Review of Additional Transmission Alternatives
There are two areas with problems identified on the PJM system through 2021 that still require transmission solutions.

• Northern New Jersey – there were 17 overloads identified. The majority of these were on the 230 kV system and occurred from 2015 through 2021. The Transmission Owners have provided upgrades to relieve a few of the problems but new transmission is still expected to be needed to resolve the overall import issue into Northern New Jersey.

• Western / Central Interface – Overloads on three 500 kV circuits along the PJM Western and Central interfaces occur in 2019 and 2020.
<table>
<thead>
<tr>
<th>Test Resulting in Highest Overload</th>
<th>Year That Facility Loading Exceeds Conductor Rating</th>
<th>Overloaded Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load Deliverability</td>
<td>2015</td>
<td>East Windsor - Smithburg 230 kV</td>
</tr>
<tr>
<td>Generator Deliverability</td>
<td>2015</td>
<td>Greystone - Whippany 230 kV</td>
</tr>
<tr>
<td>Load Deliverability</td>
<td>2016</td>
<td>Cox's Corner - Lumberton 230 kV</td>
</tr>
<tr>
<td>Load Deliverability</td>
<td>2016</td>
<td>Branchburg - Readington 230 kV</td>
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<tr>
<td>Load Deliverability</td>
<td>2016</td>
<td>Whippany - Roseland 230 kV</td>
</tr>
<tr>
<td>Load Deliverability</td>
<td>2016</td>
<td>Kittatinny - Pohatcong 230 kV</td>
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<tr>
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<td>2016</td>
<td>Hosensack - Elroy 500 kV</td>
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<tr>
<td>Generator Deliverability</td>
<td>2016</td>
<td>Atlantic - Larrabee 230 kV</td>
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<tr>
<td>Load Deliverability</td>
<td>2016</td>
<td>Lumberton - Cookstown 230 kV</td>
</tr>
<tr>
<td>Load Deliverability</td>
<td>2017</td>
<td>Branchburg - Flagtown 230 kV</td>
</tr>
<tr>
<td>Load Deliverability</td>
<td>2017</td>
<td>Flagtown - Somerville 230 kV</td>
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<tr>
<td>Generator Deliverability</td>
<td>2017</td>
<td>Somerville - Bridgewater 230 kV</td>
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<tr>
<td>Load Deliverability</td>
<td>2017</td>
<td>Martins Creek - Portland 230 kV</td>
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<tr>
<td>Generator Deliverability</td>
<td>2019</td>
<td>Portland - Kittatinny 230 kV</td>
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<tr>
<td>Generator Deliverability</td>
<td>2019</td>
<td>Portland - Greystone 230 kV</td>
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<tr>
<td>Load Deliverability</td>
<td>2020</td>
<td>Pleasant Valley - Lawrence 230 kV</td>
</tr>
<tr>
<td>Load Deliverability</td>
<td>2021</td>
<td>Readington - Roseland 230 kV</td>
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</table>
Northern New Jersey Overloads

System Upgrade Needed by June 2015 (9 years)
<table>
<thead>
<tr>
<th>Test Resulting in Highest Overload</th>
<th>Year That Facility Loading Exceeds Conductor Rating</th>
<th>Overloaded Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load Deliverability</td>
<td>2019</td>
<td>Airydale - Juniata 500 kV Circuit 1</td>
</tr>
<tr>
<td>Load Deliverability</td>
<td>2019</td>
<td>Airydale - Juniata 500 kV Circuit 2</td>
</tr>
<tr>
<td>Load Deliverability</td>
<td>2020</td>
<td>Keystone - Conemaugh 500 kV</td>
</tr>
</tbody>
</table>
Western & Central Interface Overloads

System Upgrade Needed by June 2019 (13 years)
Two types of studies were performed by PJM to evaluate the strength of the transmission alternatives.

