2021 Michigan State Infrastructure Report
(January 1, 2021 – December 31, 2021)

May 2022

This report reflects information for the portion of Michigan within the PJM service territory.
1. Planning
   • Generation Portfolio Analysis
   • Transmission Analysis
   • Load Forecast

2. Markets
   • Capacity Market Results
   • Market Analysis
   • Net Energy Import/Export Trend

3. Operations
   • Generator Production
   • Emissions Data
Executive Summary
2021 Michigan State Infrastructure Report

• **Existing Capacity:** Nuclear represents approximately 67.1 percent of the total installed capacity in the Michigan service territory while natural gas represents approximately 32.7 percent. This differs from PJM where natural gas and nuclear are 44.2 and 17.5 percent of total installed capacity.

• **Interconnection Requests:** Natural gas represents 50.1 percent of new interconnection requests in Michigan, while solar represents approximately 46.6 percent of new requests.

• **Deactivations:** No generation in Michigan gave a notification of deactivation in 2021.

• **RTEP 2021:** Michigan’s 2021 RTEP project total represents approximately $203.75 million in investment.
• **Load Forecast:** Michigan’s summer peak load served within the AEP portion of PJM’s footprint is projected to grow at about 0.1 annually over the next ten years. Comparatively, the overall PJM RTO projected load growth rate is 0.4 percent.

• **1/1/21 – 12/31/21 Market Performance:** Michigan’s average hourly LMPs generally aligned with the PJM average hourly LMP.

• **2022/23 Capacity Market:** The portion of Michigan within the PJM footprint cleared at the RTO price of $50/MW-day in the 2022/2023 Base Residual Auction.
The PJM service area in Michigan is the AEP zone and is represented by the shaded portion of the map.

PJM operates transmission lines that extend beyond the service territory.
Planning
Generation Portfolio Analysis
PJM – Existing Installed Capacity
(CIRs – as of Dec. 31, 2021)

- Coal, 49,670 MW
- Natural Gas, 82,510 MW
- PJM, 186,868 MW
- Wind, 2,597 MW
- Hydro, 8,249 MW
- Solar, 1,824 MW
- Oil, 8,558 MW
- Nuclear, 32,656 MW
- Waste, 804 MW

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Michigan – Existing Installed Capacity
(CIRs – as of Dec. 31, 2021)

MI Total
3,251 MW

Nuclear, 2,181 MW
Solar, 2 MW
Hydro, 6 MW
Natural Gas, 1,062 MW
Michigan – Queued Capacity (MW) by Fuel Type
(Requested CIRs – as of Dec. 31, 2021)

Solar, 1,144 MW
Nameplate Capacity, 1,795 MW
Storage, 81 MW
Natural Gas, 1,230 MW

Total 2,455 MW

Note: Nameplate capacity represents a generator’s rated full power output capability.
Michigan – Historical Interconnection Requests by Fuel Type
(as of Dec. 31, 2021)

<table>
<thead>
<tr>
<th>Non-Renewable Fuel Type</th>
<th>In Queue</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Active</td>
<td>Under Construction</td>
</tr>
<tr>
<td></td>
<td>Projects</td>
<td>Capacity (MW)</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>1</td>
<td>145.0</td>
</tr>
<tr>
<td>Nuclear</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Storage</td>
<td>3</td>
<td>81.3</td>
</tr>
<tr>
<td>Renewable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methane</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Solar</td>
<td>15</td>
<td>1,143.7</td>
</tr>
<tr>
<td>Wind</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Grand Total</td>
<td>19</td>
<td>1,370.0</td>
</tr>
</tbody>
</table>

Note: The "Under Construction" column includes both “Engineering and Procurement” and “Under Construction” project statuses.
Michigan – Progression History of Interconnection Requests

This graphic shows the final state of generation submitted to the PJM queue that completed the study phase as of Dec. 31, 2021, meaning the generation reached in-service operation, began construction, or was suspended or withdrawn. It does not include projects considered active in the queue as of Dec. 31, 2021.
Michigan had no generators give notice of deactivation in 2021.
Planning
Transmission Infrastructure Analysis
Please note that PJM is now listing all transmission projects in its Annual RTEP and state infrastructure reports, beginning with this year’s 2021 Annual RTEP. In previous years only projects above a $10 million threshold were listed in the Annual RTEP Report and projects above a $5 million threshold were listed in the state infrastructure reports. This change may increase the amount of projects listed in these reports going forward now that smaller projects below the previous $5 million cutoff are being included.

