Resilience:
Operationalizing Gas Pipeline Contingencies

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Operationalize Gas-Electric Contingencies
Purpose & Intent

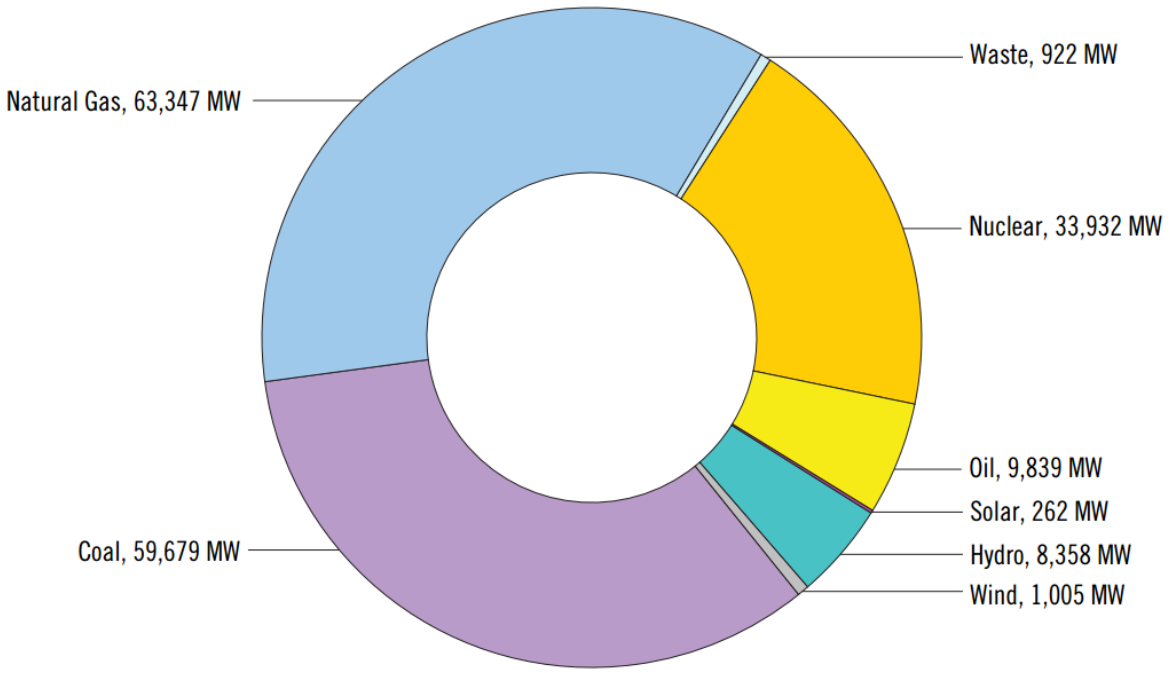
Current initiative is to create operating procedure to evaluate gas infrastructure redundancy and operationalize gas contingencies under

- **Electric/Natural gas infrastructure constraints/failures and**
- **External threat conditions (cyber/physical threats)**

