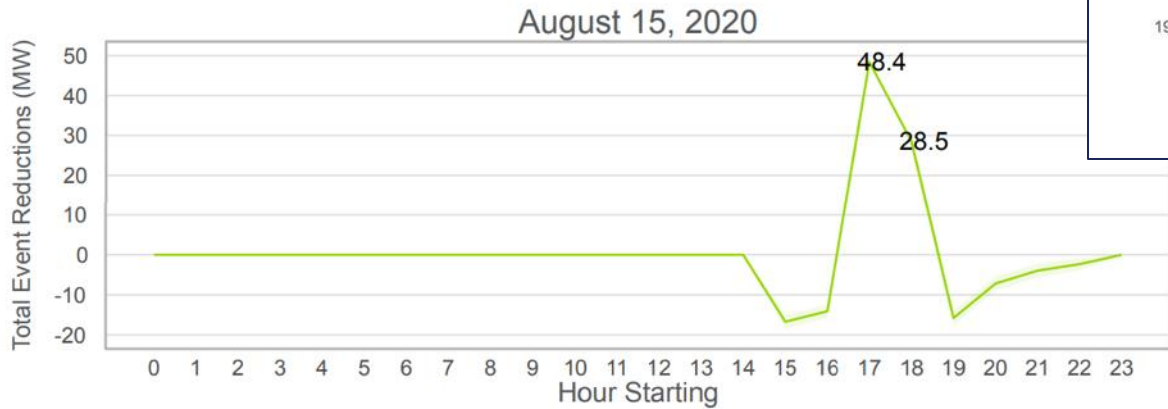
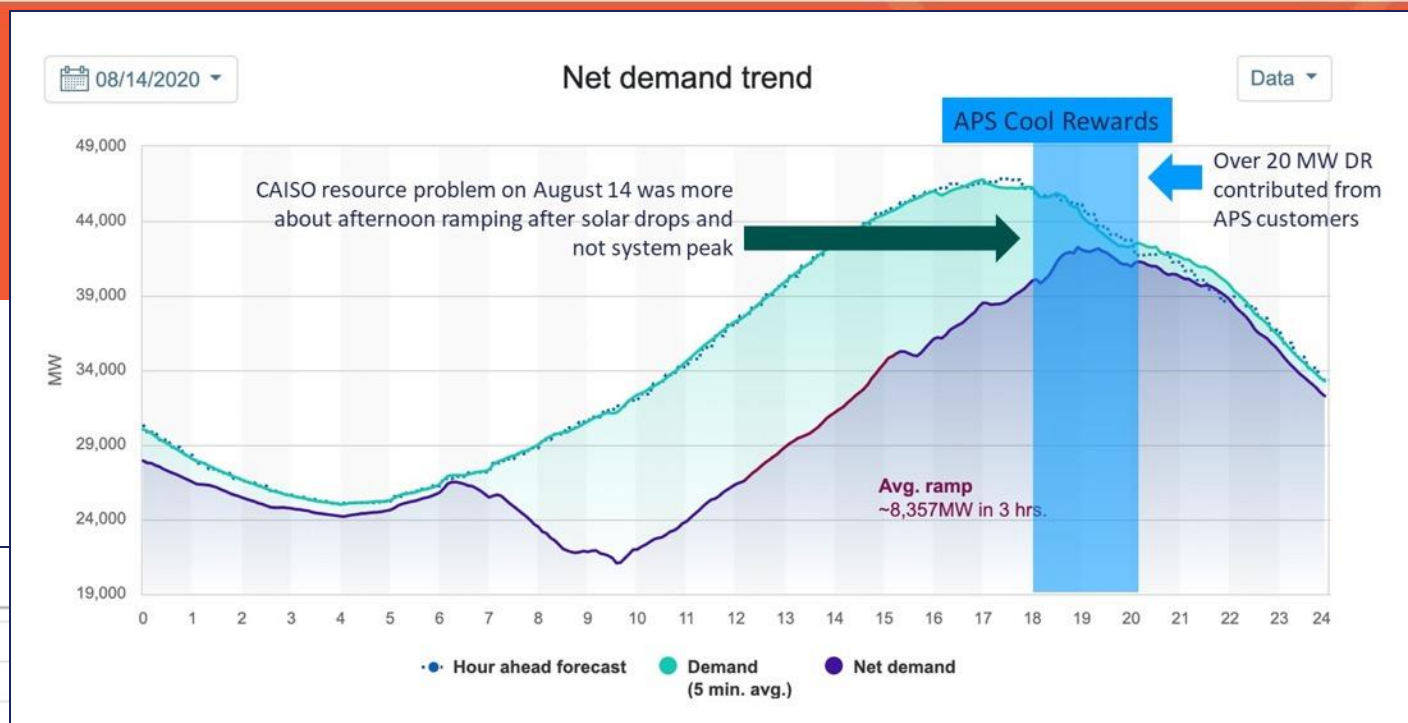


Natural diversity present in unmanaged DERs



Managed DERs can have rebounds, which in turn will need to be managed.

