

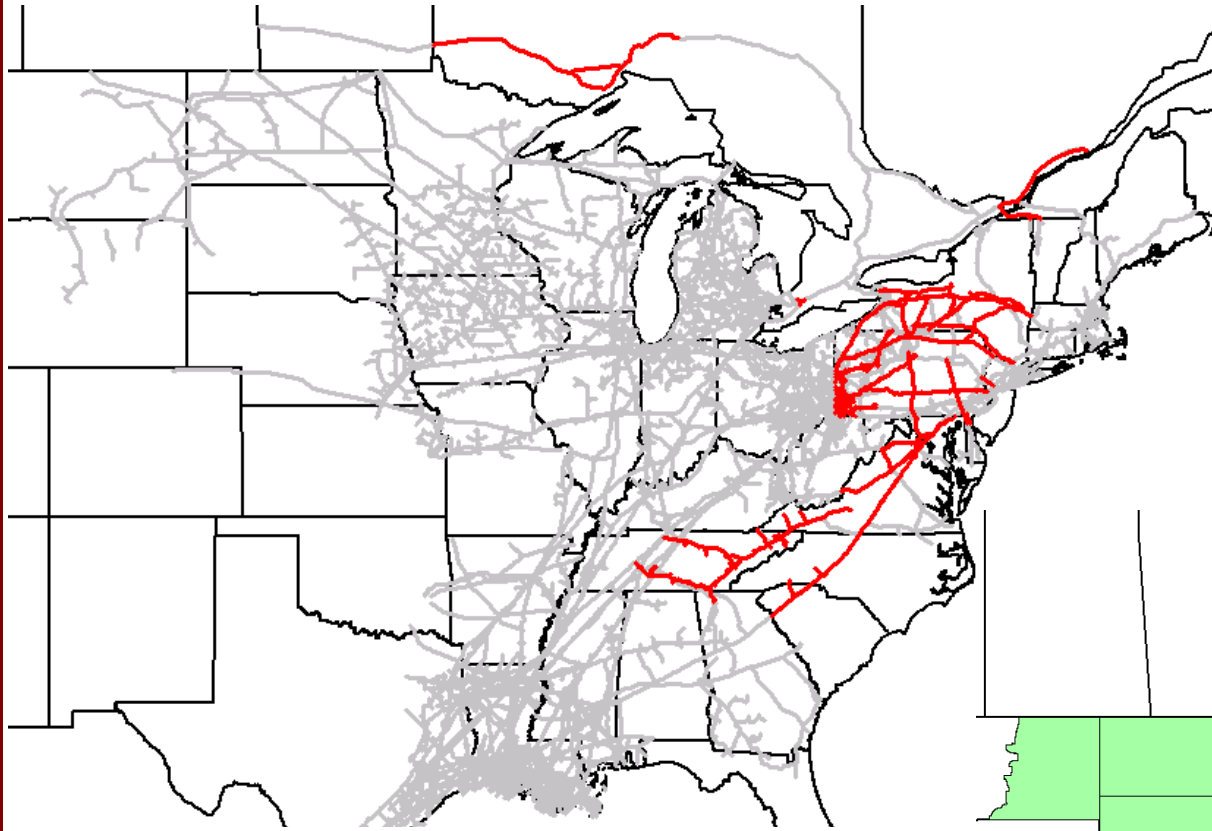
**Showcase Roundtable
Gas/Electric Integration Issues in PJM Footprint**