Transfer Study

The base system model used for all transfer studies was a 2016 RTEP basecase. The RTEP 2016 basecase contains all system upgrades previously approved by the PJM Board. Also, the case was modified so that the FCITC analysis would only be limited by conductor ratings.

FCITC (First Contingency Incremental Transfer Capability) – for the purposes of this presentation the FCITC is based on a transfer from PJM Western Region generation to PJM Mid-Atlantic Region load. The facility which limits the FCITC and the FCITC MW value provides an indication of the relative benefit of each alternative.
Baseline Study

PJM modeled each alternative in the 2011 RTEP basecase and determined the impacts to the Northern New Jersey and Western/Central interface overloads through the next 15 years.

The tests applied for the baseline review were generator deliverability, Mid-Atlantic Region load deliverability and Eastern Mid-Atlantic load deliverability since these were the tests that resulted in the majority of system problems.
**Transmission Alternatives**

**Alternative 14:**
Amos - Kemptown 765 kV  
Bossards - Jefferson - Roseland 500 kV

**Alternative 15:**
Kammer / South Canton - Keystone 765 kV  
Amos - Kemptown 765 kV  
Keystone - Sunbury 500 kV  
Bossards - Jefferson - Roseland 500 kV

**Alternative 16:**
Kammer / South Canton - Keystone 765 kV  
Amos - Kemptown 765 kV  
Keystone - TMI 500 kV  
Bossards - Jefferson - Roseland 500 kV

**Alternative 17:**
Amos - Kemptown - Possum Point 765 kV  
Possum Point - Vienna - Salem 500 kV

**Alternative 18:**
Amos - Kemptown - Deans 765 kV  
Bossards - Jefferson - Roseland 500 kV

**Alternative 19:**
Open Dooms - Elmont at Cunningham 500 kV  
Dooms - Cunningham - Ladysmith 500 kV  
Joshua Falls - Elmont 500 kV  
Bossards - Jefferson - Roseland 500 kV

**Alternative 20:**
Axton - Clover 765 kV  
Bossards - Jefferson - Roseland 500 kV

**Alternative 21:**
Amos - Kemptown 765 kV  
Calvert Cliffs - Indian River 500 kV

**Alternative 22:**
Bristers - Possum Point 500 kV  
Possum Point - Vienna - Salem 500 kV

**Alternative 23:**
Kammer - 502 Junction 765 kV  
502 Junction - Hampshire - Bedington  
Bedington - Hunterstown - TMI 500 kV  
Bossards - Jefferson - Roseland 500 kV

**Alternative 24:**
Kammer - 502 Junction 765 kV  
502 Junction - Hunterstown - TMI 500 kV  
Bossards - Jefferson - Roseland 500 kV

**Alternative 25:**
Kammer / South Canton - Keystone 765 kV  
Keystone - TMI 500 kV  
Bossards - Jefferson - Roseland 500 kV

**Alternative 25a:**
Kammer / South Canton - Keystone 765 kV  
Keystone - Sunbury 500 kV  
Bossards - Jefferson - Roseland 500 kV

**Alternative 25b:**
Kammer / South Canton - Keystone 765 kV  
Keystone - TMI 500 kV  
Bossards - Jefferson - Roseland 500 kV

**Alternative 26:**
Kammer - Prexy 765 kV  
Prexy - White Valley - Conemaugh - TMI 500 kV  
Bossards - Jefferson - Roseland 500 kV

**Alternative 27:**
Possum Point - Vienna - Salem 500 kV  
Joshua Falls - Possum Point 500 kV

**Alternative 28:**
Possum Point - Vienna - Salem 500 kV  
Joshua Falls - Ladysmith 500 kV

**Alternative 29:**
Possum Point - Vienna - Salem 500 kV  
Joshua Falls - Ladysmith 500 kV
**Alternative 14:**
Amos - Kemptown 765 kV
Bossards - Jefferson - Roseland 500 kV

**FCITC = 5995 MW limited by Airydale - Juniata 500 kV #1**
(This amounts to a 3541 MW increase in transfer capability from the basecase).

