



ARPA-E GO Competition Challenge 3 Workshop

Computational Challenges in Power Systems

Khaled Abdul-Rahman, Ph.D.

Vice President

Power Systems and Market
Technology

George Angelidis, Ph.D.

Principal

Power Systems Technology
Development

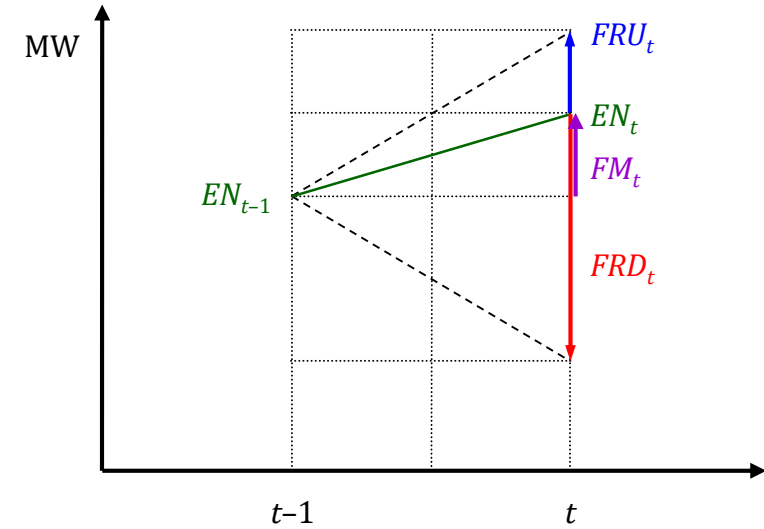
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Overview

- Flexible Ramping Product Refinements
- Energy Storage and DER Resources

What is the Flexible Ramping Product?

- Combination of two products:
 - ◆ Forecasted Movement (FM)
 - Energy dispatch difference from interval $t-1$ to interval t
 - ◆ Flexible Ramp Up/Down (FRU/FRD) award
 - Reserved ramp capability from interval $t-1$ to interval t for uncertainty that may materialize in the next market run



EN: Energy schedule

FM: Forecasted Movement

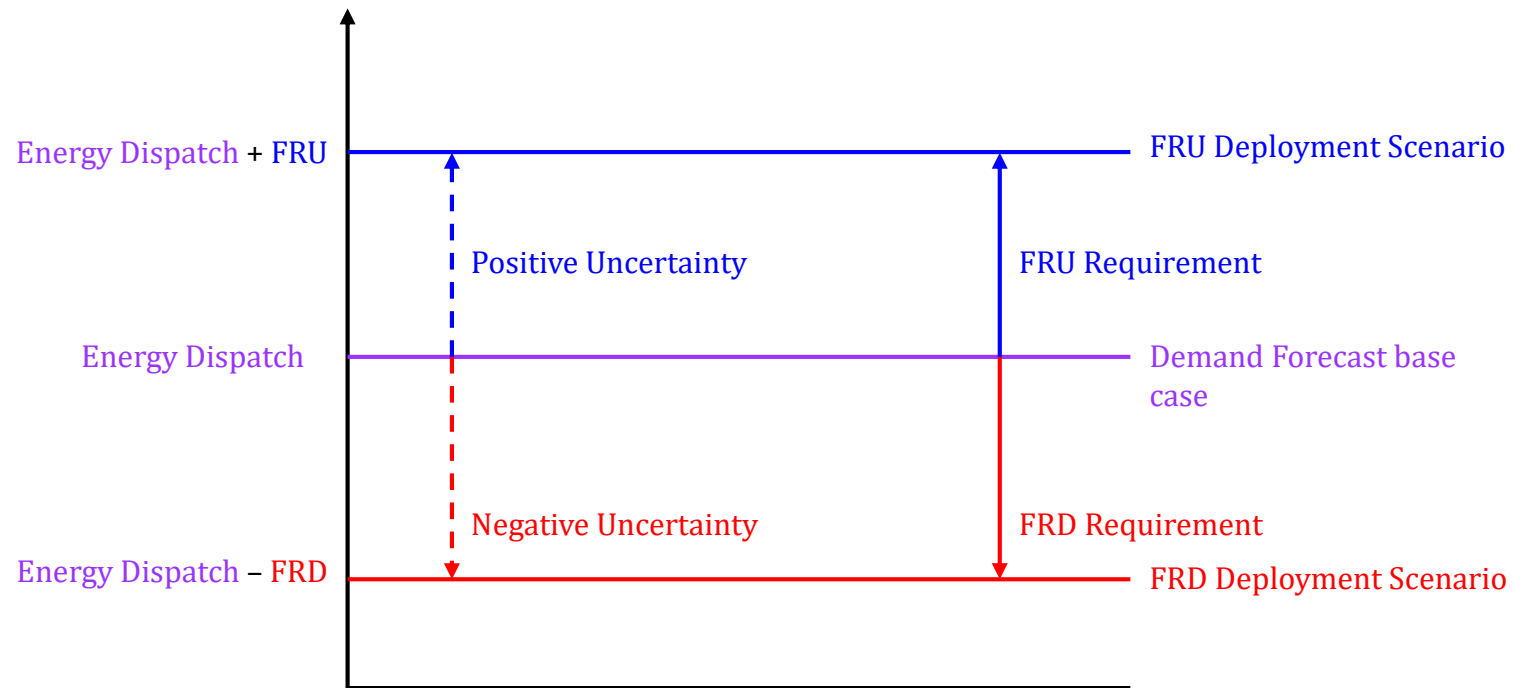
FRU: Flexible Ramp Up award

FRD: Flexible Ramp Down award

Deliverability issue with current Flexible Ramping Product

- Resources with Energy schedules bound by transmission constraints have unused capacity with low opportunity cost
 - ◆ These resources are awarded FRU/FRD that cannot be deployed if uncertainty materializes in the next market run because that would violate transmission constraints
- A CAISO study has shown that ~25% of FRU awards are not deliverable because of transmission constraints

Addition of FRU/FRD deployment scenarios in the Real-Time Market for Base + Contingencies



FRU/FRD deployment scenario setup in the Energy Imbalance Market

- FRU/FRD awards are deployed in all BAAs while the demand forecast in the EIM Area is increased/decreased by the FRU/FRD requirement to balance
- All physical transmission constraints (base case and contingencies) are enforced
- All scheduling limits (transfer limits) are enforced
- AC power flow cases (base + contingencies) **x 3**
- Transmission constraints in MIP model **x 3**

Storage & DER Resources

- FERC 841 in 2018 & FERC 2222 in 2020
- Increased number of participating resources in market
- Small sizes of bid curve
- Reduced MIP gap setting
- Long solution time
- Need for more computation power to maintain current real-time market timelines

Questions & Answers

Thank you