# APS orchestrates demand



Event Date	Average per Device Reductions Over the Event Period	Total Average Event Period Reductions	Total Peak Hour Reductions
14-Aug-20	1.25 kW	29.9 MW	37.9 MW
15-Aug-20	1.61 kW	38.6 MW	48.4 MW
17-Aug-20	1.19 kW	28.7 MW	35.8 MW
18-Aug-20	1.17 kW	28.2 MW	34.9 MW

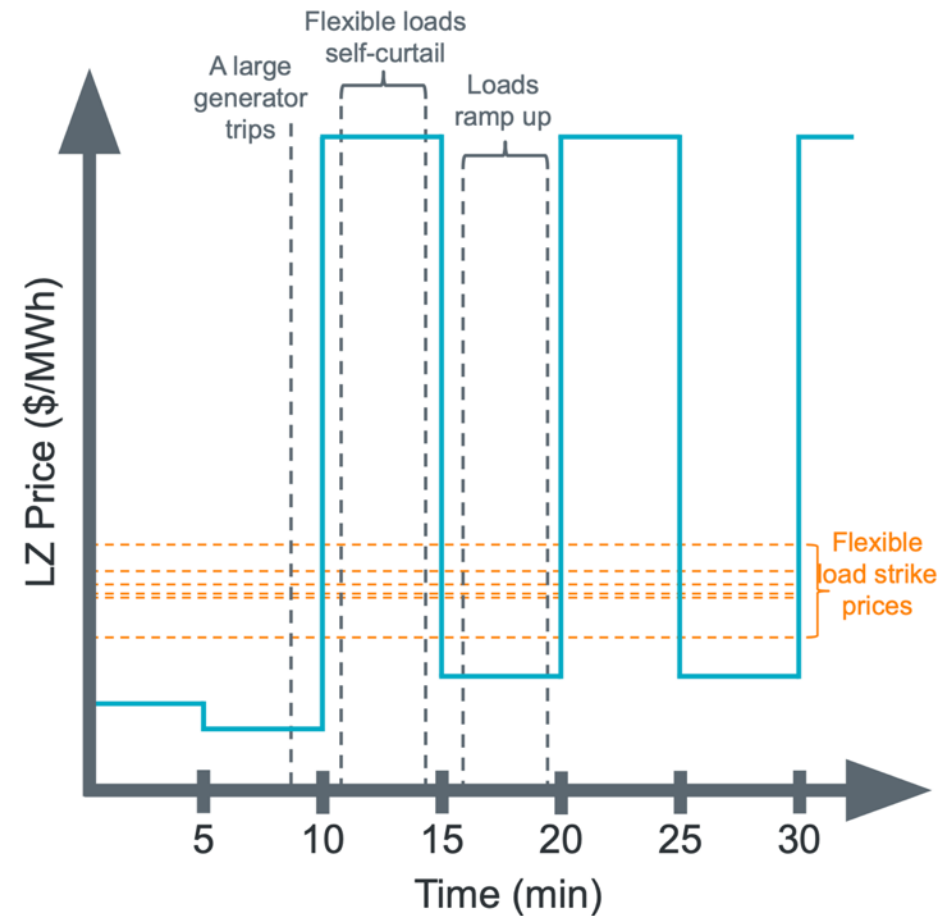
APS uses retail pricing as a crude tool to shape demand. Then they use DER programs as a precise tool in real-time.