The complete list of all RTEP projects in PJM, including those from prior years, can be found at the “RTEP Upgrades & Status – Transmission Construction Status” page on pjm.com.

https://www.pjm.com/planning/project-construction
Michigan – RTEP Baseline Projects

Note: Baseline upgrades are those that resolve a system reliability criteria violation.
<table>
<thead>
<tr>
<th>Map ID</th>
<th>Project</th>
<th>Description</th>
<th>Required In-Service Date</th>
<th>Project Cost ($M)</th>
<th>TO Zone</th>
<th>TEAC Date</th>
</tr>
</thead>
</table>
Michigan – RTEP Network Projects

Michigan had no network project upgrades in 2021.

Note: Network upgrades are new or upgraded facilities required primarily to eliminate reliability criteria violations caused by proposed generation, merchant transmission or long term firm transmission service requests, as well as certain direct connection facilities required to interconnect proposed generation projects.
Note: Supplemental projects are transmission expansions or enhancements that are not required for compliance with PJM criteria and are not state public policy projects according to the PJM Operating Agreement. These projects are used as inputs to RTEP models, but are not required for reliability, economic efficiency or operational performance criteria, as determined by PJM.
## Michigan – TO Supplemental Projects

<table>
<thead>
<tr>
<th>Map ID</th>
<th>Project</th>
<th>Description</th>
<th>Projected In-Service Date</th>
<th>Project Cost ($M)</th>
<th>TO Zone</th>
<th>TEAC Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>s2390</td>
<td>Replace the failed 345 kV breaker N1 at DC Cook 765/345 kV station.</td>
<td>10/17/2020</td>
<td>$0.30</td>
<td>9/11/2020</td>
<td></td>
</tr>
<tr>
<td></td>
<td>s2440.1</td>
<td>Rebuild the 7.7 mile Bridgman-Pletcher line with 556 ACSR conductor.</td>
<td>1/14/2024</td>
<td>$32.00</td>
<td>AEP</td>
<td>12/18/2020</td>
</tr>
<tr>
<td></td>
<td>s2440.2</td>
<td>Install new 69/34.5 kV Bucktown station to replace Buchanan Hydro station. Install new 69/34.5 kV transformer with two 34.5 kV line breakers and four 69 kV breaker ring bus.</td>
<td>2/14/2024</td>
<td>$32.00</td>
<td>AEP</td>
<td>12/18/2020</td>
</tr>
<tr>
<td></td>
<td>s2440.3</td>
<td>Retire 1 mile of 4/0 copper conductor from Buchanan Hydro to Clark Equipment and Jack’s Post customer. Construct 0.1 miles of 34.5 kV line from Jack’s Post to new Bucktown station.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>s2440.4</td>
<td>Retire 1 mile of 4/0 copper conductor from Buchanan Hydro to Clark Equipment and Jack’s Post customer. Construct 0.1 miles of 34.5 kV line from Jack’s Post to new Bucktown station.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2</td>
<td>s2571.1</td>
<td>Riverside-Hartford 138 kV – Rebuild ~14.7 miles of 1950s wood H-frame line with 795 Drake ACSR.</td>
<td>10/28/2024</td>
<td>$65.40</td>
<td>7/16/2021</td>
<td></td>
</tr>
<tr>
<td></td>
<td>s2571.2</td>
<td>South Haven-Hartford 69 kV – Rebuild ~18.7 miles of 1960s wood pole line with 795 Drake ACSR.</td>
<td></td>
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<tr>
<td></td>
<td>s2571.3</td>
<td>Phoenix Switch 69 kV – Replace the switch with a new phase-over-phase switch with line MOABs.</td>
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<tr>
<td></td>
<td>s2571.4</td>
<td>Bangor 69 kV – Install a bus tie breaker at Bangor 69 kV station.</td>
<td></td>
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<tr>
<td>Map ID</td>
<td>Project</td>
<td>Description</td>
<td>Projected In-Service Date</td>
<td>Project Cost ($M)</td>
<td>TO Zone</td>
<td>TEAC Date</td>
</tr>
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</tr>
<tr>
<td>s2584.1</td>
<td>East Elkhart-Mottville Hydro 138 kV – Rebuild ~10 miles of 1950s wood on the East Elkhart-Mottville Hydro 138 kV line using 795 Drake ACSR.</td>
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<tr>
<td>s2584.2</td>
<td>Mottville Hydro-Corey 138 kV – Retire the ~9 mile 138 kV line.</td>
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<tr>
<td>s2584.3</td>
<td>Moore Park 69 kV tap – Retire the ~9 mile 69 kV line.</td>
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<tr>
<td>s2584.4</td>
<td>Moore Park 69 kV SW – Retire the 69 kV phase-over-phase switch.</td>
<td>3/25/2025</td>
<td>$91.15</td>
<td>AEP</td>
<td>8/16/2021</td>
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<tr>
<td>s2584.5</td>
<td>Moore Park 69 kV station – Install a 90 MVA, 138/69 kV XFR with a high-side switcher and low-side circuit breaker. 69 kV circuit breaker “C” will be replaced with the 69 kV circuit breaker “B”. Replace 69 kV cap switcher “BB”.</td>
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<tr>
<td>s2584.6</td>
<td>Retire Sturgis 69 kV station.</td>
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<tr>
<td>s2584.7</td>
<td>Stubey Rd 138/69 kV station – Expand station to include six 69 kV circuit breakers in a ring, four 138 kV circuit breakers in a ring, two 138/69 kV, 130 MVA XFRs and two 17.6 MVAR, 69 kV cap banks. Reterminate the Sturgis IP line into Stubey Road. Reterminate the Corey line into Stubey Road to energize the line at 138 kV.</td>
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<tr>
<td>s2584.8</td>
<td>Howe (Nipsco)-Sturgis 69 kV – Retire the ~2.9 mile 69 kV line.</td>
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<tr>
<td>s2584.9</td>
<td>Mottville Hydro-Stubey Rd. 138 kV – Re-energize the existing line from Mottville-Pigeon River to 138 kV and construct a new ~8.9 mile 138 kV line between Pigeon River and Stubey Road to reestablish the 138 kV through path to Corey station.</td>
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<tr>
<td>s2584.10</td>
<td>Pigeon River 69 kV station – Remove 69 kV circuit breaker “K” from Pigeon River to reuse at Stubey Rd.</td>
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<tr>
<td>s2584.11</td>
<td>Mottville Hydro 138/69 kV station – Remove 69 kV circuit breaker “D” from Mottville Hydro to reuse at Stubey Rd. E.</td>
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<tr>
<td>s2584.12</td>
<td>Corey 138/69 kV station – Remove 69 kV circuit breaker “C” from Corey to reuse at Stubey Rd. E.</td>
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<tr>
<td>s2584.13</td>
<td>White Pigeon 69 kV Ext – Build new 69 kV 0.2 mile extension from Corey-Pigeon River to the existing White Pigeon station.</td>
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<tr>
<td>s2584.14</td>
<td>Florence Rd. 69 kV station – Replace the line switches at Florence Rd.</td>
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</tr>
</tbody>
</table>
Planning
Load Forecast
PJM Annual Load Forecasts