<table>
<thead>
<tr>
<th>Facility</th>
<th>Basecase FCITC (MW)</th>
<th>Alternative 14 FCITC (MW)</th>
<th>FCITC Change (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Storm - Doubs 500 kV</td>
<td>2454</td>
<td>7572</td>
<td>5119</td>
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<td>Pruntytown - Mt. Storm 500 kV</td>
<td>2844</td>
<td>10122</td>
<td>7278</td>
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<td>Hosensack - Elroy 500 kV</td>
<td>3490</td>
<td>13146</td>
<td>9656</td>
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<tr>
<td>Keystone - Airydale 500 kV</td>
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<td>Keystone - Conemaugh 500 kV</td>
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<td>7259</td>
<td>3655</td>
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<td>Airydale - Juniata 500 kV #1</td>
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<td>5995</td>
<td>2289</td>
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<tr>
<td>Kammer 765/500 kV</td>
<td>3768</td>
<td>7977</td>
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<td>Airydale - Juniata 500 kV #2</td>
<td>3820</td>
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<td>Lexington - Dooms 500 kV</td>
<td>4018</td>
<td>10947</td>
<td>6929</td>
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<tr>
<td>Conastone - Graceton 230 kV</td>
<td>6217</td>
<td>3958</td>
<td>-2259</td>
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<td>Brighton 500/230 kV</td>
<td>19043</td>
<td>4867</td>
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</table>
PJM also modeled Alternative 14 in the 2011 RTEP baseline case and determined the impact to the overloads identified through 2021.

• The majority of Northern New Jersey overloads were resolved through 2021 with this alternative.

• The Western and Central interface overloads were resolved with this alternative.
The ROW routes shown on this diagram are for illustrative purposes only and they may not depict the actual route that could eventually be selected. The substation locations may also be modified if a more beneficial connection is determined.
Transmission Alternatives

**Alternative 15:**
Kammer / South Canton - Keystone 765 kV
Amos - Kemptown 765 kV
Keystone - Sunbury 500 kV
Bossards - Jefferson - Roseland 500 kV

**FCITC = 9599 MW limited by Airydale - Juniata 500 kV #1**
(This amounts to a 7145 MW increase in transfer capability from the basecase).

<table>
<thead>
<tr>
<th>Facility</th>
<th>Basecase FCITC (MW)</th>
<th>Alternative 15 FCITC (MW)</th>
<th>FCITC Change (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Storm - Doubs 500 kV</td>
<td>2454</td>
<td>10053</td>
<td>7600</td>
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<tr>
<td>Pruntytown - Mt. Storm 500 kV</td>
<td>2844</td>
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<td>10670</td>
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<td>Hosensack - Elroy 500 kV</td>
<td>3490</td>
<td>10167</td>
<td>6677</td>
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<td>Keystone - Airydale 500 kV</td>
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<td>Keystone - Conemaugh 500 kV</td>
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<td>7406</td>
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<tr>
<td>Airydale - Juniata 500 kV #1</td>
<td>3706</td>
<td>9599</td>
<td>5893</td>
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<tr>
<td>Kammer 765/500 kV</td>
<td>3768</td>
<td>11637</td>
<td>7869</td>
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<tr>
<td>Airydale - Juniata 500 kV #2</td>
<td>3820</td>
<td>9787</td>
<td>5967</td>
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<tr>
<td>Lexington - Dooms 500 kV</td>
<td>4018</td>
<td>12727</td>
<td>8709</td>
</tr>
</tbody>
</table>

* No significant 230 kV or 345 kV FCITC reduction identified
PJM also modeled Alternative 15 in the 2011 RTEP baseline case and determined the impact to the overloads identified through 2021.

- The majority of Northern New Jersey overloads were resolved through 2021 with this alternative.

