



# **PJM November 2014 Queue Generation Affected System Impact Study**

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## 1 Executive Summary

This report documents the system impacts of Nine (9) projects in the PJM generator interconnection queue on the Midcontinent Independent System Operator (“MISO”) transmission system. The projects are listed in Table 1-1.

**Table 1-1 List of PJM Group Generation Interconnection Projects**

| Queue Number | POI                         | Size(MW) | Fuel Type | State | TO    |
|--------------|-----------------------------|----------|-----------|-------|-------|
| V4-033       | Desoto- Tanners Creek 345kV | 299.2    | wind      | IN    | AEP   |
| W4-004       | Madison-Tanners Creek 138kV | 90       | wind      | IN    | AEP   |
| W4-008       | Madison-Tanners Creek 138kV | 90       | wind      | IN    | AEP   |
| X2-006       | Baker 345kV                 | 585      | CC        | KY    | AEP   |
| Y3-038       | Rockport Unit 1             | 36       | coal      | IN    | AEP   |
| Z1-035       | Lake Erie Wind 69Kv         | 18       | wind      | OH    | ATSI  |
| Z1-051       | DC Cook Unit 2              | 102      | nuclear   | MI    | AEP   |
| Z1-079       | Todhunter-Foster 345kV      | 513      | CC        | OH    | DEOK  |
| Z1-127       | University Park             | 20       | Peaker    | IL    | ComEd |

Steady State AC analysis was performed to identify any reliability criteria violations caused by the study generators. The study did not identify any constraints in both the near term (2017) and the out year (2024) scenarios. The study projects have full injection capability conditional to the transmission and generation assumptions in this study.

Please note that additional projects have executed a Facility study Agreement (FSA) with PJM and were part of the list of projects supplied for the November 2014 analysis. These projects are remote to the MISO system and have not been included in this study

**Table 1-2 List of Remote Projects in the group**

| Queue Number | Size(MW) | Fuel Type   | State | TO       |
|--------------|----------|-------------|-------|----------|
| Y2-080       | 1065     | natural gas | PA    | APS      |
| Y3-068       | 525      | natural gas | WV    | AEP      |
| Z1-036       | 300.3    | wind        | NC    | Dominion |
| T121         | 75       | wind        | PA    | PENELEC  |
| W4-016       | 340      | natural gas | NJ    | AEC      |
| X3-087       | 894      | natural gas | MD    | PEPCO    |
| Y1-077       | 73       | natural gas | NJ    | AEC      |
| Y2-110       | 40       | natural gas | NJ    | AEC      |
| Y3-033       | 129      | wind        | MD    | DPL      |



| Queue Number | Size(MW) | Fuel Type   | State | TO      |
|--------------|----------|-------------|-------|---------|
| Y3-046       | 6        | natural gas | NJ    | PSEG    |
| Y3-051       | 47       | natural gas | NJ    | PSEG    |
| Z1-038       | 19.9     | natural gas | PA    | PENELEC |
| Z1-058       | 23       | natural gas | NJ    | PSEG    |
| Z1-059       | 23       | natural gas | NJ    | PSEG    |
| Z1-069       | 70       | wind        | PA    | PENELEC |
| Z1-076       | 14       | solar       | MD    | DPL     |
| Z1-077       | 10       | solar       | MD    | DPL     |
| Z1-081       | 6        | solar       | MD    | DPL     |
| Z1-087       | 40       | hydro       | PA    | PENELEC |
| Z1-090       | 381      | natural gas | PA    | PPL     |
| Z1-091       | 19.94    | natural gas | PA    | PENELEC |
| Z1-092       | 19.94    | natural gas | PA    | PENELEC |
| Z1-110       | 19.9     | natural gas | PA    | PENELEC |
| Z1-116       | 785      | natural gas | NJ    | PSEG    |



## 2 Study Methodology & Assumptions

### 2.1 Study Criteria

All interconnection requirements are based on the applicable MISO Interconnection Planning Criteria and in accordance with the NERC Reliability Standards. Steady state violations of applicable planning criteria were attributed to the PJM group generation requests by the usage of MISO injection criteria, and applicable local planning criteria, especially, Northern Indiana Power Service Co. (NIPSCO) generation interconnection criteria. NIPSCO's Generation Interconnection criteria can be found under section 4.5 of the planning methodology document available at:

<https://www.misoenergy.org/Library/Repository/Study/TO%20Planning%20Criteria/NIPSCO%20TO%20Planning%20Criteria.pdf>

### 2.2 Contingency Criteria

A comprehensive list of contingencies was considered for steady-state AC contingency analysis:

- NERC Category A with system intact
- NERC Category B contingencies
  - Single element outages, at buses with a nominal voltage of 69 kV and above, in the following areas: NIPS (area 217), DEI (area 208), IPL (area 216), MEC (area 635), CWLD (area 333), AMMO (area 356), AMIL (area 357), CWLP (area 360), CE (area 222), AEP (area 205).
  - Multiple-element outages initiated by a fault with normal clearing such as multi-terminal lines, in AEP, CE, Ameren, MEC, CWLP, DEI, IPL, NIPS.
- NERC Category C contingencies
  - Selected NERC Category C events.

### 2.3 Monitored Elements

Table 2-1 Monitored Area outlines the list of areas monitored for this study. All facilities in the study region with a voltage of 69kV and above were monitored.

**Table 2-1 Monitored Area**

| Area # | Area ID | Area Name                               |
|--------|---------|-----------------------------------------|
| 207    | HE      | Hoosier Energy                          |
| 208    | DEI     | Duke Energy Indiana                     |
| 210    | SIGE    | Southern Indiana Gas & Electric Company |
| 216    | IPL     | Indianapolis Power & Light Company      |
| 217    | NIPS    | Northern Indiana Public Service Company |
| 333    | CWLD    | Columbia, MO Water and Light            |
| 356    | AMMO    | Ameren Missouri                         |
| 357    | AMIL    | Ameren Illinois                         |



| Area # | Area ID | Area Name                                      |
|--------|---------|------------------------------------------------|
| 360    | CWLP    | City of Springfield (IL) Water Light & Power   |
| 361    | SIPC    | Southern Illinois Power Cooperative            |
| 295    | WEC     | Wisconsin Electric Power Company (ATC)         |
| 600    | XEL     | Xcel Energy North                              |
| 608    | MP      | Minnesota Power & Light                        |
| 613    | SMMPA   | Southern Minnesota Municipal Power Association |
| 615    | GRE     | Great River Energy                             |
| 620    | OTP     | Otter Tail Power Company                       |
| 627    | ALTW    | Alliant Energy West                            |
| 633    | MPW     | Muscatine Power & Water                        |
| 635    | MEC     | MidAmerican Energy                             |
| 661    | MDU     | Montana-Dakota Utilities Co.                   |
| 680    | DPC     | Dairyland Power Cooperative                    |
| 694    | ALTE    | Alliant Energy East (ATC)                      |
| 696    | WPC     | Wisconsin Public Service Corporation (ATC)     |
| 697    | MGE     | Madison Gas and Electric Company (ATC)         |
| 698    | UPPC    | Upper Peninsula Power Company (ATC)            |

## 2.4 Model Development

The following base case load profiles were used for the study:

- 2017 Shoulder
- 2017 Summer Peak
- 2024 Shoulder
- 2024 Summer Peak

The study cases were built by adding and dispatching the appropriate queue projects to the base cases. The detail of each PJM interconnection request is listed in Table 1-1. The study projects were dispatched per MISO criteria to the entire PJM footprint, where generators were scaled in proportion to the available reserve.

## 2.5 Study Assumptions

This affected system impact study was conducted with all the participating generators operating together as a group. Analysis was not performed on individual generating units or subsets of the generating units unless specifically noted otherwise. Higher queued PJM projects were modeled as outlined in Appendix A of the report. The results obtained in this analysis may change if any of the data or assumptions made during the development of the study models is revised.



### **3 Steady State Analysis**

#### **3.1 Near Term (2017) Analysis**

The analysis did not identify any criteria violations.

#### **3.2 Out Year (2024) Analysis**

The analysis did not identify any criteria violations.

### **4 Conclusion**

The Affected system study did not identify any Steady State - Thermal or Voltage violations with the interconnection of the Nine PJM projects on the monitored MISO transmission system. Both Near-Term (2017) and Out-year (2024) analysis were performed as part of the study. These study projects have full injection capability conditional to the transmission and generation assumptions in this study.