Natural Gas / Electric Nexus in PJM

Richard L. Levitan
October 29, 2015

LEVITAN & ASSOCIATES, INC.
MARKET DESIGN, ECONOMICS AND POWER SYSTEMS

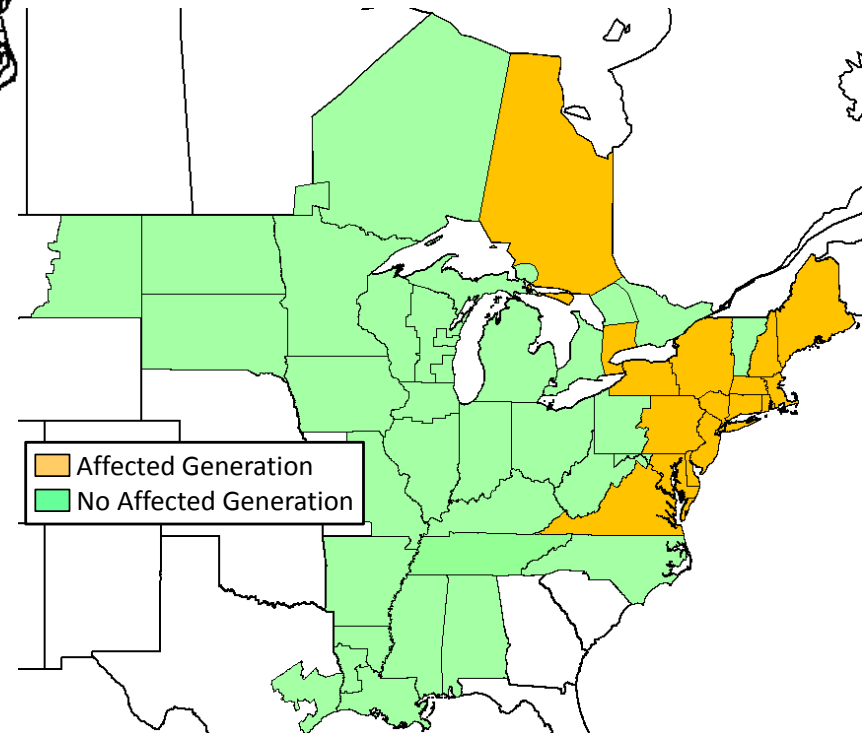
EIPC Study Results: Reference Case, Winter 2018



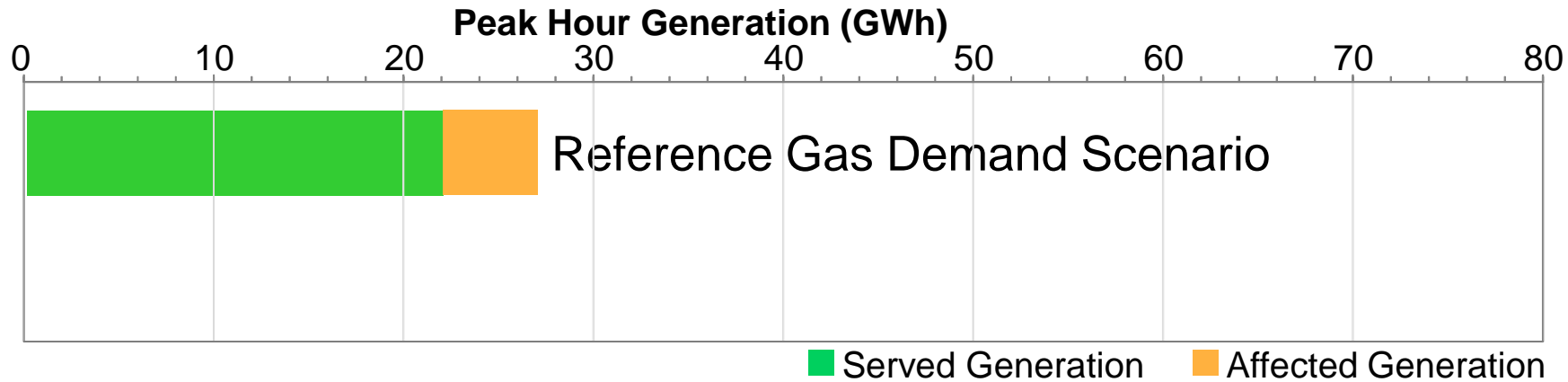
“Affected Generation” does not imply a risk to electric reliability

Study Region Peak Hour Affected Generation: 21,707 MWh (27%)

PJM Peak Hour Affected Generation: 5,020 MWh (19%)

