MISO PJM IPSAC

March 7, 2016

Agenda

- Targeted Market Efficiency Project Study
- Michigan Interface Study Results
  - N-1
  - Generator Deliverability
- Quad Cities Analysis Results
- Metrics & Process
  - Review existing criteria/process
  - Priorities
- Process Schedule for 2016

Targeted Study Process

- February 5, 2016 – Notice of April issues review
- March 7, 2016 – IPSAC & stakeholder input to issues review due
- April 8, 2016 – IPSAC issues review

Quantification of Congestion

- Congestion is the sum of day ahead and balancing congestion
- Total congestion on a flowgate is the sum congestion for each RTO
- Congestion is for the 2015 calendar year

Top Historical M2M Congested Flowgates (1/4)

Flowgate ID	Monitored Branch	Contingency	Total Congestion
589	Cherry Valley 345/138 TX	Cherry Valley - Silver Lake 345kV	$ 70,162,556
3191	Rising 345/138-kV TX1	Clinton - Brokaw 345kV	$ 38,766,192
3336	Oak Grove-Galesburg 161kV	Nelson - Electric Junction 345kV	$ 21,317,554
230	Breed - Wheatland 345kV	Jefferson - Rockport 765kV	$ 15,347,538
3405	Eugene - Bunsonville 345kV	Breed - Casey 345kV	$ 13,215,241
2286	Burnham - Munster 345kV	Dumont - Wilton Center 765kV	$ 11,266,421
2647	Bayshore - Monroe 345kV	Lulu 345 kV Sub	$ 9,170,850
2975	Crete - St. John 345kV	Dumont - Wilton Center 765kV	$ 8,507,257
505	Cordova - Nelson 345 kV	Quad Cities - H471 345 kV	$ 8,288,666
2427	Michigan City - Laporte 138kV	Dumont - Wilton Center 765kV	$ 5,422,600
20932	Oak Grove-Mercer 161 kV l/o Nelson-Electric Junction 345 kV	Nelson-Electric Junction 345kV (15502 line)	$ 5,027,626
2207	Braidwood-East Frankfurt 345kV	Braidwood - E. Frankfort 345kV	$ 4,883,720
2395	Marysville-Tangy 345kV	Malizewski-Marysville 765kV	$ 4,816,134
3326	974 ZION345 KV PLPL41	Zion-Pleas PR (2221) 345 Line	$ 4,813,174

Top Historical M2M Congested Flowgates (2/4)

Flowgate ID	Monitored Branch	Contingency	Total Congestion
519	Dixon-McGirr Rd 138 kV	Nelson - Electric Junction 345kV	$ 4,501,568
2577	17ROXANA138 KV 17R-PRA1	Dumont-Wilton Center 765kV	$ 4,424,396
20737	Klondcin - Purdue 138kV	Caysub - Eugene 345kV	$ 3,983,323
514	Cordova - Nelson 345kV	H471-Nelson 345kV	$ 3,744,927
550	Belvidere - 12205 138kV	Cherry Valley - Silver Lake 345kV	$ 3,672,366
20729	Reynolds_Magneation_flo_Schahfer_BurrOak		$ 3,541,948
2578	Michigan City - Trail Creek 138kV	Dumont - Wilton Center 765kV	$ 3,346,401
20865	Munster 345/138	Dumont - Wilton Center 765kV	$ 3,208,684
539	Belvidere-12205 138kV	Cherry Valley - Silver Lake 345kV	$ 3,130,931
3441	1352-Lilly 138 kV	Duck Creek - Tazwell 345kV	$ 3,077,579
3429	Oak_Grove_Mercer161_flo_Nelson_ElectricJct		$ 3,038,193
3435	Rising 345/138	Dumont-Wilton Center 765kV	$ 2,956,179
3289	6 Byron 345kV	Nelson - Electric Junction 345kV	$ 2,795,910
2205	Burnham - Munster 345kV	Braidwood - E. Frankfort 345kV	$ 2,770,442