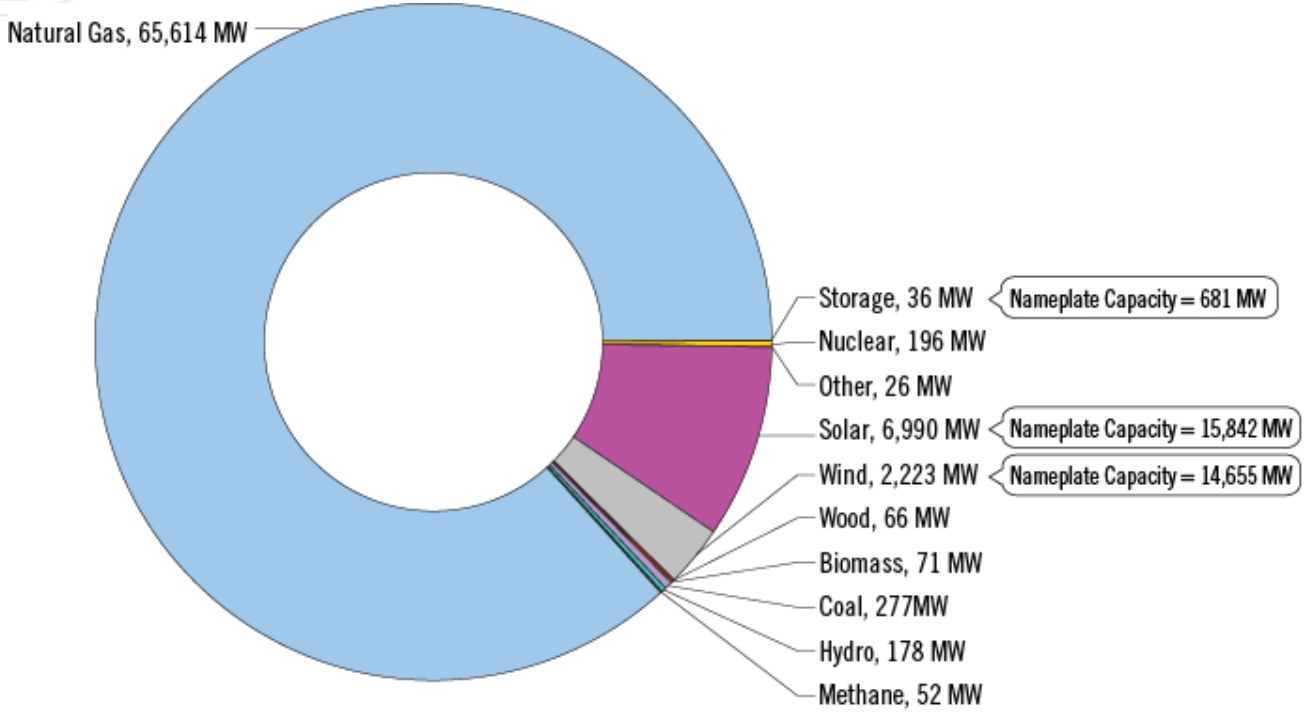
- Define Gas infrastructure redundancy criteria
- Refine Gas unit exposure time
- Define Operating procedures to include triggers, thermal/voltage and reserve requirements.
- Define new process with
  - Decision flow diagram
  - Outline assessment steps in Operating Memo and PJM Manuals.