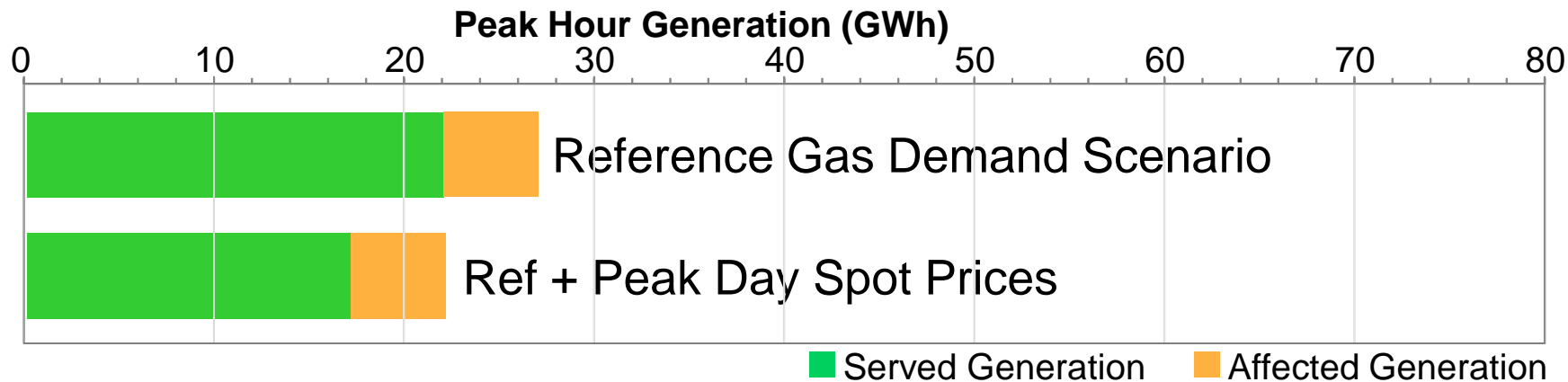


EIPC Study Results: PJM, Winter 2018



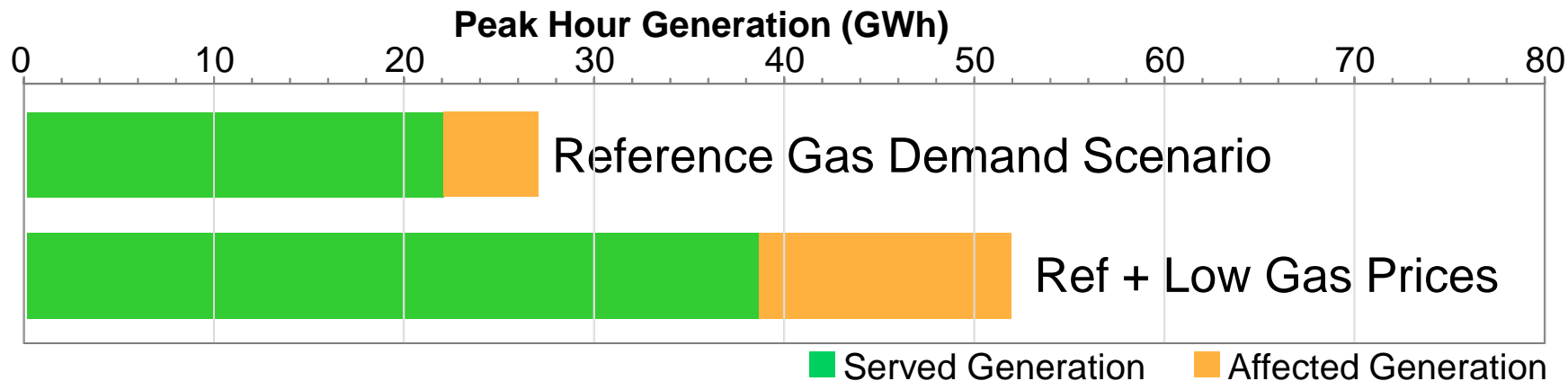
- ◆ Reference Scenario: 19% of generation is affected