(Jan. 2022)

PJM RTO Summer Peak Demand Forecast

Load (MW)

190,000
180,000
170,000
160,000
150,000
140,000

2015 2017 2019 2021 2023 2025 2027 2029 2031 2033 2035 2037

The summer and winter peak megawatt values reflect the estimated amount of forecasted load to be served by each transmission owner in the noted state/district. Estimated amounts were calculated based on the average share of each transmission owner’s real-time summer and winter peak load in those areas over the past five years.
2022/2023 Base Residual Auction Clearing Prices ($/MW-Day)

- **ComEd**: $68.96
- **DEO&K**: $71.69
- **RTO**: $50
- **BGE**: $126.50
- **MAAC**: $95.79
- **EMAAC**: $97.86
**PJM – 2022/2023 Cleared MW (UCAP) by Resource Type**

<table>
<thead>
<tr>
<th></th>
<th>ANNUAL</th>
<th>SUMMER</th>
<th>WINTER</th>
<th>Total (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Generation</strong></td>
<td>130,844.9</td>
<td>9.9</td>
<td>686.8</td>
<td>131,541.6</td>
</tr>
<tr>
<td><strong>DR</strong></td>
<td>8,369.9</td>
<td>442.0</td>
<td>0.0</td>
<td>8,811.9</td>
</tr>
<tr>
<td><strong>EE</strong></td>
<td>4,575.7</td>
<td>234.9</td>
<td>0.0</td>
<td>4,810.6</td>
</tr>
<tr>
<td><strong>Total (MW)</strong></td>
<td>143,790.5</td>
<td>686.8</td>
<td>686.8</td>
<td>144,163.3</td>
</tr>
</tbody>
</table>
Markets
Market Analysis
Michigan – Average Daily LMP

LMP ($/MWh)

- PJM Average RT Daily LMP
- MI Average RT Daily LMP
Michigan’s average hourly LMPs generally aligned with the PJM average hourly LMP.
This chart reflects the portion of Michigan that PJM operates. Positive values represent exports and negative values represent imports.
Operations
The data in this chart comes from EIA Form 923 (2021) and represents only generators within the PJM portion of MI.
2005 – 2021 PJM Average Emissions

CO₂ (lbs/MWh)


SO₂ and NOₓ (lbs/MWh)

0.0 1.5 3.0 4.5 6.0 7.5 9.0

Carbon Dioxide
Nitrogen Oxides
Sulfur Dioxide

Nitrogen Oxides
Sulfur Dioxide
Carbon Dioxide