## Appendix A PJM Higher Queued Projects

### A.1 PJM May 2014 Cycle

| PJM Queue | PJM POI              | State | MISO SH Output | MISO SPK Output | Fuel           |
|-----------|----------------------|-------|----------------|-----------------|----------------|
| X1-087    | Stillman Valley      | IL    | 0              | 19              | methane        |
| X3-023    | S. Greenwich-Willard | OH    | 60             | 12              | wind           |
| Y2-050    | Tidd-Canton Central  | OH    | 371            | 742             | natural gas,CC |
| Y2-053    | Lemoyne 138kV        | OH    | 0              | 35              | Gas            |
| Y3-088    | Kendall I            | IL    | 10             | 20              | natural gas,CC |
| Y3-089    | Kendall II           | IL    | 10             | 20              | natural gas,CC |
| Y3-090    | Kendall III          | IL    | 10             | 20              | natural gas,CC |
| Y3-091    | Kendall IV           | IL    | 10             | 20              | natural gas,CC |
| Y3-103    | Valley-Raccoon 138kV | PA    | 102.5          | 205             | natural gas,CC |

### A.2 PJM November 2013 Cycle

| PJM Queue | PJM POI                             | State | MISO SH Output | MISO SPK Output | Fuel        |
|-----------|-------------------------------------|-------|----------------|-----------------|-------------|
| V1-024    | LaSalle 1                           | IL    | 20.0           | 20.0            | nuclear     |
| V1-025    | LaSalle 2                           | IL    | 20.0           | 20.0            | nuclear     |
| V4-046    | Byron 1                             | IL    | 20.0           | 20.0            | nuclear     |
| V4-047    | Byron 2                             | IL    | 20.0           | 20.0            | nuclear     |
| V4-048    | Braidwood 1                         | IL    | 20.0           | 20.0            | nuclear     |
| V4-049    | Braidwood 2                         | IL    | 20.0           | 20.0            | nuclear     |
| W2-048    | Pontiac MidPoint – Lanesville 345kV | IL    | 62.5           | 12.5            | wind        |
| W3-046    | Powerton 345kV – Katydid 345kV      | IL    | 208.0          | 51.6            | wind        |
| W4-005    | Pontiac Midpoint – Latham 345kV     | IL    | 351.0          | 70.2            | wind        |
| X1-096    | Loretto-Kings Creek 138kV           | MD    | 150.0          | 30              | wind        |
| X2-022    | Pontiac Midpoint-Lanesville II      | IL    | 189.0          | 37.8            | wind        |
| X2-031    | Krayn 115kV                         | PA    | 50.0           | 10              | wind        |
| X2-052    | Dumont-Olive 345kV                  | IN    | 0              | 675.0           | natural gas |
| X3-051    | Flatlick 765kV                      | OH    | 0              | 610.0           | natural gas |
| X4-020    | Peach Bottom-TMI #1 500kV I         | PA    | 0              | 800.0           | natural gas |
| X4-021    | Peach Bottom-TMI #2 500kV II        | PA    | 0              | 320.0           | natural     |



| PJM Queue | PJM POI              | State | MISO SH Output | MISO SPK Output | Fuel        |
|-----------|----------------------|-------|----------------|-----------------|-------------|
|           |                      |       |                |                 | gas         |
| X4-025    | Millbrook Park 138kV | KY    | 80.0           | 80.0            | coal        |
| Y1-030    | Forest 69kV          | OH    | 100.0          | 20              | wind        |
| Y1-065    | Rock Spring 500kV    | MD    | 0              | 852.0           | natural gas |

