



Eastern Interconnection Planning Collaborative

EIPC Gas-Electric Coordination Study Update: Target 3 Results

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NYISO EGCWG/IPTF Meeting

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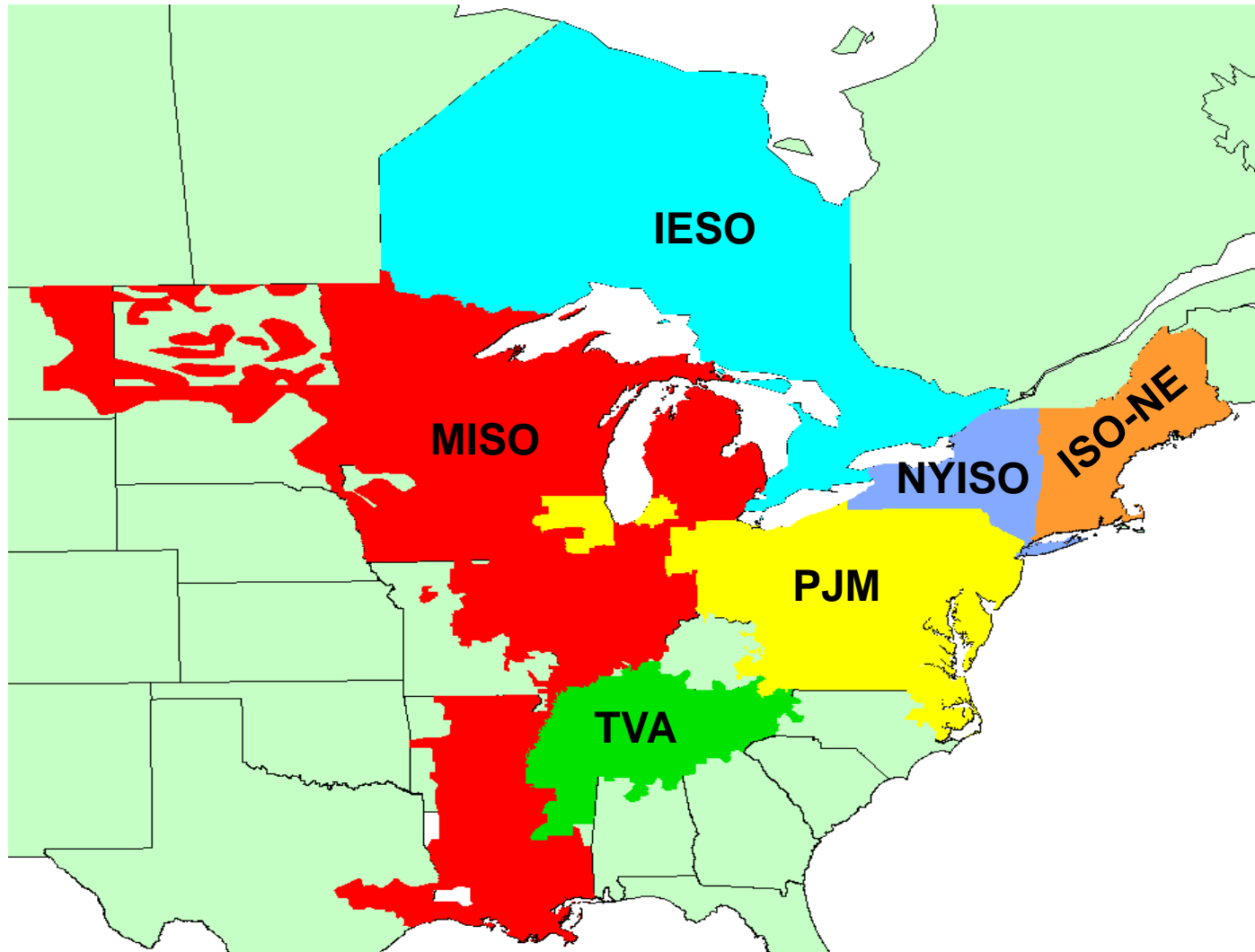
Outline

- Overview
- Target 3 Highlights
- Remaining Schedule

Gas-Electric System Interface Study

- Current Status of Four Target Areas to be Analyzed:
 - Target 1: Baseline assessment and description of the natural gas-electric system interface (final draft report complete)
 - Target 2: Evaluate the capability of the natural gas system(s) to supply the fuel requirements of the electric power sector (final draft report complete)
 - Target 3: Identify contingencies on the natural gas system that could adversely affect electric system reliability and vice versa (draft report posted – stakeholder comments under review)
 - Target 4: Review the availability or non-availability of dual fuel capability at electric generating stations (final draft report complete)