# High levels of open-ended price response can lead to issues

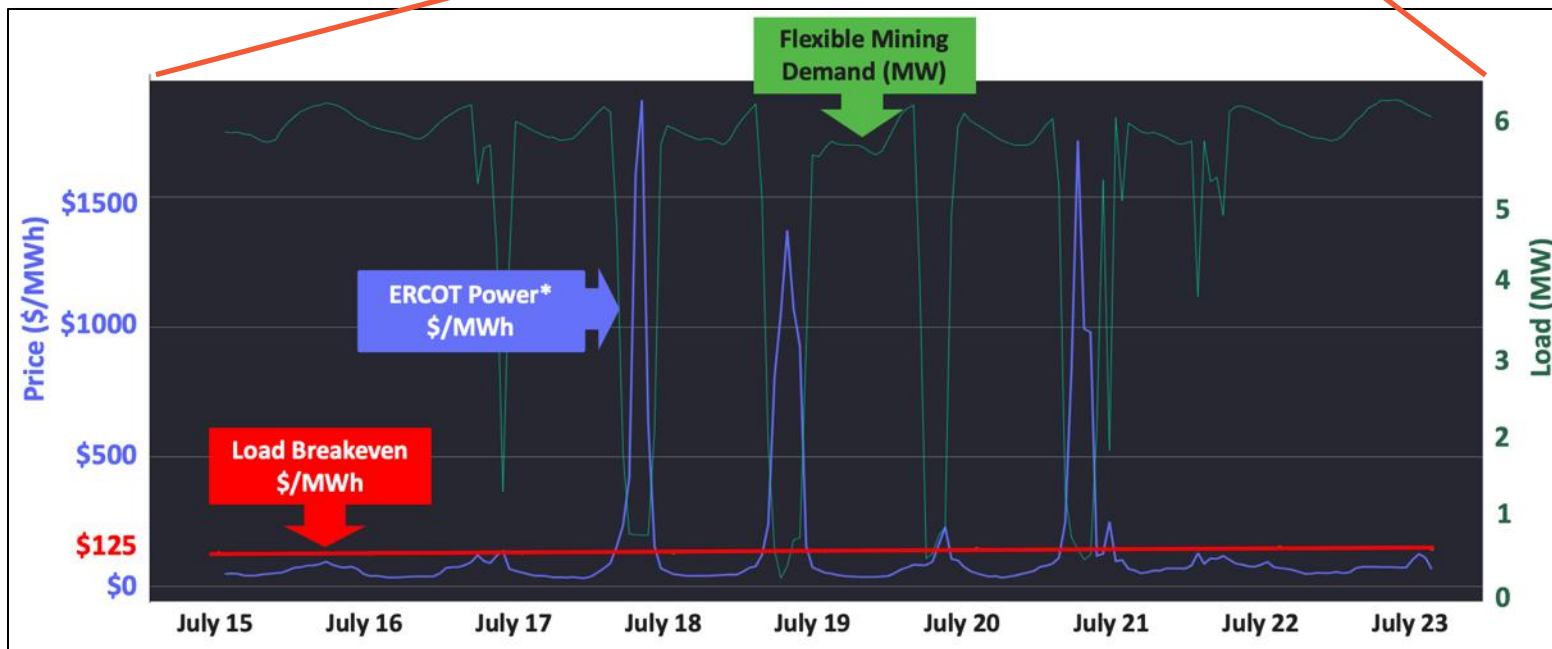
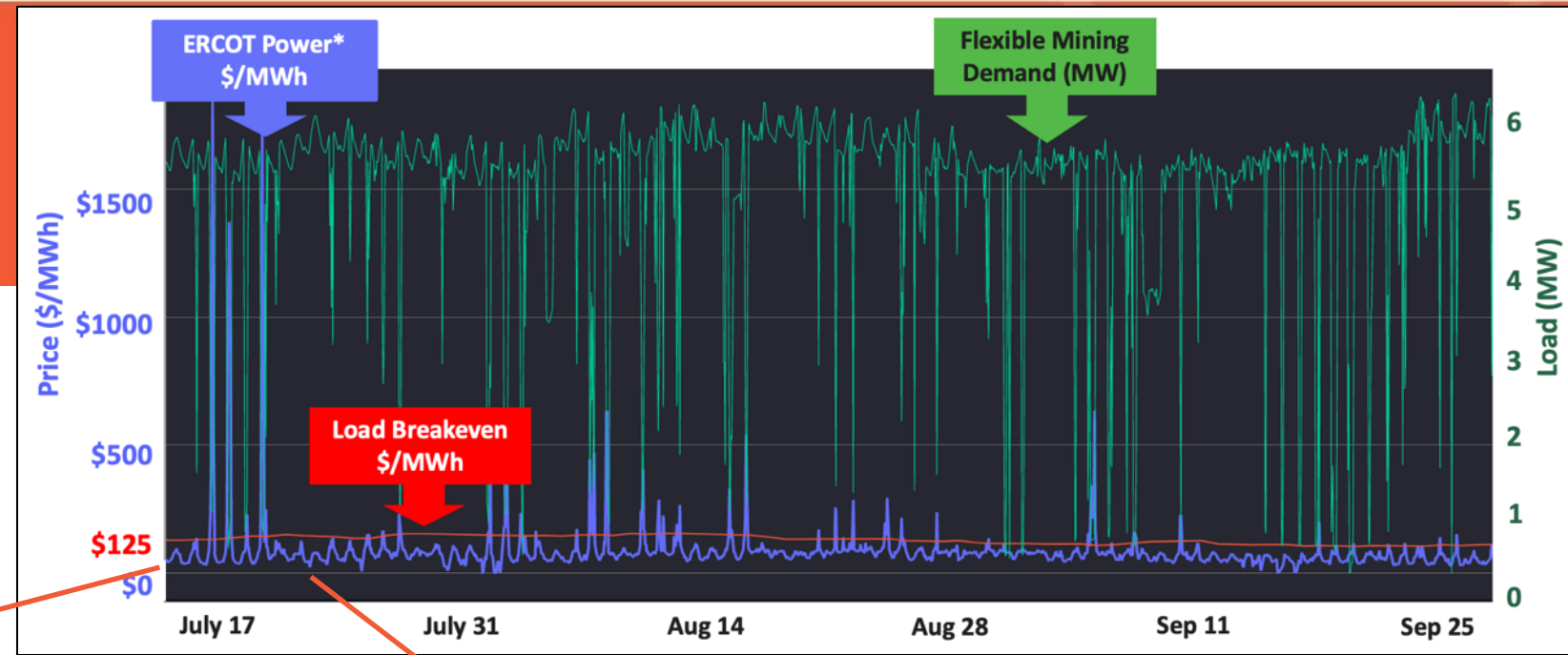
Anything that makes large amounts of DERs act in a common-mode fashion should be carefully considered.

