2019 Kentucky State Infrastructure Report
(January 1, 2019 – December 31, 2019)

May 2020
(updated July 2020)

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

2. Markets
   • Market Analysis

3. Operations
   • Emissions Data
• **Existing Capacity:** Coal represents approximately 53.4 percent of the total installed capacity in the Kentucky service territory while natural gas represents approximately 43.7 percent. This differs from PJM where natural gas and coal are at 42.4 and 28.7 percent of total installed capacity.

• **Interconnection Requests:** Solar represents 65.3 percent of new interconnection requests in Kentucky, while natural gas represents approximately 32.2 percent of new requests.

• **Deactivations:** No generation in Kentucky gave notification of deactivation in 2019.

• **RTEP 2019:** Kentucky’s 2019 RTEP projects total approximately $125 million in investment. Approximately 52 percent of that represents supplemental projects. These investment figures only represent RTEP projects that cost at least $5 million.
• **Load Forecast:** Kentucky’s load in PJM is projected to grow from 0.7 to 1.5 percent annually over the next ten years. Comparatively, the overall PJM RTO projected load growth rate is 0.6 percent.

• **2022/23 Capacity Market:** No Base Residual Auction was conducted in 2019. For the most recent auction results, please see the 2018 Kentucky State Infrastructure Report.

• **1/1/19 – 12/31/19 Market Performance:** Kentucky’s average hourly LMPs generally aligned with PJM average hourly LMPs.

• **Emissions:** 2019 carbon dioxide emissions were down from 2018, while sulfur dioxide and nitrogen oxide emissions are both flat from 2018 levels.
The PJM service area in Kentucky 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, 2019)

Hydro, 8,332 MW
Solar, 791 MW
Oil, 9,424 MW

Nuclear, 32,653 MW
Wind, 1,239 MW

Coal, 52,838 MW
Waste, 849 MW

Natural Gas, 78,047 MW
Kentucky – Existing Installed Capacity
(CIRs – as of Dec. 31, 2019)

Hydro, 136 MW
Coal, 2,577 MW
Natural Gas, 2110 MW

KY
4,823 MW
PJM – Queued Capacity (MW) by Fuel Type

(Requested CIRs – as of Dec. 31, 2019)

- Solar, 35,759 MW
- Other, 40 MW
- Nuclear, 169 MW
- Oil, 27 MW
- Natural Gas, 34,990 MW
- Storage, 3,920 MW
- Wind, 6,240 MW
- Wood, 66 MW
- Coal, 96 MW
- Diesel, 4 MW
- Methane, 1 MW
- Hydro, 520 MW
Kentucky – Queued Capacity (MW) by Fuel Type

(Requested CIRs – as of Dec. 31, 2019)

Solar, **2,233 MW**
Nameplate Capacity, 3,480 MW

Storage, **85 MW**

Natural Gas, **1,100 MW**

**KY**
3,418 MW

*Note: Nameplate Capacity represents a generator’s rated full power output capability.*
Kentucky – Percentage of MW in Queue by Fuel Type
(Dec. 31, 2019)
# Kentucky – Interconnection Requests

(Unforced Capacity – as of Dec. 31, 2019)

<table>
<thead>
<tr>
<th></th>
<th>In Queue</th>
<th>Complete</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Active</td>
<td>Under Construction</td>
<td>In Service</td>
</tr>
<tr>
<td></td>
<td>No. of Projects</td>
<td>Capacity (MW)</td>
<td>No. of Projects</td>
</tr>
<tr>
<td>Non-Renewable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Storage</td>
<td>2</td>
<td>85.0</td>
<td>0</td>
</tr>
<tr>
<td>Renewable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biomass</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hydro</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Solar</td>
<td>36</td>
<td>2,232.7</td>
<td>0</td>
</tr>
<tr>
<td>Grand Total</td>
<td>38</td>
<td>2,317.7</td>
<td>1</td>
</tr>
</tbody>
</table>

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

This graphic shows the final state of generation submitted in all PJM queues that reached in-service operation, began construction, or was suspended or withdrawn as of Dec. 31, 2019.
Kentucky had no generation deactivation notifications in 2019.
Planning
Transmission Infrastructure Analysis
Please note that PJM historically used $5 million as the threshold for listing projects in the RTEP report. Beginning in 2018, it was decided to increase this cutoff to $10 million. All RTEP projects with costs totaling at least $5 million are included in this state report. However, only projects that are $10 million and above are displayed on the project maps.