Study Region



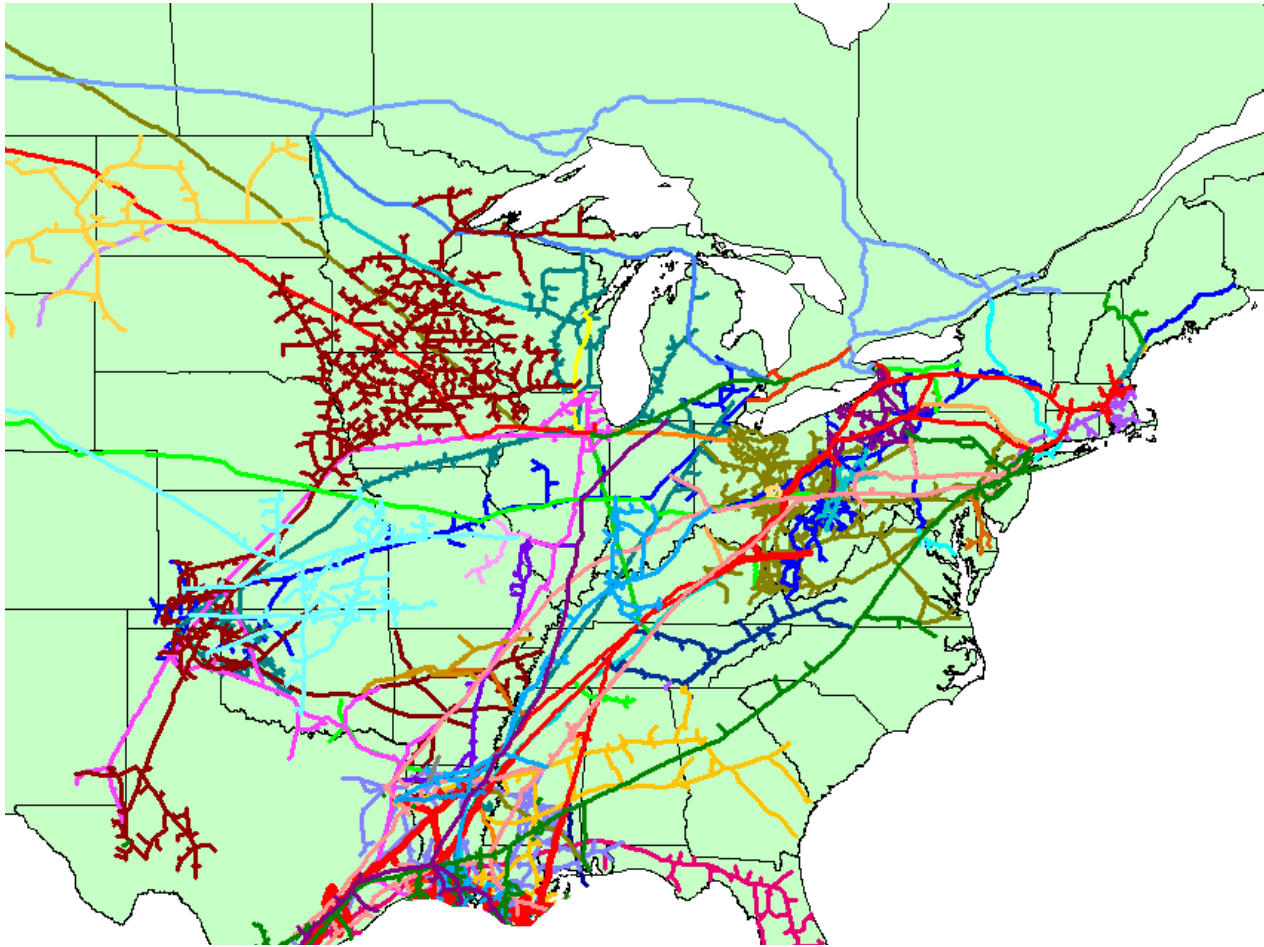
Generator Statistics By PPA

PPA	% GWh Gas (2012)	Total ICAP (GW)	Gas-Capable ICAP (GW)	% Total (GW)	Direct-Connect ICAP (GW)	LDC-Served ICAP (GW)
PJM	19%	185	78.7	43%	35.1	43.6
MISO	9% _(N/C) / 52% _(S)	177	68.0	38%	44.8	23.2
NYISO	45%	38	24.7	65%	7.4	17.3
ISO-NE	50%	35	18.6	54%	14.3	4.3
TVA	12%	34	10.6	31%	8.0	0.6
IESO	15%	33	9.9	28%	1.2	8.7
Total		502	208.5	41%	110.8	97.7

Note: N/C – MISO North & Central Regions, S = MISO South Region

Source: PPAs

Interstate Pipelines Operating in the Study Region



Target 3 Highlights

Target 3 Primary Research Objectives

- Test the resiliency of the consolidated network of pipeline and storage facilities when gas or electric equipment failures are postulated in the vicinity of gas-fired generators in each PPA
- Identify operational measures that can mitigate the adverse impacts of gas- and electric-side contingencies, including market initiatives
- Focus is on the natural gas system—this is NOT an electric reliability analysis