EIPC Study Results: PJM, Winter 2018



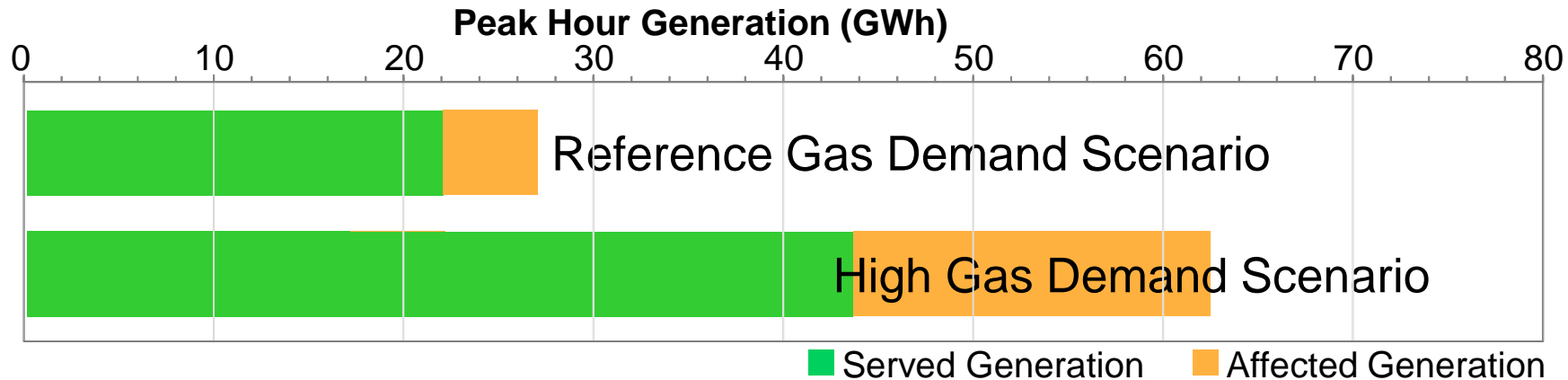
- ◆ Reference Scenario: 19% of generation is affected
- ◆ Peak Day Spot Gas Prices: Demand -25% v. Ref, 17% is affected

EIPC Study Results: PJM, Winter 2018



- ◆ Reference Scenario: 19% of generation is affected
- ◆ Low Gas Prices: Demand +93% v. Ref, 26% is affected