Prices-to-devices with fast controls/communications/automation could result in oscillatory behavior as devices chase prices, and in doing so, change prices.

It would increase the need for regulation reserves. At worst, it could cause a reliability event.



# A future of demand flexibility



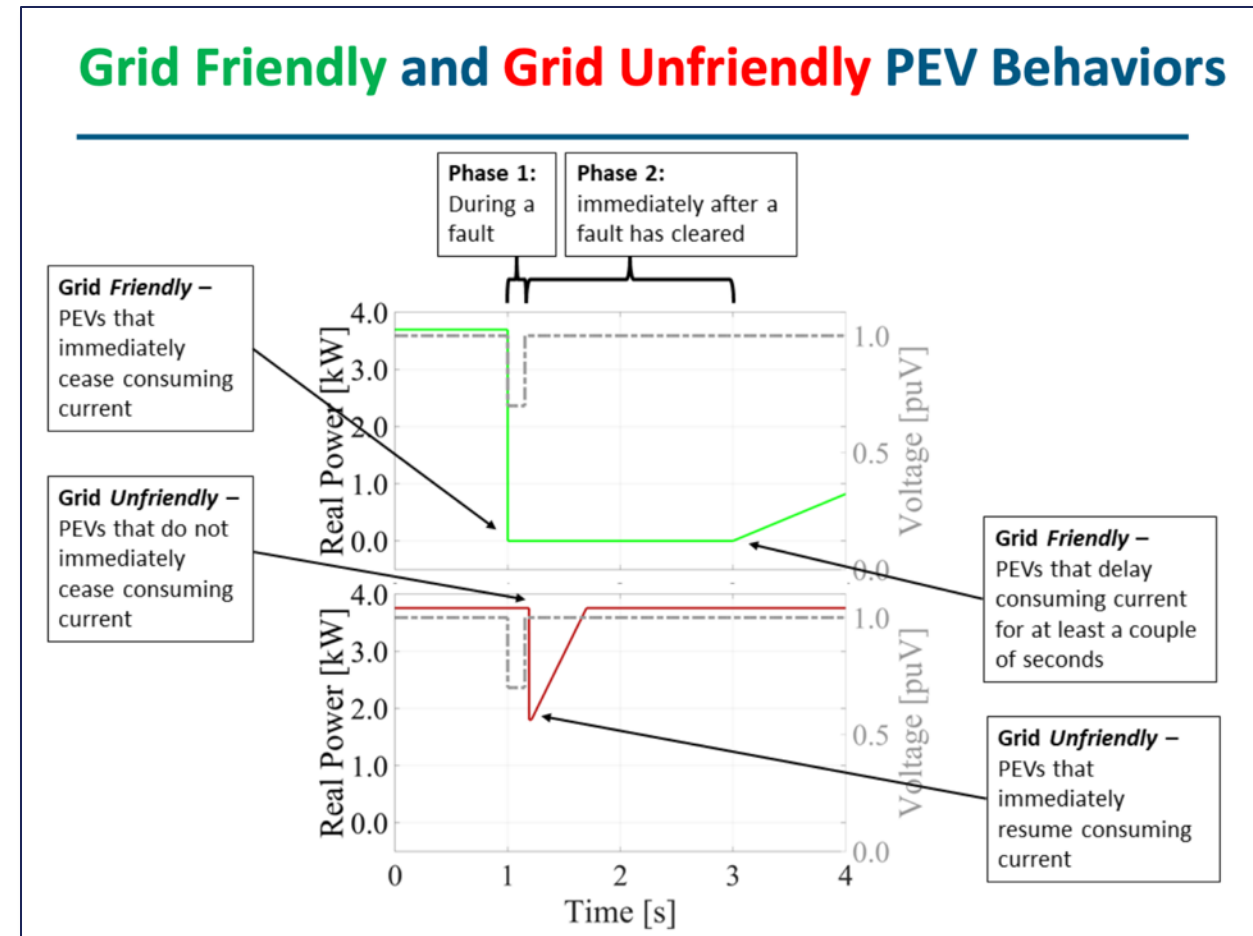
Controllable Load Resources in ERCOT are dispatched to 5 min set points and provide frequency response



