



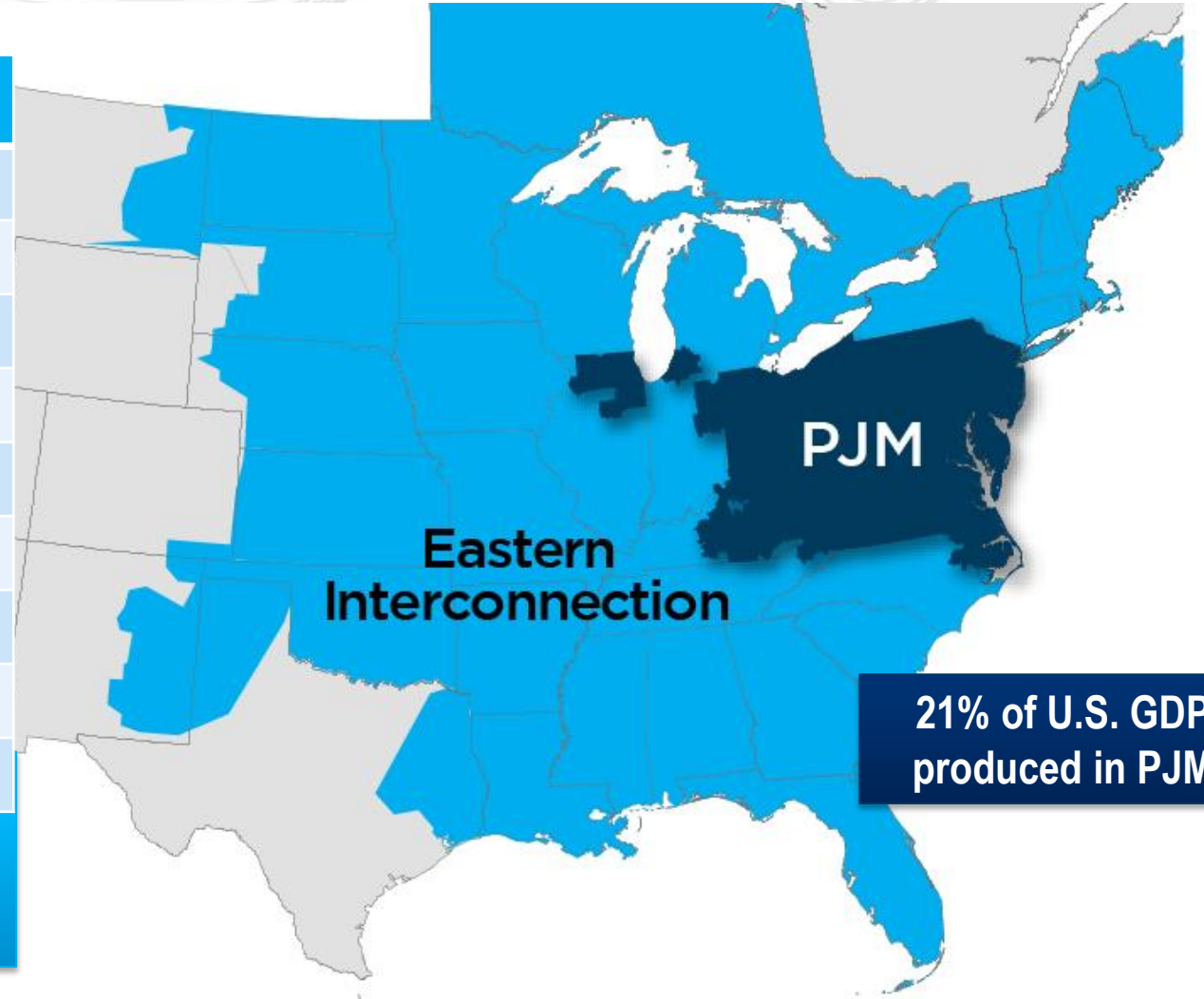
Primary Frequency Response in PJM

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Key Statistics

Member companies	1,040+
Millions of people served	65
Peak load in megawatts	165,492
MW of generating capacity	178,563
Miles of transmission lines	84,042
2017 GWh of annual energy	773,522
Generation sources	1,379
Square miles of territory	243,417
States served	13 + DC