Top Historical M2M Congested Flowgates (3/4)

Flowgate ID	Monitored Branch	Contingency	Total Congestion
3227	0404 Quad Cities-H471 345kV	Cordova - Nelson 345kV	$ 2,592,725
2530	Pierce - Beckjord 138kV	Pierce - Foster 345kV	$ 2,579,181
2548	MAGNTATN138 KV MAG-REY	Cayuga2-Cayuga3 345 kV	$ 2,533,827
2540	Michigan City - Laporte 138kV	Babcock - Stillwell 345kV + Stillwell 345/138	$ 2,492,889
20796	Byron-Wempletown 0624 345 kV line	Byron - Cherry Valley 345kV	$ 2,404,222
3245	Cherry Valley - Silver Lake 345kV	Nelson - Electric Junction 345kV	$ 2,325,776
3218	0622 Byron-Cherry Valley 345 kV	Byron - Cherry Valley 345kV	$ 2,160,766
3445	RISING 345 KV 45TR1	Loretto-Wilton Center 345 kV	$ 2,157,951
3429	Oak_Grove_Galesburg_flo_Nelson_ElectricJct		$ 2,143,493
583	NELS-15508 138 KV	Nelson - Electric Junction 345kV	$ 1,880,208
2531	Roxana_Praxair_138kV_flo_Inland5_Marktown_138kV		$ 1,829,147
20707	Klondcin-Purdue 138kV l/o Westwood-tippecan	Westwood-Tippecanoe Labs 138 kV	$ 1,738,031
2445	BATESVIL138 KV BAT-HUB1	Tanners Crk-Miami Fort 345	$ 1,704,731

Top Historical M2M Congested Flowgates (4/4)

Flowgate ID	Monitored Branch	Contingency	Total Congestion
3654	08LAFYTE138 KV 08L-BUS1	Westwood-Concord-Southeast 138 kV	$ 1,680,640
20849	Tippecanoe - Lafayette South 138kV	Caysub - Eugene 345kV	$ 1,664,244
2685	Reynolds-Magnetation 138kV	Burr Oak - Schahfer 345kV	$ 1,496,842
21090	DTAP1384138 KV DTA-MCL1	Loretto-Wilton Center 345 kV	$ 1,455,739
3642	Pierce - Foster 345kV	East Bend - Terminal 345kV	$ 1,363,153
3083	6101-Hennepin 138kV	Prince tap 138kV	$ 1,330,754
6229	Oak Grove - Galesburg 161kV	Nelson - Cordova 345kV	$ 1,303,709
21139	Tippecanoe - Lafayette South 138kV	Westwood Tap - W. Lafayette 138kV	$ 1,234,629
2908	Miami Fort 345/138 TX9	East Bend - Terminal 345kV	$ 1,049,143

Next Steps

- Congestion caused by transmission outages and nature of outages
- Planned upgrades that may relieve congestion
- Limiting element(s) and conductor ratings
- Potential low cost, quick implementation upgrades

Michigan Interface Study

Michigan Interface Study Objectives

- Identify causes of significant historical congestion on MI Interface
  - Cook - Palisades
  - Benton Harbor – Palisades
  - Michigan City – LaPorte
- Evaluate how future configuration & interconnection changes impact congestion
- Develop and evaluate solutions as required

Michigan Interface – Economic Results Summary

- Coordinated PROMOD models were developed by PJM and MISO
- Both models showed little to no future congestion on Palisades area facilities
- Sensitivity analysis shows two major drivers for this are:
  - Reduced Michigan imports (Michigan imports reduced in fall 2014, and reversed in 2015)
  - The Covert unit will join the PJM market June 1, 2016. Segreto station (interconnection facility) changes electrical topology

- Michigan City area congestion (primarily 138kV facilities) is expected to be an ongoing issue