- The Western and Central interface overloads were resolved with this alternative.
The ROW routes shown on this diagram are for illustrative purposes only and they may not depict the actual route that could eventually be selected. The substation locations may also be modified if a more beneficial connection is determined.
**Transmission Alternatives**

**Alternative 16:**
- Kammer / South Canton - Keystone 765 kV
- Amos - Kemptown 765 kV
- Keystone - TMI 500 kV
- Bossards - Jefferson - Roseland 500 kV

*FCITC = 9036 MW limited by Airydale - Juniata 500 kV #1*
(This amounts to a 6582 MW increase in transfer capability from the basecase).

<table>
<thead>
<tr>
<th>Facility</th>
<th>Basecase FCITC (MW)</th>
<th>Alternative 16 FCITC (MW)</th>
<th>FCITC Change (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Storm - Doubs 500 kV</td>
<td>2454</td>
<td>10512</td>
<td>8059</td>
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<td>Pruntytown - Mt. Storm 500 kV</td>
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<td>14360</td>
<td>11516</td>
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<td>Hosensack - Elroy 500 kV</td>
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<td>11199</td>
<td>7709</td>
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<td>Keystone - Airydale 500 kV</td>
<td>3519</td>
<td>9955</td>
<td>6436</td>
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<tr>
<td>Keystone - Conemaugh 500 kV</td>
<td>3604</td>
<td>10928</td>
<td>7324</td>
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<tr>
<td>Airydale - Juniata 500 kV #1</td>
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<td>9036</td>
<td>5330</td>
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<tr>
<td>Kammer 765/500 kV</td>
<td>3768</td>
<td>11642</td>
<td>7874</td>
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<td>Airydale - Juniata 500 kV #2</td>
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<tr>
<td>Lexington - Dooms 500 kV</td>
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<td>12891</td>
<td>8873</td>
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</table>

* No significant 230 kV or 345 kV FCITC reduction identified
PJM also modeled Alternative 16 in the 2011 RTEP baseline case and determined the impact to the overloads identified through 2021.

- The majority of Northern New Jersey overloads were resolved through 2021 with this alternative.

- The Western and Central interface overloads were resolved with this alternative.
The ROW routes shown on this diagram are for illustrative purposes only and they may not depict the actual route that could eventually be selected. The substation locations may also be modified if a more beneficial connection is determined.
**Alternative 17:**
Amos - Kemptown - Possum Point 765 kV
Possum Point - Vienna - Salem 500 kV

FCITC = 7377 MW limited by Airydale - Juniata 500 kV #1
(This amounts to a 4923 MW increase in transfer capability from the basecase).

<table>
<thead>
<tr>
<th>Facility</th>
<th>Basecase FCITC (MW)</th>
<th>Alternative 17 FCITC (MW)</th>
<th>FCITC Change (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Storm - Doubs 500 kV</td>
<td>2454</td>
<td>7893</td>
<td>5440</td>
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<tr>
<td>Pruntytown - Mt. Storm 500 kV</td>
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<td>Keystone - Airydale 500 kV</td>
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<td>4592</td>
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<td>Keystone - Conemaugh 500 kV</td>
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<td>Airydale - Juniata 500 kV #1</td>
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<td>Lexington - Dooms 500 kV</td>
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<td>6262</td>
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</table>

* No significant 230 kV or 345 kV FCITC reduction identified
PJM also modeled Alternative 17 in the 2011 RTEP baseline case and determined the impact to the overloads identified through 2021.

- Most of the overloads in Northern New Jersey were not resolved with this alternative.

- The Western and Central interface overloads were resolved with this alternative.
The ROW routes shown on this diagram are for illustrative purposes only and they may not depict the actual route that could eventually be selected. The substation locations may also be modified if a more beneficial connection is determined.
**Transmission Alternatives**

**Alternative 18:**
Amos - Kemptown - Deans 765 kV
Bossards - Jefferson - Roseland 500 kV

**FCITC = 6660 MW limited by Mt. Storm - Doubs 500 kV**
(This amounts to a 4207 MW increase in transfer capability from the basecase).