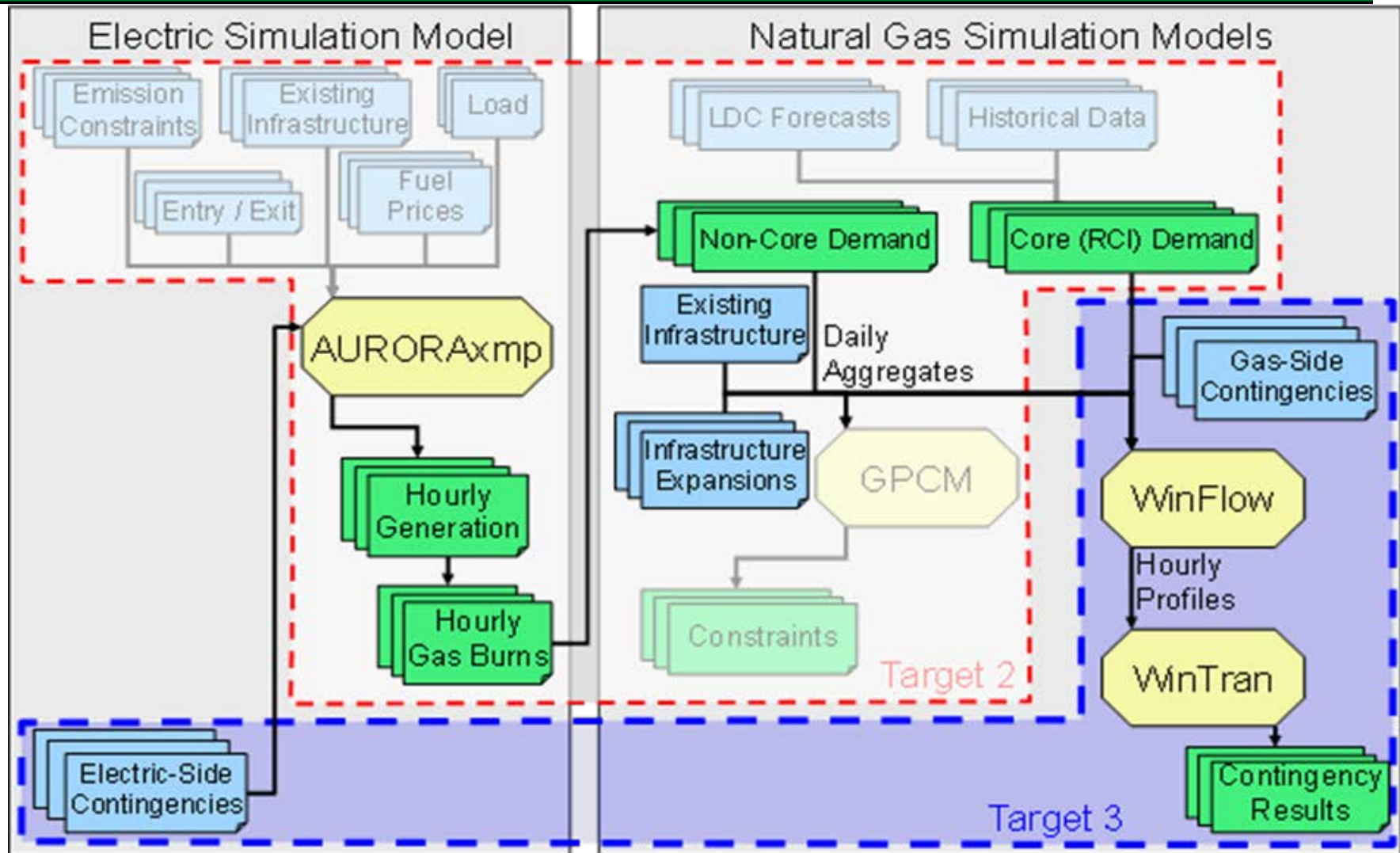
Target 3 Approach

- Select pipeline segments across the Study Region that exhibited congestion effects based on Target 2 results
 - Using input assumptions from Target 2 – developed in 2nd Qtr-2014
- Identify gas-side contingencies and electric-side contingencies in each of the six PPAs Regions
 - Gas-side contingencies include compressor outages, pipeline ruptures, and loss of major storage deliverability
 - Electric-side contingencies include loss of transmission and major generator(s)
- Pre- and post-contingency hourly gas use profiles derived from AURORAxmp chronological production cost model
- Scenarios Analyzed – RGDS W/S 2018 & 2023; HGDS W/S 2018

Target 3 Approach (cont'd)

- Sub-hourly ramping profiles developed for each gas-fired technology type
- Prior to any contingency, utilize baseline pressure and flow within the PPA-specific consolidated pipeline model(s) to determine whether the full fuel quantities are deliverable
- Apply WinTran (transient flow) model to the consolidated pipeline model to quantify over the next 24 post-contingency hours:
 - Affected generation = Scheduled generation with full or partial undeliverable gas
 - Time-to-trip interval: *i.e.*, insufficient pressure to sustain scheduled operation on gas