# DER behavior during disturbances will be important



- We need to consider interconnection requirements and how aggregated DERs behave during events such as transmission faults or loss of largest resource
- Avoid the Germany 50.2 Hz issue – reprogramming hundreds of thousands of inverters
- LBNL has found EV charging can be supportive or detrimental to the grid during fault-induced delayed voltage recovery events
- Some have suggested that EV chargers could provide frequency response services.



# DERs are like the Swiss army knives of the power system



## Bulk power system needs

- Capacity
- Energy
- Operating reserves
- Frequency response
- Avoid transmission upgrades

## Distribution system needs

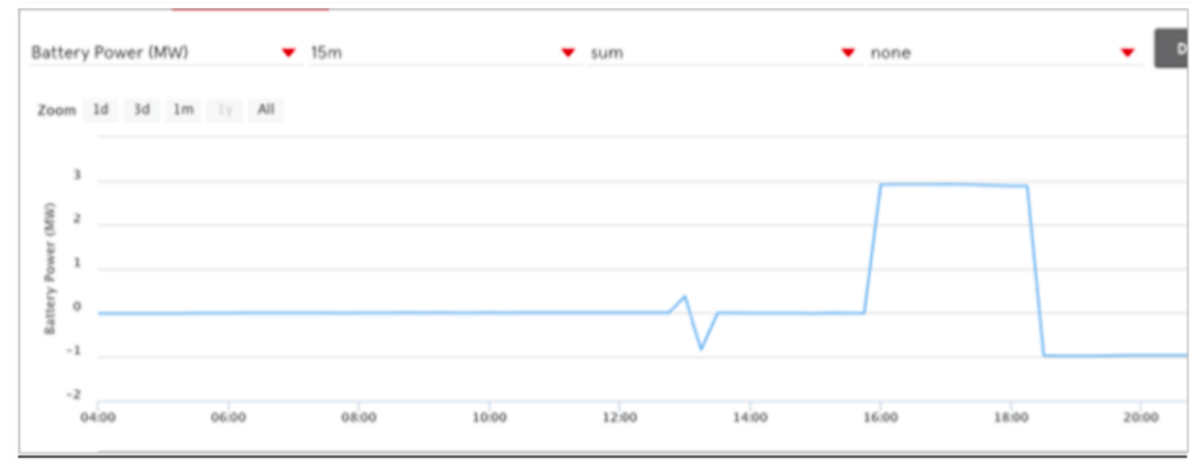
- Avoid distribution upgrades
- Manage voltage
- Resilience



# Coordination to provide bulk power system and distribution services



- High value needs
  - Avoid the need for generation, transmission or distribution infrastructure
  - Backup generation during resilience events
- Green Mountain Power's home energy storage programs
  - Customers lease or buy battery storage systems
  - Battery provides backup power in case of outages; GMP prioritizes backup prior to extreme weather
  - GMP uses the batteries to reduce peak consumption which reduces their capacity obligation and their transmission charge, and also to provide regulation reserves
  - GMP estimates this value and reduces lease price accordingly



Doug Smith, Green Mountain Power, ESIG Fall Workshop, 10/19/21



# THANK YOU

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