<table>
<thead>
<tr>
<th>Facility</th>
<th>Basecase FCITC (MW)</th>
<th>Alternative 18 FCITC (MW)</th>
<th>FCITC Change (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Storm - Doubs 500 kV</td>
<td>2454</td>
<td>6660</td>
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<tr>
<td>Pruntytown - Mt. Storm 500 kV</td>
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<tr>
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<td>18792</td>
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<td>Keystone - Airydale 500 kV</td>
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<td>5461</td>
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<td>Keystone - Conemaugh 500 kV</td>
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<td>Kammer 765/500 kV</td>
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<td>Lexington - Dooms 500 kV</td>
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<td>6850</td>
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</table>

* No significant 230 kV or 345 kV FCITC reduction identified
PJM also modeled Alternative 18 in the 2011 RTEP baseline case and determined the impact to the overloads identified through 2021.

• The majority of Northern New Jersey overloads were resolved through 2021 with this alternative.

• The Western and Central interface overloads were resolved with this alternative.
The ROW routes shown on this diagram are for illustrative purposes only and they may not depict the actual route that could eventually be selected. The substation locations may also be modified if a more beneficial connection is determined.
**Alternative 19:**
Open Dooms - Elmont at Cunningham 500 kV  
Dooms - Cunningham - Ladysmith 500 kV  
Joshua Falls - Elmont 500 kV  
Bossards - Jefferson - Roseland 500 kV

**FCITC = 3608 MW limited by Mt. Storm - Doubs 500 kV**  
(This amounts to a 1155 MW increase in transfer capability from the basecase).

<table>
<thead>
<tr>
<th>Facility</th>
<th>Basecase FCITC (MW)</th>
<th>Alternative 19 FCITC (MW)</th>
<th>FCITC Change (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Storm - Doubs 500 kV</td>
<td>2454</td>
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<td>Keystone - Conemaugh 500 kV</td>
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<td>4049</td>
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<tr>
<td>Lexington - Dooms 500 kV</td>
<td>4018</td>
<td>9617</td>
<td>5599</td>
</tr>
</tbody>
</table>

* No significant 230 kV or 345 kV FCITC reduction identified
PJM also modeled Alternative 19 in the 2011 RTEP baseline case and determined the impact to the overloads identified through 2021.

- The majority of Northern New Jersey overloads were resolved through 2021 with this alternative.

- The Western and Central interface overloads were not resolved with this alternative.
The ROW routes shown on this diagram are for illustrative purposes only and they may not depict the actual route that could eventually be selected. The substation locations may also be modified if a more beneficial connection is determined.

Joshua Falls – Elmont 500 kV Option

Bossards – Jefferson – Roseland 500 kV Option

Cunningham – Ladysmith 500 kV Option

Open Dooms – Elmont 500 kV
**Alternative 20:**
Axton - Clover 765 kV
Bossards - Jefferson - Roseland 500 kV

**FCITC = 3285 MW limited by Mt. Storm - Doubs 500 kV**
(This amounts to a 832 MW increase in transfer capability from the basecase).

<table>
<thead>
<tr>
<th>Facility</th>
<th>Basecase FCITC (MW)</th>
<th>Alternative 20 FCITC (MW)</th>
<th>FCITC Change (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Storm - Doubs 500 kV</td>
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<td>3285</td>
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<tr>
<td>Pruntytown - Mt. Storm 500 kV</td>
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<td>Kammer 765/500 kV</td>
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<tr>
<td>Lexington - Dooms 500 kV</td>
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<td>8073</td>
<td>4055</td>
</tr>
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</table>

* No significant 230 kV or 345 kV FCITC reduction identified
PJM also modeled Alternative 20 in the 2011 RTEP baseline case and determined the impact to the overloads identified through 2021.

- The majority of Northern New Jersey overloads were resolved through 2021 with this alternative.