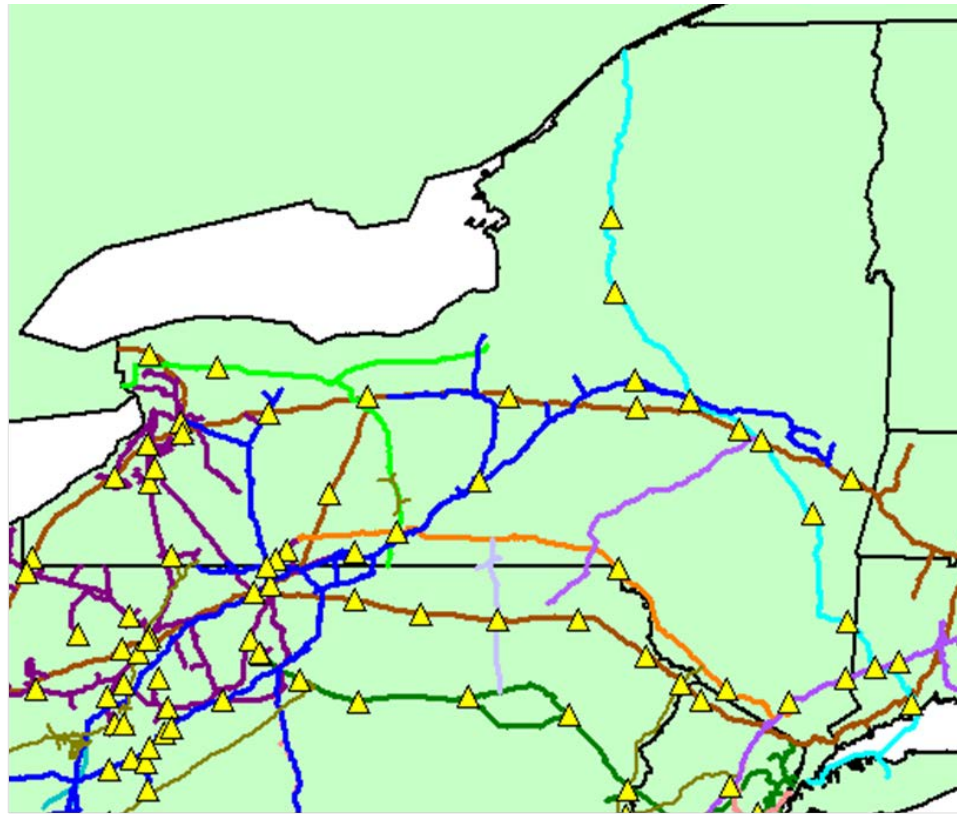
Target 3 Model Components



Structure of the Target 3 Report

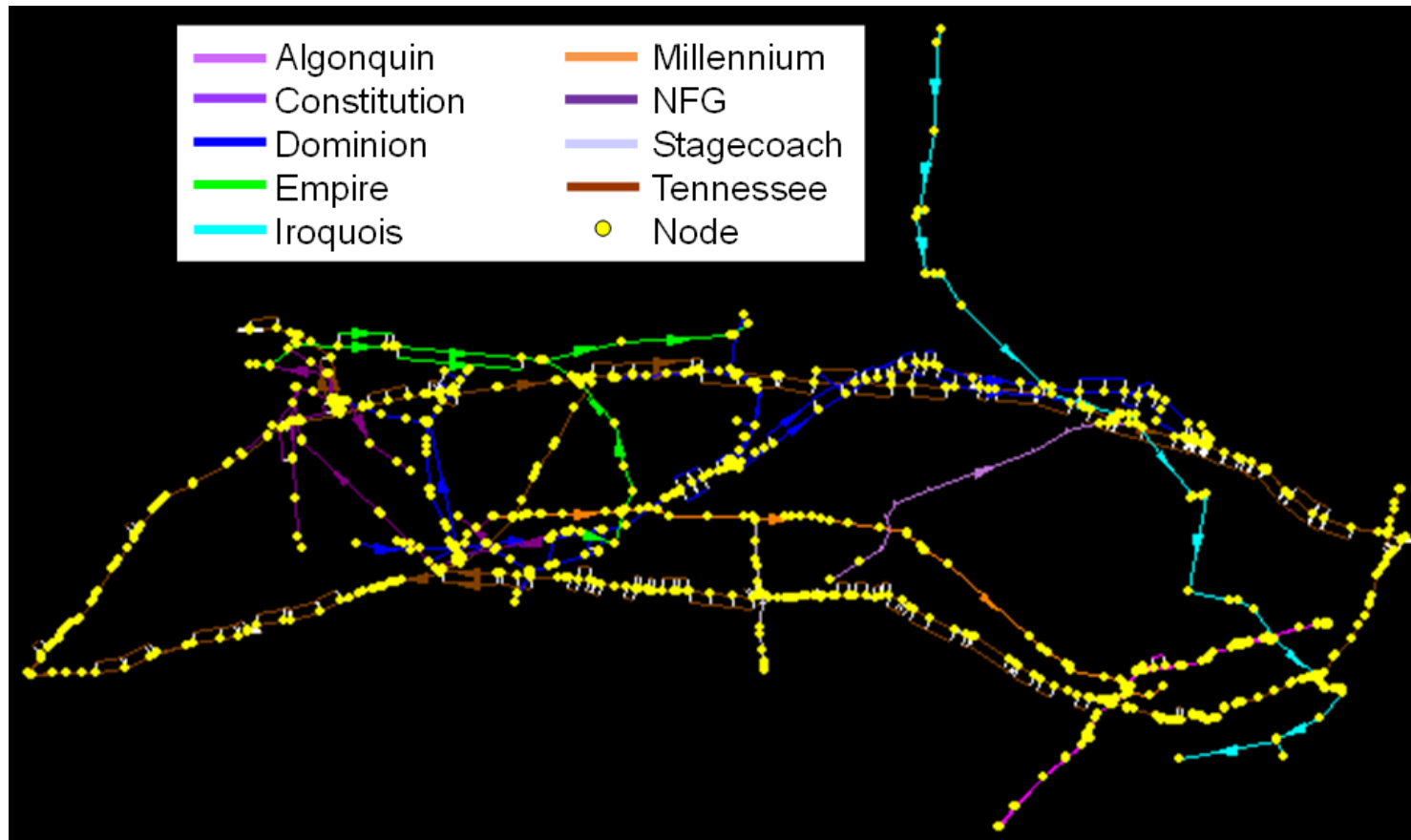
- Report
 - Modeling description and assumptions
 - Baseline hydraulic model results
 - Gas-side contingency analysis
 - Electric-side contingency analysis
 - Mitigation measures to alleviate contingency impacts
- Appendices (CEII)
 - Results for selected LDCs in PJM and NYISO as well as IESO (province wide)

