Spillovers from Ancillary Services to Wholesale Power Markets

Source: https://energystorage.org/

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Grid reliability

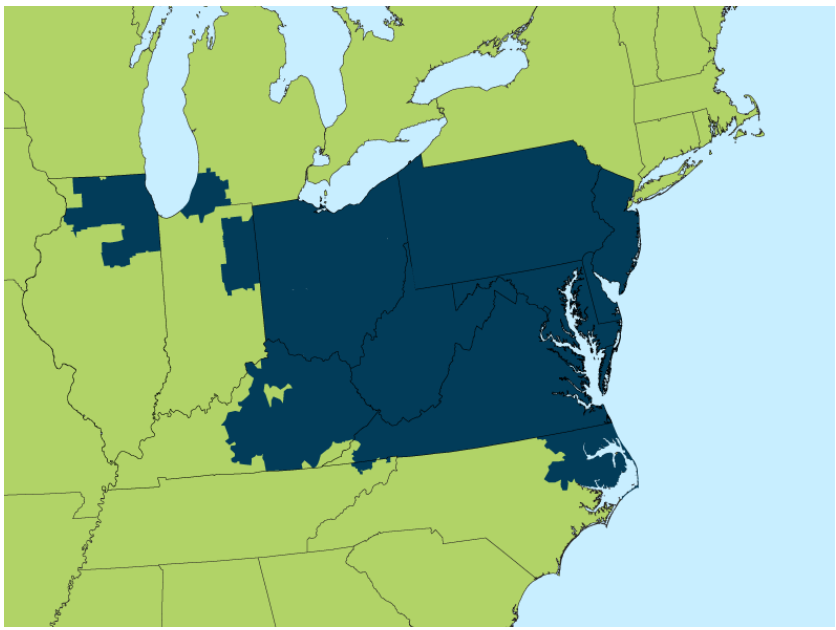
- With more renewables/batteries and extreme weather, ISOs are changing how they think about and compensate grid reliability and resilience.
- **How do changes to ancillary service markets impact the behavior of generators in the much-larger energy market?**
- *Definitions:*
  - *Energy provision market - market for electricity sales*
  - *Ancillary services markets - markets for reliability*

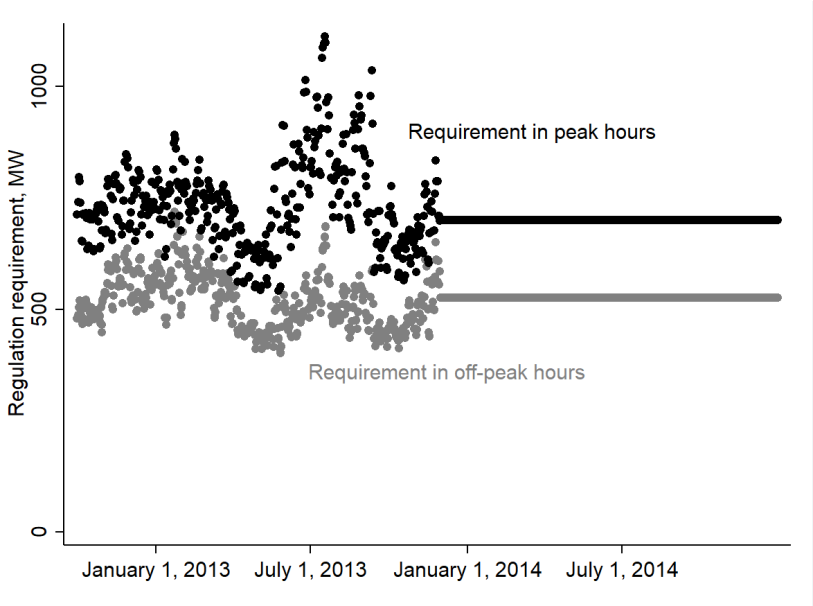
Background - ancillary service markets

- Economists tend to focus on energy markets.
- Ancillary service markets are interesting and important!
  - **Frequency regulation** - adjusting generation output to balance grid frequency
  - Reserves - supplies not in use but quickly available if necessary

Our paper

- We look at changes in PJM's frequency regulation market over the 2012-2014 period,
- Showing how generators responded by changing their behavior in the energy market.





Results

- When the regulation requirement is increased by 100 MW,
- Boilers generate 360 MWh less in each hour (p-value <0.05),
- Combined cycle units generate 390 MWh more (p-value 0.01),
- Other unit types experience only small and noisy changes.

Mechanisms

- Some generators need “headroom” to provide more regulation.
- Some generators go from zero generation to e.g. 50% of capacity,
  - To be at their min. constraint and to provide “footroom.”

Concluding thoughts and applications

- Ancillary services markets interact directly with generation markets.
- Minimum constraints can be important.
- Renewables, batteries, climate change are all leading to a rethinking of ancillary services and other reliability issues.
- Shortly after this time period, batteries installed to provide frequency regulation in PJM – our results suggest this could have *increased* CO2 emissions.
- With imperfect environmental regulations, we need to be careful about unintended consequences of our policies and of new technologies (e.g. batteries).

Thank you!