- The Western and Central interface overloads were not resolved with this alternative.
The ROW routes shown on this diagram are for illustrative purposes only and they may not depict the actual route that could eventually be selected. The substation locations may also be modified if a more beneficial connection is determined.
**Alternative 21:**
Amos - Kemptown 765 kV
Calvert Cliffs - Indian River 500 kV

**FCITC = 6809 MW limited by Hosensack - Elroy 500 kV**
(This amounts to a 4355 MW increase in transfer capability from the basecase).

<table>
<thead>
<tr>
<th>Facility</th>
<th>Basecase FCITC (MW)</th>
<th>Alternative 21 FCITC (MW)</th>
<th>FCITC Change (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Storm - Doubs 500 kV</td>
<td>2454</td>
<td>7082</td>
<td>4629</td>
</tr>
<tr>
<td>Pruntytown - Mt. Storm 500 kV</td>
<td>2844</td>
<td>8336</td>
<td>5492</td>
</tr>
<tr>
<td>Hosensack - Elroy 500 kV</td>
<td>3490</td>
<td>6809</td>
<td>3319</td>
</tr>
<tr>
<td>Keystone - Airydale 500 kV</td>
<td>3519</td>
<td>7711</td>
<td>4192</td>
</tr>
<tr>
<td>Keystone - Conemaugh 500 kV</td>
<td>3604</td>
<td>8137</td>
<td>4533</td>
</tr>
<tr>
<td>Airydale - Juniata 500 kV #1</td>
<td>3706</td>
<td>7015</td>
<td>3309</td>
</tr>
<tr>
<td>Kammer 765/500 kV</td>
<td>3768</td>
<td>7859</td>
<td>4091</td>
</tr>
<tr>
<td>Airydale - Juniata 500 kV #2</td>
<td>3820</td>
<td>7164</td>
<td>3344</td>
</tr>
<tr>
<td>Lexington - Dooms 500 kV</td>
<td>4018</td>
<td>10347</td>
<td>6329</td>
</tr>
<tr>
<td>Brighton 500/230 kV</td>
<td>19043</td>
<td>3201</td>
<td>-15842</td>
</tr>
</tbody>
</table>
PJM also modeled Alternative 21 in the 2011 RTEP baseline case and determined the impact to the overloads identified through 2021.

• Most of the overloads in Northern New Jersey were not resolved with this alternative.

• The Western and Central interface overloads were resolved with this alternative.
The ROW routes shown on this diagram are for illustrative purposes only and they may not depict the actual route that could eventually be selected. The substation locations may also be modified if a more beneficial connection is determined.
**Alternative 22:**
Bristers - Possum Point 500 kV
Possum Point - Vienna - Salem 500 kV

**FCITC = 1914 MW limited by Pruntytown - Mt. Storm 500 kV**
(This amounts to a 540 MW decrease in transfer capability from the basecase).

<table>
<thead>
<tr>
<th>Facility</th>
<th>Basecase FCITC (MW)</th>
<th>Alternative 22 FCITC (MW)</th>
<th>FCITC Change (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Storm - Doubs 500 kV</td>
<td>2454</td>
<td>2557</td>
<td>104</td>
</tr>
<tr>
<td>Pruntytown - Mt. Storm 500 kV</td>
<td>2844</td>
<td>1914</td>
<td>-930</td>
</tr>
<tr>
<td>Hosensack - Elroy 500 kV</td>
<td>3490</td>
<td>5539</td>
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</tr>
<tr>
<td>Keystone - Airydale 500 kV</td>
<td>3519</td>
<td>4619</td>
<td>1100</td>
</tr>
<tr>
<td>Keystone - Conemaugh 500 kV</td>
<td>3604</td>
<td>4729</td>
<td>1125</td>
</tr>
<tr>
<td>Airydale - Juniata 500 kV #1</td>
<td>3706</td>
<td>4802</td>
<td>1096</td>
</tr>
<tr>
<td>Kammer 765/500 kV</td>
<td>3768</td>
<td>3796</td>
<td>28</td>
</tr>
<tr>
<td>Airydale - Juniata 500 kV #2</td>
<td>3820</td>
<td>4935</td>
<td>1115</td>
</tr>
<tr>
<td>Lexington - Dooms 500 kV</td>
<td>4018</td>
<td>3720</td>
<td>-298</td>
</tr>
</tbody>
</table>