Maps from Target 1 – NYISO Gas Pipeline Map



Algonquin	Equitrans	Tennessee
Columbia Gas	Iroquois	Texas Eastern
Constitution	Millennium	Transco
Dominion	NFG	Compressor Station
Empire	Stagecoach	

Consolidated NYISO Pipeline Model



Baseline Results – RGDS Winter 2018

PPA	Scheduled Gas (MDth)	Scheduled Energy (MWh)	Scheduled Energy with Undeliverable Gas (MWh)	Scheduled Energy with Undeliverable Gas (%)
ISO-NE	1,136	156,821	19,979 (gas only) 489 (dual fuel)	13
MISO	1,874	257,301	26,655 (gas only) 21,352 (dual fuel)	19
NYISO	637	86,428	5,238 (gas only) 6,980 (dual fuel)	14
PJM	2,607	352,687	10,707 (gas only) 13,322 (dual fuel)	7
TVA	1,187	169,348	0 (gas only) 0 (dual fuel)	0

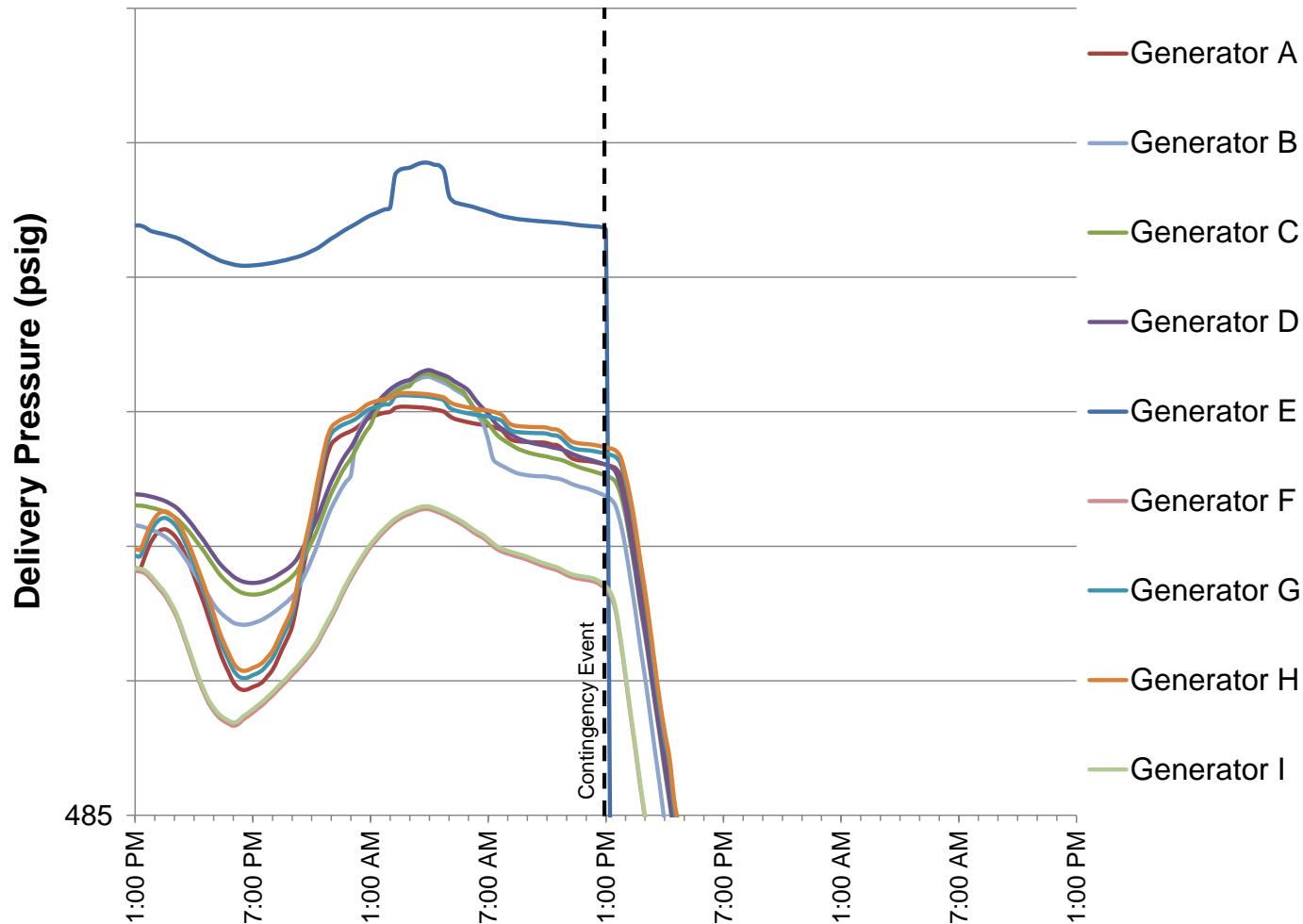
Note: Results include only the footprint included in each PPA's hydraulic model