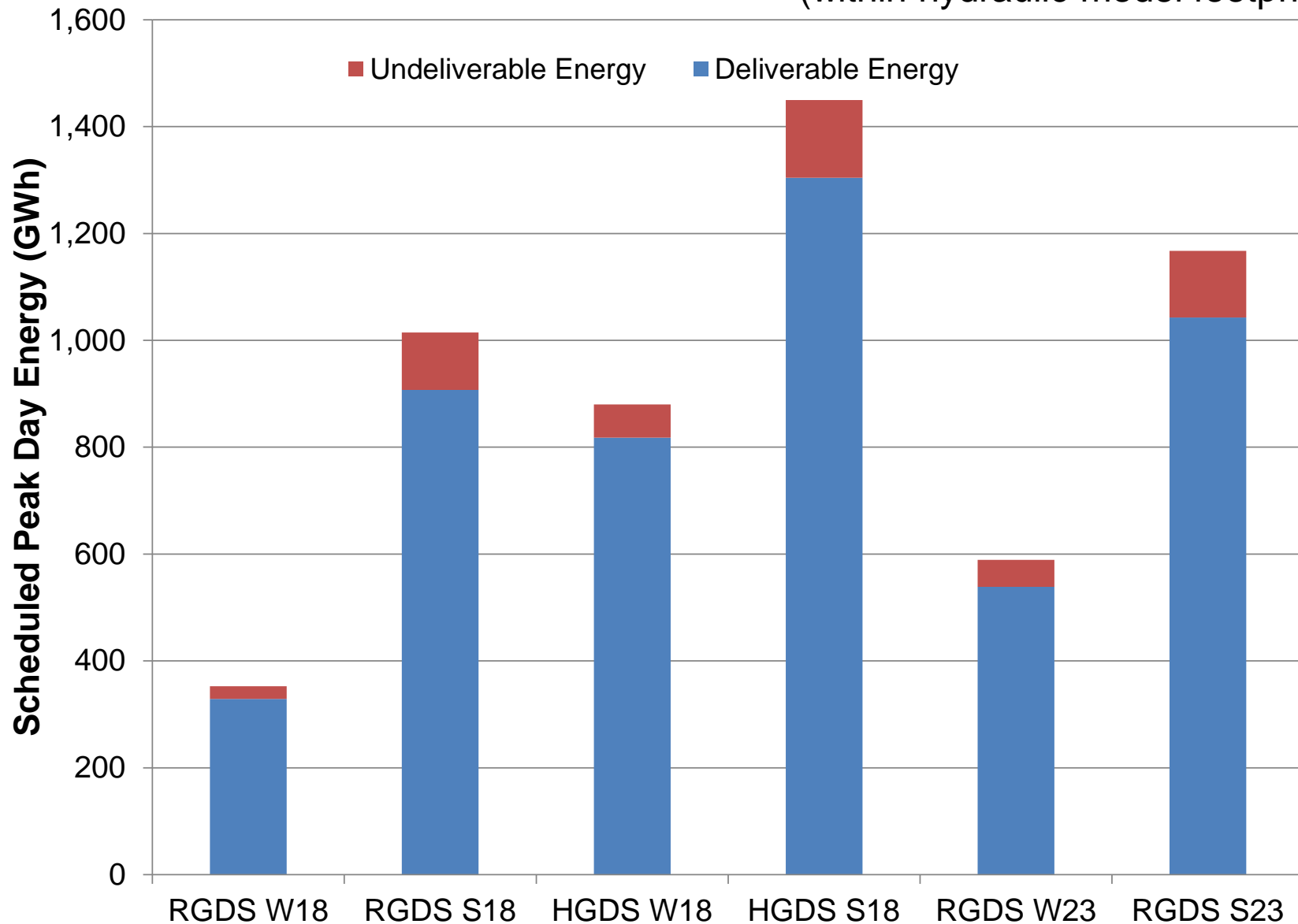
EIPC Study Results: PJM, Winter 2018



- ◆ Reference Scenario: 19% of generation is affected
- ◆ High Gas Demand Scenario: Demand +132% v. Ref, 30% is affected

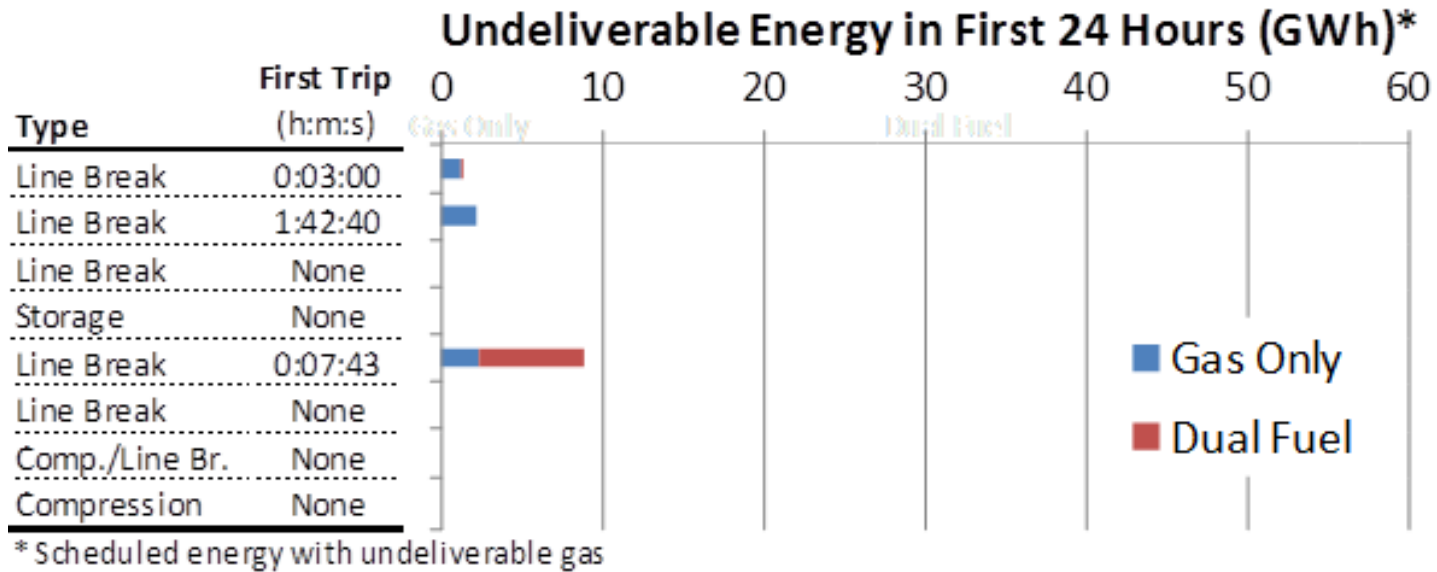
EIPC Study Results: PJM Hydraulic Baseline