Queued Resource Mix

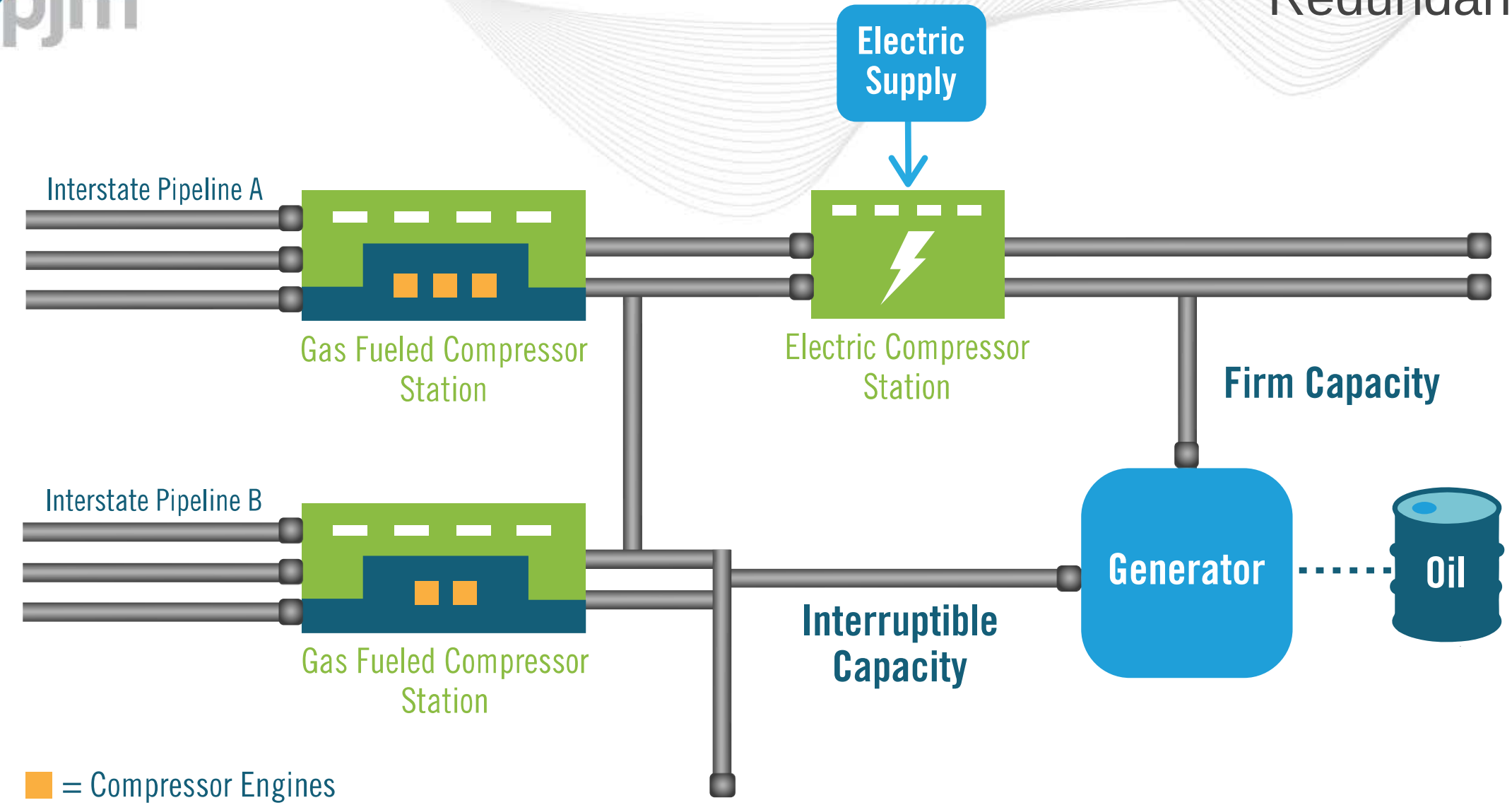
Existing Installed Capacity



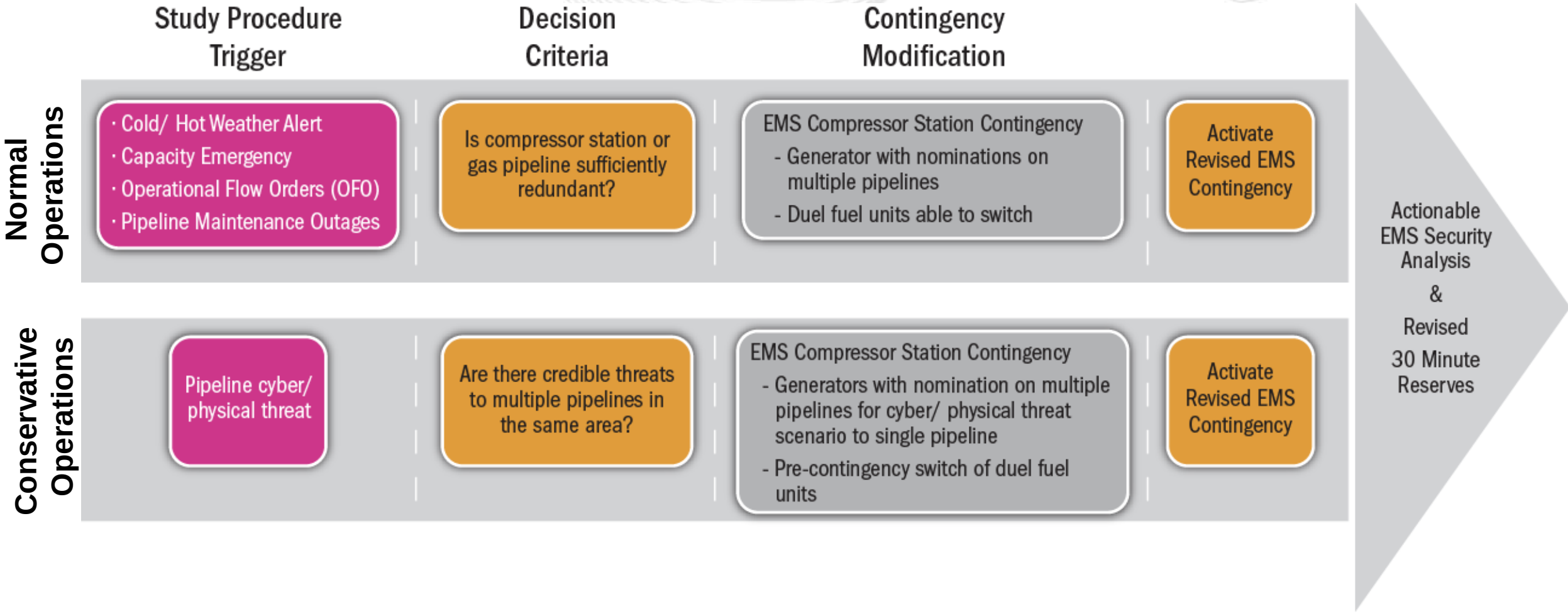
Queued Capacity Requests (CIRs)