Baseline Results – RGDS Summer 2018

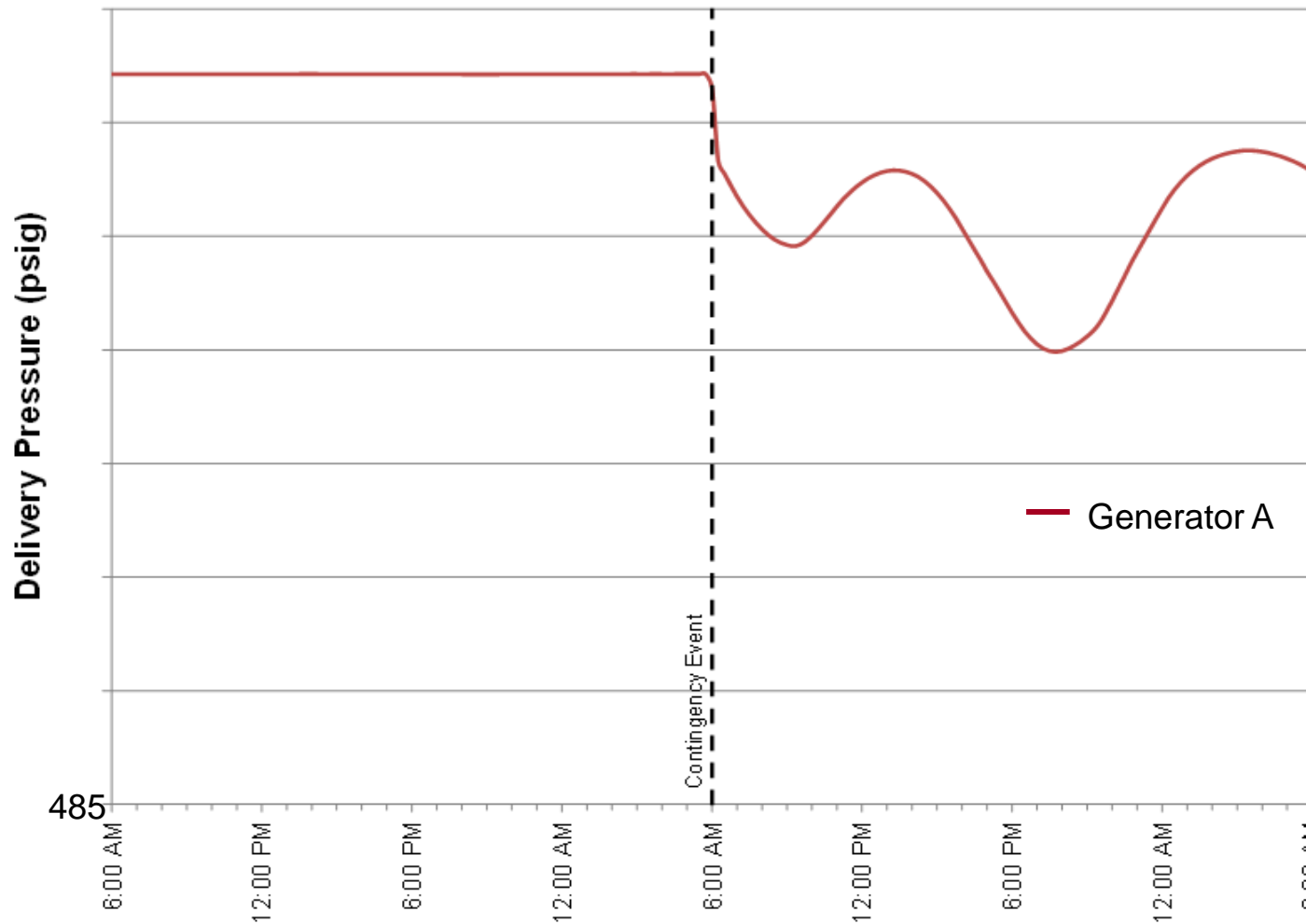
PPA	Scheduled Gas (MDth)	Scheduled Energy (MWh)	Scheduled Energy with Undeliverable Gas (MWh)	Scheduled Energy with Undeliverable Gas (%)
ISO-NE	2,286	281,745	5,905 (gas only) 40,469 (dual fuel)	16
MISO	2,744	358,026	12,254 (gas only) 6,471 (dual fuel)	5
NYISO	1,133	138,542	1 (gas only) 13,999 (dual fuel)	10
PJM	7,827	1,014,709	44,317 (gas only) 63,070 (dual fuel)	11
TVA	1,147	161,209	0 (gas only) 0 (dual fuel)	0