For a complete list of all RTEP projects, please visit the “RTEP Upgrades & Status – Transmission Construction Status” page on pjm.com.

Kentucky – RTEP Baseline Projects
(Greater than $10 million)

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>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>b2761</td>
<td>Replace and relocate the Hazard 161/138 kV transformer and circuit breaker M. Upgrade protection scheme on the new transformer including installation of low side breaker.</td>
<td>6/1/2021</td>
<td>$20.6</td>
<td>AEP</td>
<td>10/6/2016</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rebuild the Hazard-Wooton 161 kV line utilizing 795 26/7 ACSR conductor (300 MVA rating). Replace line relaying and associated termination equipment.</td>
<td></td>
<td></td>
<td></td>
<td>11/2/2017</td>
</tr>
<tr>
<td>2</td>
<td>b3087</td>
<td>Construct a new greenfield station to the west (~1.5 mi.) of the existing Fords Branch Station, potentially in/near the new Kentucky Enterprise Industrial Park. This new station will consist of four 138 kV breaker ring buses and two 30 MVA 138/34.5 kV transformers. The existing Fords Branch Station will be retired.</td>
<td>12/1/2023</td>
<td>$23.2</td>
<td>AEP</td>
<td>11/29/2018</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Construct ~5 miles of new double circuit 138 kV line in order to loop the new Fords Branch station into the existing Beaver Creek-Cedar Creek 138 kV circuit.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remote end work will be required at Cedar Creek Station.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Map ID</td>
<td>Project</td>
<td>Description</td>
<td>Projected In-Service Date</td>
<td>Project Cost ($M)</td>
<td>TO Zone</td>
<td>TEAC Date</td>
</tr>
<tr>
<td>--------</td>
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<td>---------</td>
<td>-----------</td>
</tr>
<tr>
<td>3</td>
<td>b3118</td>
<td>Expand existing Chadwick station and install a second 138/69 kV transformer at a new 138 kV bus tied into the Bellefonte-Grangston 138 kV circuit. The 69 kV bus will be reconfigured into a ring bus arrangement to tie the new transformer into the existing 69 kV via installation of four 3000A 63 kA 69 kV circuit breakers. Perform 138 kV remote end work at Grangston station. Perform 138 kV remote end work at Bellefonte station. Relocate the Chadwick-Leach 69 kV circuit within Chadwick station. Terminate the Bellefonte-Grangston 138 kV circuit to the Chadwick 138 kV bus. Chadwick-Tri-State No. 2 138 kV circuit will be reconfigured within the station to terminate into the newly established 138 kV bus No. 2 at Chadwick due to construction aspects. Reconductor Chadwick-Leach and Chadwick-England Hill 69 kV lines with 795 ACSS conductor. Perform a LiDAR survey and a sag study. Rebuild 336 ACSR portion of Leach-Miller Stainless Steel 69 kV line section (~0.3 miles) with 795 ACSS conductor. Replace 69 kV line risers (towards Chadwick) at Leach station.</td>
<td>6/1/2022</td>
<td>16.9</td>
<td>AEP</td>
<td>2/20/2019</td>
</tr>
</tbody>
</table>
Kentucky – RTEP Network Projects
(Greater than $5 million)

Kentucky had no network project upgrades in 2019.