(within hydraulic model footprint)

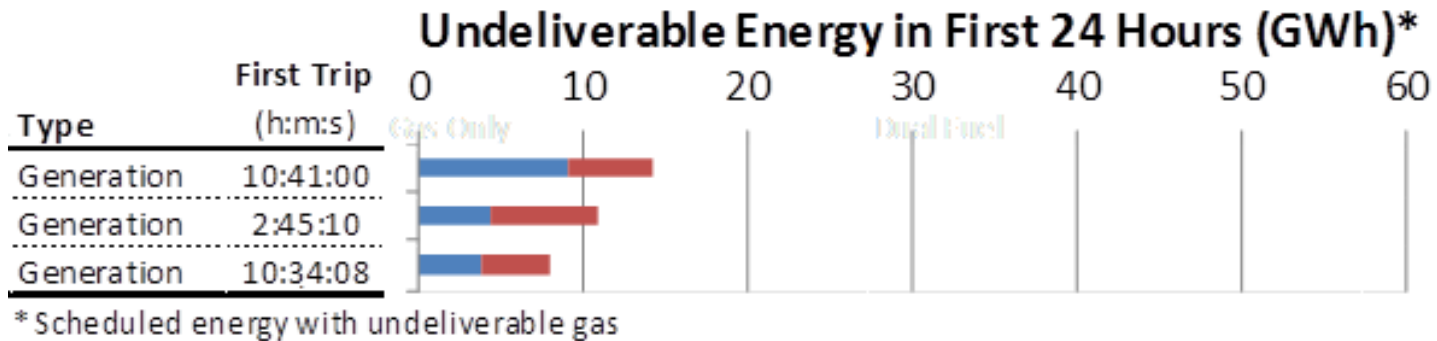


EIPC Study Results: PJM Contingencies, Winter 2018

Gas-Side Contingencies



Electric-Side Contingencies



EIPC Study Results: Mitigation Measures

- ◆ Physical infrastructure improvements
 - Applicable for frequent / extended constraints
 - New pipeline from a liquid sourcing point
 - Loopline or compression along constrained segment
 - New conventional or LNG storage
- ◆ Use of alternate fuels / services
 - Fragility of the supply chain
 - Applicable for infrequent / short constraints
 - Installation of new or use of existing oil tanks
 - Flow day diversions earmarked for LNG exports
 - LDC gas DR measures

Pipeline Contracting and Risk Allocation

- ◆ Who will contract for new gas pipeline capacity?
 - Deterioration in producers' credit
 - Low LDC growth rates
 - Market / commercial hindrances affecting generators' willingness to enter into long-term contracts
- ◆ Solutions?
 - Expanded role for EDCs
 - Paradigm shift, *i.e.*, back to the future
 - Pipelines' willingness to tolerate risk may warrant equity sweetener

Electric/Gas Market Coordination Challenges

- ◆ Day-Ahead Scheduling
 - Gas day extends over 2 electric days
 - Timely Cycle nomination deadline delayed 90 minutes
 - Time to schedule issuance shortened

- ◆ Intraday/Real-Time Scheduling
 - Electric System: 5-minutes intervals
 - Gas System: With addition of required Intraday 3 cycle, minimum of 4 opportunities to adjust nomination volumes

- ◆ Pipeline Hourly Nomination Protocols