Note: Results include only the footprint included in each PPA's hydraulic model

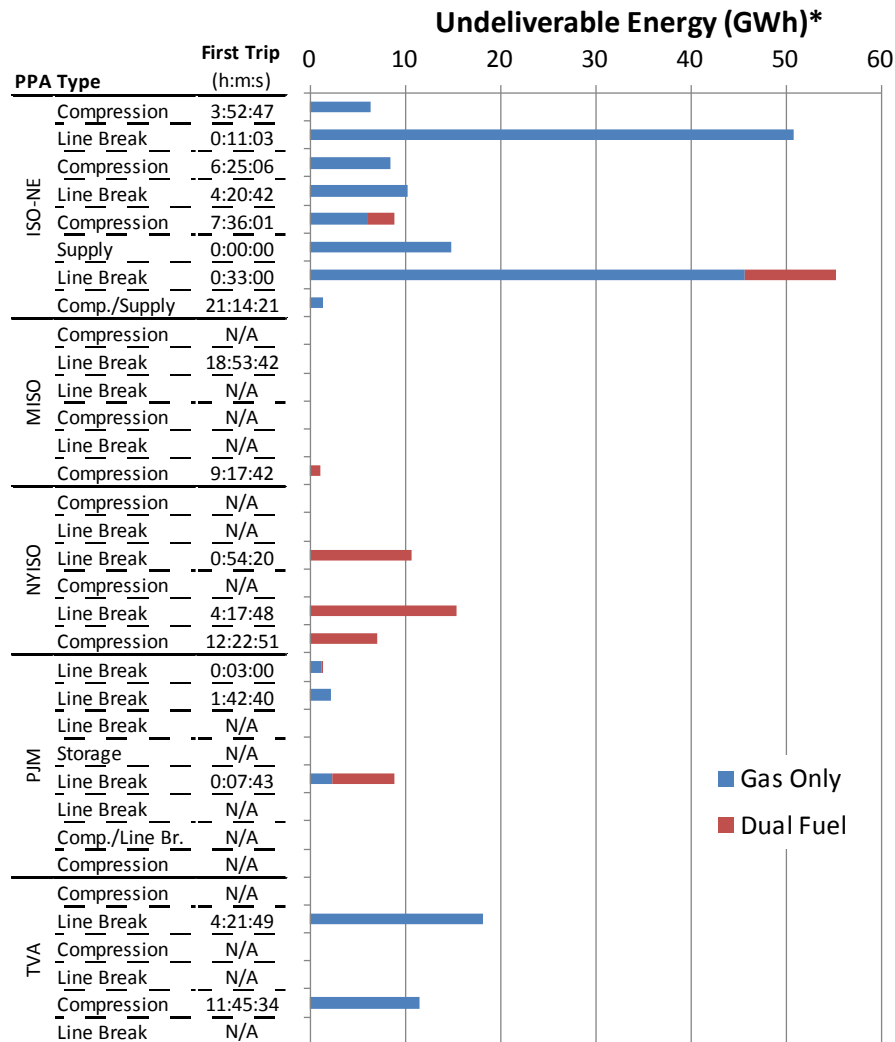
Example Transient Model Results (1)



Example Transient Model Results (2)