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.
Kentucky – TO Supplemental Projects
(Greater than $10 million)

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.
# Kentucky – TO Supplemental Projects

(Greater than $5 million)

<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>s1782</td>
<td>Install a new 138 kV, three-breaker ring bus substation, Woodspoint. Install a new 138 kV, six-breaker ring bus, Aero, near Amazon Prime Hub. Install new 138 kV lines from Woodspoint to Aero, and from Aero to Oakbrook.</td>
<td>12/31/2020</td>
<td>$30.2</td>
<td>DEO&amp;K</td>
<td>1/11/2019</td>
</tr>
<tr>
<td>2</td>
<td>s1940</td>
<td>Rebuild Boone County-Williamstown 69 kV line using 556.5 ACSR (28.5 miles).</td>
<td>12/1/2024</td>
<td>$15.8</td>
<td>EKPC</td>
<td>3/25/2019</td>
</tr>
<tr>
<td>3</td>
<td>s1941</td>
<td>Rebuild the KU Wofford-Whitley City 69 kV line using 556.5 ACSR conductor (20.7 miles)</td>
<td>12/31/2022</td>
<td>$13.0</td>
<td>EKPC</td>
<td>3/25/2019</td>
</tr>
<tr>
<td></td>
<td>s1939</td>
<td>Rebuild Monticello 69/25/12.5 kV substation on new site with a 69 kV breaker station. Rebuild Homestead Tap partially on new R/W (1.3 miles).</td>
<td>12/1/2020</td>
<td>$5.5</td>
<td>EKPC</td>
<td>3/25/2019</td>
</tr>
</tbody>
</table>
Planning
Load Forecast
PJM Annual Load Forecasts
(January 2020)

PJM RTO Summer Peak Demand Forecast
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. 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.

The Load Forecast was produced prior to COVID-19 and will be updated before the next Base Residual Auction to reflect changes in load patterns.
Markets
Market Analysis
Kentucky – Average Daily Load and LMP

(Jan. 1, 2019 – Dec. 31, 2019)

Note: The price spike in October reflects the Performance Assessment Interval event that occurred on October 2nd.
Kentucky’s average hourly LMPs generally aligned with the PJM average hourly LMP.
This chart reflects the portion of Kentucky that PJM operates. Positive values represent exports and negative values represent imports.
Operations
Emissions Data
2005 – 2019 PJM Average Emissions

**CO₂ (lbs/MWh)**

- 2005: 1,300 lbs/MWh
- 2006: 1,250 lbs/MWh
- 2007: 1,200 lbs/MWh
- 2008: 1,150 lbs/MWh
- 2009: 1,100 lbs/MWh
- 2010: 1,050 lbs/MWh
- 2011: 1,000 lbs/MWh
- 2012: 950 lbs/MWh
- 2013: 900 lbs/MWh
- 2014: 850 lbs/MWh
- 2015: 800 lbs/MWh
- 2016: 750 lbs/MWh
- 2017: 700 lbs/MWh
- 2018: 650 lbs/MWh
- 2019: 600 lbs/MWh

**SO₂ and NOₓ (lbs/MWh)**

- 2005: 10 lbs/MWh
- 2006: 9 lbs/MWh
- 2007: 8 lbs/MWh
- 2008: 7 lbs/MWh
- 2009: 6 lbs/MWh
- 2010: 5 lbs/MWh
- 2011: 4 lbs/MWh
- 2012: 3 lbs/MWh
- 2013: 2 lbs/MWh
- 2014: 1 lbs/MWh
- 2015: 1 lbs/MWh
- 2016: 1 lbs/MWh
- 2017: 1 lbs/MWh
- 2018: 1 lbs/MWh
- 2019: 1 lbs/MWh

**Graph Key**

- Blue: Carbon Dioxide
- Orange: Nitrogen Oxides
- Green: Sulfur Dioxides
Kentucky – Average Emissions (lbs/MWh) (Feb. 7, 2020)

- Carbon Dioxide
- Nitrogen Oxides
- Sulfur Dioxides

CO₂ (lbs/MWh)

SO₂ and NOₓ (lbs/MWh)