Primary Frequency Response – Energy Storage

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Where we are…

The Problem?

» Fleet and rules changes driving consideration Primary Frequency Response (PFR) provision.

- PFR is important
- No financial incentives to provide this critical service
- No longer workable to assume PFR will be provided 'for free'

Solution?

» An **in-market constraint or product can incent capability and perform**ance while compensating for opportunity costs
- CAISO Markets should reserve PFR capability and service

» Constraint/Product design should **include mechanisms for calculating how much PFR resources can provide**
- Not all resources provide PFR equally or linearly

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PFR: *"In-Market"* Design

» How an in-market constraint or product would work:
- Day-Ahead and Real-Time Markets solve for constraints and products, including reserving capacity/capability for PFR provision
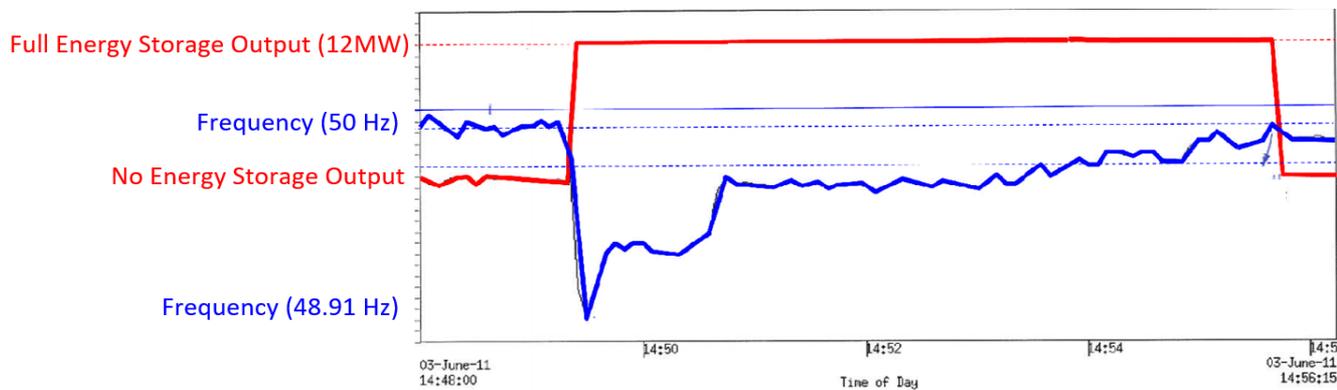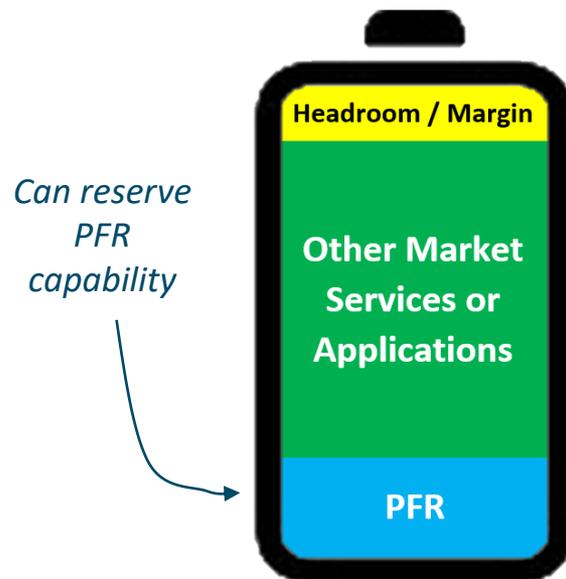- When dispatched, resources also settles for energy (like Regulation)

» How much PFR capability (in MW of PFR service) is procured
- ISO to determine based on BAL-003 need

» Procured from whom?
- From eligible resources if so equipped/capable and with deliverable and countable PFR capability

» How to determine capability of PFR from a resource
- Counting metric is: "MW capable and delivered/ MW reserved"
  - "1/1" is very efficient, but ".1/1" is less efficient
- Easy to determine/know PFR capability from some resources
- May need methodology for determining amount *of* PFR available from some resources.
- Duration of PFR 'burst' (in terms of energy backing a MW of PFR) may need definition.

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PFR from Energy Storage

» Efficient provider of PFR, a.k.a. "1:1"

» Autonomous, instantaneous response & contribution

» Most storage has sufficient energy, e.g. ≥ 15 min., for PFR service.

» Fully configurable: rate of response, time-delay, deadband

» Bi-directional if required (under and over freq. support)

Can reserve PFR capability

Headroom / Margin

Other Market Services or Applications

PFR

Full Energy Storage Output (12MW)

Frequency (50 Hz)

No Energy Storage Output

Frequency (48.91 Hz)

Time of Day

03-June-11
14:48:00

14:50   14:52   14:54

03-June-11
14:56:15

Source: *https://www.neces.com/assets/CIGRE-Frequency-Response-from-Autonomous-Storage-Units1.pdf*

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Appendix

» Storage can be programming for any desired PFR responses.

- (MW/0.1Hz, time-delay, deadband etc.)