Results of Gas-Side Contingencies – Winter 2018



* Scheduled energy with undeliverable gas



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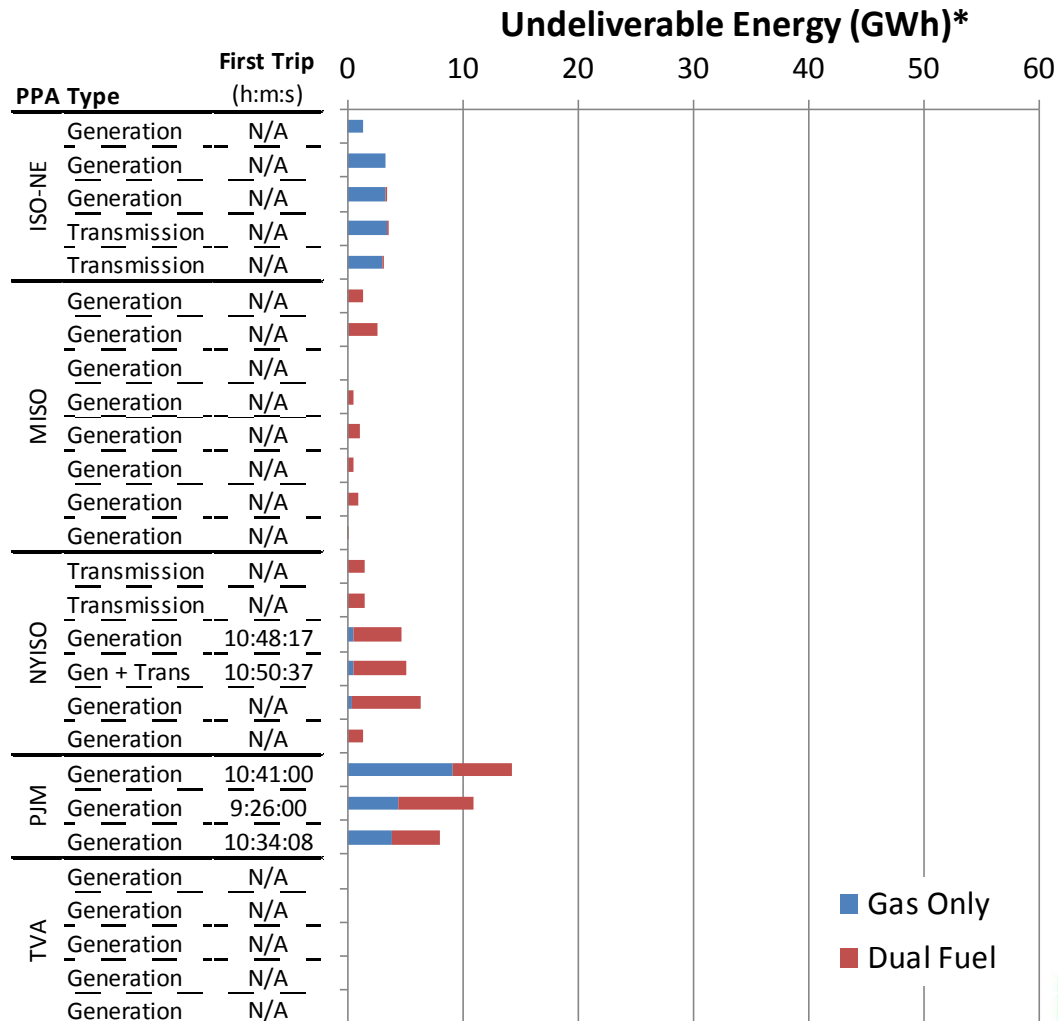
Results of Gas-Side Contingencies – Winter 2018

- Severity of the contingency event impacts characterized by short time-to-trip intervals and large quantity of affected generation
- ISO-NE exhibited most severe impacts
 - Most affected generation not dual fuel capable
- PJM (MAAC area) and NYISO (Lower Hudson Valley and downstate) exhibited isolated pockets of affected generation
 - Substantial portion of affected generation is dual fuel capable
- MISO (North/Central), PJM (rest of RTO), TVA, IESO have less affected generation
 - Consolidated pipeline network and storage facilities provides resiliency

Results of Gas-Side Contingencies – Summer 2018

- Outside of ISO-NE and the EMAAC and SWMAAC parts of PJM, network of pipeline and storage infrastructure results in negligible affected generation
- In ISO-NE, pipeline pressure limitations potentially constrain availability of gas-fired units
 - Redispatch of other units and other electric system operator actions can mitigate impacts (Beyond the study scope)
- Detailed results for each Region are contained in the CEII Report

Results of Electric-Side Contingencies – Winter 2018



* Scheduled energy with undeliverable gas



Results of Electric-Side Contingencies

- For RGDS Winter 2018, results show
 - Affected generation in ISO-NE, NYISO and PJM happens many hours after the event
 - Dual-fuel capable units in MAAC portion of PJM and NYISO lessen impacts
 - Negligible affected generation in MISO, none in TVA
- Detailed results for each Region are contained in the CEI Report

Contingency Mitigation

- **Intrinsic** – Operator actions included as part of the model solutions
 - Use of line-pack
 - Increased interconnect flows from neighboring pipelines
 - Increased utilization of spare horsepower from downstream compression stations
 - Reversal-of-flow across key pipeline segments
- **Extrinsic** – Considered in the analysis, but not included in the model solutions
 - Communication initiatives among the PPAs, pipelines and/or LDCs
 - Select pipeline tariff innovations
 - Continued efforts to promote harmonization of gas day and electric day scheduling procedures

Remaining Schedule

Next Steps (1 of 2)

- Stakeholder Comments on Draft Target 3 Report are under review
- Final Draft Target 3 Report submitted to DOE (Target 3 Complete) – 3/27/15
- Post Draft Revision to Phase II Report and send notice to SSC and Stakeholders – 5/8/15
- **SSC Meeting** – discuss Revised Draft Phase II Report – 5/28/15 at MISO's Offices in Egan, MN

Next Steps (2 of 2)

- Final Written Stakeholder Input on Draft Report Due – 6/3/15
- Revised Final Draft Report Sent to DOE – 6/12/15
- DOE comments on Final Draft Report – 6/26/15
- Final Report Submitted to DOE – 6/30/15

Questions and Discussion