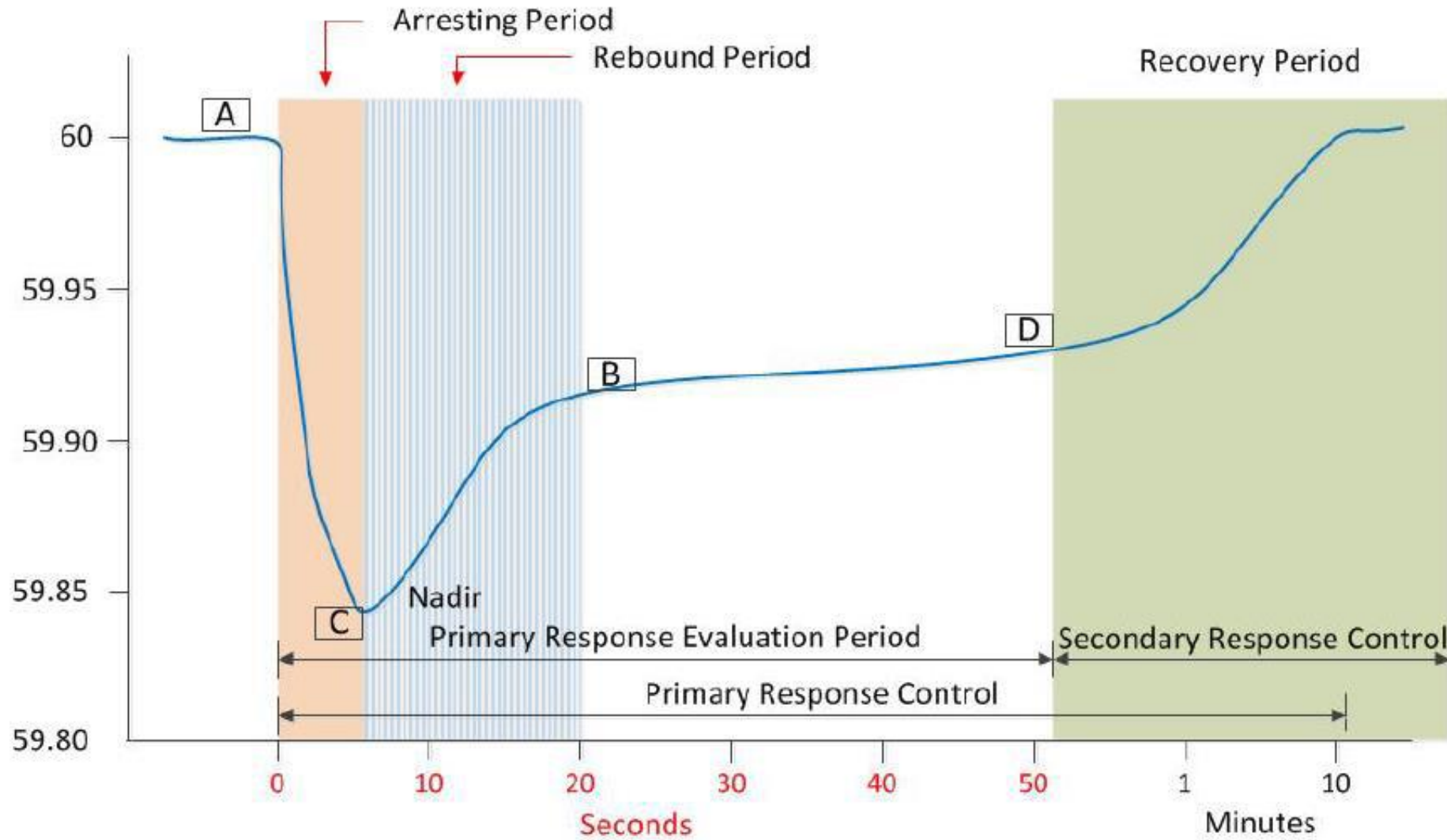
- 28% of load in Eastern Interconnection
- 20% of transmission assets in Eastern Interconnection



As of 2/2018

Primary Frequency Response (PFR):

- First stage of system frequency control
- Inherent response of resources and load to arrest local changes in frequency
- Provided automatically by unit governors or equivalent speed control systems
- Response is in seconds and not controlled by any centralized system
- Critical for controlling frequency in system restoration event



Droop Control:

- Allows units to operate in parallel so that each unit shares MW response with other generators in the system
- NERC guideline: max. 5% droop setting

Deadband:

- Is the amount of frequency change a governor must see before it starts to respond
- NERC guideline: max. +/- 36 mHz deadband setting

Drivers for enhancing PJM's PFR business rules

- Review of current generator frequency response
- NERC Std. BAL-003
- NERC Advisory on Generator Governor Frequency Response
- FERC NOPR on Primary Frequency Response



PJM Task Force formed

- Evaluate PFR within PJM
- Evaluate need to revise PJM business rules for PFR requirement
- Discuss potential compensation mechanisms related to providing PFR capability

FERC Order 842 Issued February 25, 2018

- Requires all new generation with LGIA or SGIA to install, maintain and operate to provide frequency response
- Requirements for max 5% droop, max +/- 36 mHz deadband
- No headroom requirement or compensation requirements
- Does not address PFR for existing resources

Continued stakeholder discussions on solution design components for PFR requirement:

- Applicability to existing resources
- Exception process
- Implementation plan
- Compensation
- Performance measurement