Redundancy



Operationalizing Gas Pipeline Contingencies Process Flow Diagram



Generic Contingency Example

Pipeline	Compressor Station	Impacted Generating Units	Unit ICAP	Dual Fuel Details			Alternate Gas Pipeline		Study Results
				Capable	Alternate Fuel MW	Fuel Transition Time(h)	Pipeline(s)	Source MW	Issue Type
Pipeline A	Station A	Unit A 1-4 (Firm:A,B))	231	No	-	-	Pipeline B	231	Reactive Transfer
		Unit B (Firm: A,B,C)	545	Yes	545	1	Pipeline C, Pipeline B	545	
		Unit C (Firm:B,C only)	565	Yes	565	1	Pipeline C, Pipeline B	565	
		Unit D (Firm:A,B,C)	450	Yes	450	2	Pipeline C, Pipeline B	450	
		Unit G (Firm: B only)	174	No	-	-	Pipeline C, Pipeline B	174	
		Unit F (Firm:A,B,C)	86	No	-	-	Pipeline C, Pipeline B	86	
		Unit G (Non-Firm)	1240	No	-	-	-	-	
		Unit H (Non-Firm)	760	No	-	-	-	-	
		Contingency Totals	4051		1560			2051	

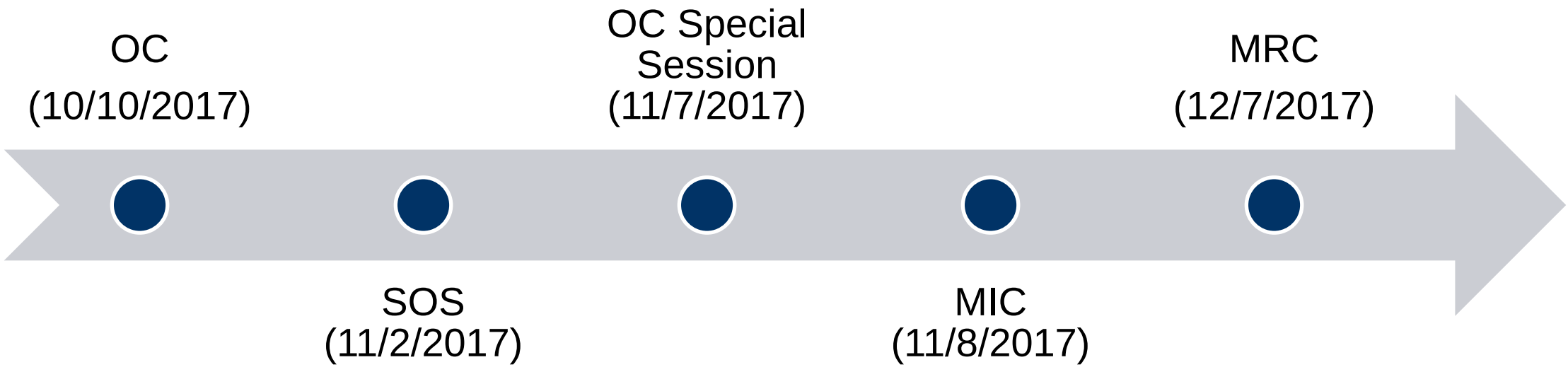
Modified Operational EMS Contingency = UNIT G + UNIT H Required 30 Minute Reserves = 2000 MW (1240 MW + 760 MW)

Next Steps

- Interstate Pipeline/LDC Coordination
  - Formal request for critical gas infrastructure operating characteristics/redundancies
    - Data to be incorporated into contingency assessments
  - Work with pipelines and LDCs to review and validate assumptions and results
    - Results would identify potential reserve quantities required to address contingencies
- Ongoing work with Argonne Labs to analyze contingencies
- PJM Stakeholder Discussions
  - Operating Committee
  - System Operations Subcommittee
  - Generator Feedback Session(s)
- PJM Manual Updates and System Operator Training
- Decision Tree automation

Timeline

Review of Operationalizing Gas/Electric Contingencies.



Timeline

Review of Manual M13 (Section 3.8) and M3 (Section 5 –CEII) for Operationalizing Gas/Electric Contingencies.