Michigan Interface Reliability Analysis

- Light load scenario, 2015 topology
- Developed Michigan import and export scenarios
- Baseline reliability analysis (singles, buses, line fault breakers, towers)
- Generator deliverability
  - PJM generation to PJM load
  - MISO generation to MISO load

Potential reliability issues show below are a function of the scenarios being tested and may not be consistent with PJM or MISO criteria testing

Generator Deliverability Analysis – Input Assumptions

- Base Case Development
  - Topology: 2015
  - Load: PJM @ 50% of Summer Peak, MISO @ Light Load levels (~50-60% of Summer Peak)
  - Base Generation Dispatch: PJM units dispatched per Light Load Criteria, MISO units dispatched per Light Load criteria
  - Interchange: PJM flows per Light Load Criteria, MISO flows per Light Load Criteria

- Sensitivity Cases Developed for Analysis
  - Import: MISO areas in the study area (MI, IN) had dispatches adjusted to simulate historical dispatch resulting in high MI imports
  - Export: MISO areas in the study area (MI, IN) had dispatches adjusted to simulate historical dispatch resulting in MI exports

- PJM Generator Deliverability Analysis
  - PJM Areas Only: All PJM areas included for dispatch
  - MISO Areas Only: HE, DEI, SIGE, IPL, NIPSCO, METC, ITC, AMMO, AMIL, SIPC, ALTW, MPW, ALTE, WPS, MGE included for dispatch

N-1 Analysis

- Import Sensitivity
  - 2 potential issues on AEP 138 kV lines with 104% and 108 % loading
  - 4 potential issues on ComEd 138 kV lines ranging from 101% to 109% loading
  - 1 potential issue on ComEd 345/138 kV transformer with 106% loading
  - 1 potential issue on METC 345 kV line with 106% loading
  - 1 potential issue on METC 345/138/14.2 kV transformer with 121% loading
  - 2 potential issues on METC 138 kV lines with 105% and 111% loading
  - 4 potential issues on ITC 120/24 kV transformers ranging from 108 % to 138 % loading
- Export Sensitivity
  - 1 potential issue on METC 345/138/14.2 kV transformer with 121% loading
  - 3 potential issues on METC 138 kV lines ranging from 116% to 125% loading
  - 4 potential issues on ITC 120/24 kV transformers ranging from 108 % to 138 % loading
  - 4 potential issues on ComEd 138 kV lines ranging from 100% to 106% loading

Generator Deliverability Analysis - MISO 2 MISO

- Import Sensitivity:
  - 4 potential issues on METC138 kV lines ranging from 100% to 125% loading
  - 2 potential issues on PJM-MISO 345 kV ties with 100% and 109% loading

- Export Sensitivity:
  - 2 potential issues on METC 138 kV lines with 118% and 124% loading

Generator Deliverability Analysis – PJM 2 PJM

- Import Sensitivity
  - 1 potential issue on AEP 345 kV line with 101% loading
  - 2 potential issues on ATSI 138 kV lines with 118% and 146% loading
  - 5 potential issues on ComEd 138 kV lines ranging from 104% to 133% loading
  - 4 potential issues on ComEd 345 kV lines ranging from 104% to 130% loading
  - 2 potential issues on ComEd 765/345 kV transformers with 127% and 130% loading
  - 2 potential issues on AEP/ComEd 345 kV ties with 123% and 141% loading
  - 2 potential issues on NIPSCO 345 kV lines with 101% and 117% loading
  - 1 potential issue on PJM-MISO 138 kV tie with 110% loading
  - 9 potential issues on PJM-MISO 345 kV ties ranging from 104% to 152% loading
- Export Sensitivity
  - 3 potential issues on ATSI 138 kV lines ranging from 102% to 142% loading
  - 5 potential issues on ComEd 138 kV lines ranging from 101% to 126% loading
  - 1 potential issue on AEP/ATSI 138kV tie with 125% loading
  - 1 potential issue on AEP/ComEd 345 kV tie with 106% loading
  - 1 potential issue on PJM-MISO 138 kV tie with 109% loading
  - 2 potential issues on PJM-MISO 345 kV ties with 101% to 108% loading