### A.3 PJM November2013 Cycle

| PJM Queue   | PJM POI                           | State | MISO SH Output | MISO SPK Output | Fuel        |
|-------------|-----------------------------------|-------|----------------|-----------------|-------------|
| T130        | Convoy – East Lima 345kV          | OH    | 300            | 60              | wind        |
| T131        | Lincoln – Sterling 138kV          | OH    | 150            | 30              | wind        |
| T142        | Southwest Lima – Marysville 345kV | OH    | 300            | 60              | wind        |
| T143        | Hennepin 138kV                    | IL    | 250            | 50              | wind        |
| T148        | Caledonia Wind II 100 MW          | IL    | 100            | 20              | wind        |
| T94         | Cook – Palesades 345kV            | MI    | 0              | 1035            | natural gas |
| T99         | Caledonia Wind 100 MW             | IL    | 100            | 20              | wind        |
| U2-028A_AT1 | Ironville 138kV                   | OH    | 135            | 135             | other       |
| U2-072      | East Lima – Marysville 345kV      | OH    | 300            | 60              | wind        |
| U3-021      | Silver Lake – Cherry Valley 345kV | IL    | 0              | 100             | natural gas |
| U4-027      | Normandy-Kewanee 138kV            | IL    | 0              | 100             | natural gas |
| V1-011      | Haviland 138kV                    | OH    | 100            | 20              | wind        |
| V1-012      | Haviland 138kV                    | OH    | 150            | 30              | wind        |
| V2-006      | East Leipsic 138kV                | OH    | 150            | 30              | wind        |
| V3-007      | Desoto-Tanners Creek #1 345kV     | IN    | 200            | 40              | wind        |
| V3-008      | Desoto-Tanners Creek #1 345kV     | IN    | 200            | 40              | wind        |
| V3-009      | Desoto-Tanners Creek #1 345kV     | IN    | 200            | 40              | wind        |
| V4-010      | Tiffin Center 138kV               | OH    | 200            | 40              | wind        |
| V4-015      | Fostoria Central 138kV            | OH    | 66.6           | 13.32           | wind        |
| V4-016      | Valley 138kV                      | MI    | 200            | 40              | wind        |
| W1-072A_AT5 | Lemoyne 345kV                     | OH    | 0              | 40              | natural gas |
| W2-001      | Fostoria Central 138kV            | OH    | 66.6           | 13.32           | wind        |
| W3-059A_At6 | Avery – Greenfield 138kV          | OH    | 99             | 19.8            | wind        |
| W3-088      | South West Lima 345kV             | OH    | 200            | 40              | wind        |
| W3-128      | Sporn – Waterford 345kV           | OH    | 0              | 652             | natural gas |
| W3-170      | Buckskin 69kV                     | OH    | 0              | 12              | solar       |



| PJM Queue    | PJM POI                            | State | MISO SH Output | MISO SPK Output | Fuel        |
|--------------|------------------------------------|-------|----------------|-----------------|-------------|
| X1-027A_AT12 | Davis Besse – Beaver 345kV         | OH    | 500            | 100             | wind        |
| Y1-006       | Jubal Early – Austinville 138kV    | VA    | 72             | 14.4            | wind        |
| Y1-069       | Bay Shore – Fostoria Central 345kV | OH    | 0              | 799             | natural gas |

## A.4 PJM November 2012 Cycle

| PJM Queue # | ProjectName                 | State | MISO SH Output | MISO SPK Output | Fuel Type   |
|-------------|-----------------------------|-------|----------------|-----------------|-------------|
| Q39         | Kewanee 138kV               | IL    | 105            | 21              | wind        |
| Q49         | Dresden 345kV               | IL    | 45             | 45              | nuclear     |
| Q50         | Dresden 345kV               | IL    | 58             | 58              | nuclear     |
| Q51         | Quad City 345kV             | IL    | 30             | 30              | nuclear     |
| Q57         | Steward-Waterman 138kV      | IL    | 22             | 4.4             | wind        |
| R16         | Lena 138kV                  | IL    | 126            | 25.2            | wind        |
| R30         | Pontiac Mid-Point 345kV     | IL    | 500            | 100             | wind        |
| R33         | Nelson 345kV                | IL    | 0              | 600             | natural gas |
| S27         | Blue Mound I                | IL    | 198            | 39.6            | wind        |
| S28         | Blue Mound II               | IL    | 198            | 39.6            | wind        |
| S36         | Kankakee 138kV              | IL    | 175            | 35              | wind        |
| S37         | Kankakee 138kV              | IL    | 175            | 35              | wind        |
| S55         | Zion 345kV                  | IL    | 0              | 510             | natural gas |
| S57         | Hvdc                        | IL    | 3500           | 1192            | HVDC        |
| U1-054      | Calumet                     | IL    | 0              | 54              | natural gas |
| U3-031      | Lincoln Generating Facility | IL    | 0              | 40              | natural gas |
| U4-033      | University Park North       | IL    | 0              | 36              | natural gas |
| 05MLCS      | Meadow Lake                 | IL    | 600            | 120             | wind        |
| Q01, Q03    | Fowler Ridge                | IN    | 750            | 150             | wind        |