Michigan Interface Reliability Conclusions

- Flows to/from Michigan heavily utilize PJM facilities
- More numerous and significant issues in the import scenario compared to export scenario for all tests
- Potential congestion issues could exist if Michigan returns to being a heavy importer or exporter

Quad Cities
Analysis Update

Quad Cities Analysis Status

- Peak summer flows around the Quad Cities in MISO-PJM joint case are lower than previous MTEP14 and MTEP15 cases where the reliability drivers of this targeted study had been identified
- MISO and PJM are verifying the appropriate interchange and flows along the Iowa/Illinois border based on historical data and agreed-upon base transactions
- The appropriate interface modeling may feed back into MISO regional processes where constraints have been found with the traditional MTEP14/15 flows

Metric and Process

Priority Improvements for 2016

- Enhance & streamline process for Targeted studies
  - Study process, approval, and benefit determination
- Longer Term MEP
  - Further simplify thresholds
  - Changes to MEP metrics
  - Changes to MEP congestion hedging assumptions

New Targeted Market Efficiency Project Type

- RTO's see value in Targeted studies
  - Conducting study again this year
  - Goal is to produce actionable results
- Want more efficient process for project approval and benefit determination
  - For Targeted studies avoid time for single model development for multiple study years and complex benefit calculations
  - Benefit determination should be consistent with share of total historical congestion cost
- Targeted project scope is limited by time to in-service

Benefit Calculation and Approval for Targeted Study Projects - Proposal

- New project type established in JOA to efficiently address historical congestion issues
- Short lead time projects focus
- Inter-RTO benefit determination based on share of total historical congestion
- Single interregional approval process by JRPC
  - Still requires board approvals, but no separate regional analyses

Targeted Study Projects – Proposal Details

- In service by 4th summer peak from year of study
- 5% GLDF for at least one generator for each RTO
- Benefit is defined as 5x historical average congestion expected to be relieved
- B/C at least 1.0
- No Regional process studies; projects recommended by the JRPC will proceed directly to each RTO's board

See proposed JOA language posted with meeting materials

Please provide written comments by 3/21

Longer Term CBMEP Metric Changes

- $20 Million Threshold
  - FERC Approved 2/5/16
- 345kV Voltage Threshold
  - MISO regional issue
  - Designated as a high priority issue by MISO and its stakeholders
    - MISO is collaborating with its stakeholders and is targeting to have a conceptual proposal by end of 2016
- Consider removal of interregional 1.25 B/C
  - Replace with JRPC recommended screening tools
  - Use interregional process to determine each regions benefits
- Congestion hedging assumption
  - PJM and MISO are open to a variety of changes to the benefit calculation, consistent with:
    - Requirement to simplify calculations
    - Metrics that can be more easily reproduced

IPSAC Work Schedule

Q1 2016

- Provide summary of annual issues review to stakeholders - **Complete**
  - Opportunity for stakeholder comments on issues review
  - Timing reviewed in previous slides
- Complete Michigan Interface reliability analysis - **Complete**
- Complete Quad Cities analysis
- Identification of facilities for 2016 Quick Hit study
- Development of “As-Is” models for targeted study analysis
- Progress on Metrics & Process to address targeted studies

IPSAC Schedule Cont.

Q2 2016

- Conduct evaluations of potential Targeted upgrades
- Make progress on both targeted and long term MEP Metric and Process discussions with stakeholders

Q3/Q4 2016

- Complete Targeted analysis and recommend projects as appropriate
- Conclude targeted Metrics & Process review and implement changes
- Identify potential longer term interregional issues from regional processes; solicit projects from stakeholders

See timeline attached to September 28 IPSAC meeting for complete two year evaluation cycle

Open Discussion

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