* No significant 230 kV or 345 kV FCITC reduction identified
PJM also modeled Alternative 22 in the 2011 RTEP baseline case and determined the impact to the overloads identified through 2021.

• Most of the overloads in Northern New Jersey were not resolved with this alternative.

• The Western and Central interface overloads were resolved with this alternative.

• The AP South Interface loadings indicate higher flows on Pruntytown – Mt. Storm 500 kV due to this alternative.
The ROW routes shown on this diagram are for illustrative purposes only and they may not depict the actual route that could eventually be selected. The substation locations may also be modified if a more beneficial connection is determined.
**Transmission Alternatives**

**Alternative 23:**
Kammer - 502 Junction 765 kV (Rebuild Kammer - 502 Junction 500 kV)
502 Junction - Hampshire - Bedington - Hunterstown - TMI 500 kV
Bossards - Jefferson - Roseland 500 kV

**FCITC = 1385 MW limited by Hampshire - Doubs 500 kV**
(This amounts to a 1069 MW decrease in transfer capability from the basecase).

<table>
<thead>
<tr>
<th>Facility</th>
<th>Basecase FCITC (MW)</th>
<th>Alternative 23 FCITC (MW)</th>
<th>FCITC Change (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Storm - Hampshire</td>
<td>2454</td>
<td>3898</td>
<td>1445</td>
</tr>
<tr>
<td>Hampshire - Doubs 500 kV</td>
<td>2454</td>
<td>1385</td>
<td>-1069</td>
</tr>
<tr>
<td>Pruntytown - Mt. Storm 500 kV</td>
<td>2844</td>
<td>8325</td>
<td>5481</td>
</tr>
<tr>
<td>Hosensack - Elroy 500 kV</td>
<td>3490</td>
<td>9014</td>
<td>5524</td>
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<tr>
<td>Keystone - Airydale 500 kV</td>
<td>3519</td>
<td>6333</td>
<td>2814</td>
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<tr>
<td>Keystone - Conemaugh 500 kV</td>
<td>3604</td>
<td>6230</td>
<td>2626</td>
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<td>Airydale - Juniata 500 kV #1</td>
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<td>2845</td>
</tr>
<tr>
<td>Kammer 765/500 kV</td>
<td>3768</td>
<td>NA</td>
<td>NA</td>
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<tr>
<td>Airydale - Juniata 500 kV #2</td>
<td>3820</td>
<td>6708</td>
<td>2888</td>
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<tr>
<td>Lexington - Dooms 500 kV</td>
<td>4018</td>
<td>5402</td>
<td>1384</td>
</tr>
</tbody>
</table>

*No significant 230 kV or 345 kV FCITC reduction identified*
PJM also modeled Alternative 23 in the 2011 RTEP baseline case and determined the impact to the overloads identified through 2021.

- The majority of Northern New Jersey overloads were resolved through 2021 with this alternative.

- The Western and Central interface overloads were resolved with this alternative.

- The AP South Interface had an overload on Hampshire - Doubs 500 kV.
The ROW routes shown on this diagram are for illustrative purposes only and they may not depict the actual route that could eventually be selected. The substation locations may also be modified if a more beneficial connection is determined.
Transmission Alternatives

**Alternative 24:**
Kammer - 502 Junction 765 kV (Rebuild Kammer - 502 Junction 500 kV)
502 Junction - Hunterstown - TMI 500 kV
Bossards - Jefferson - Roseland 500 kV

**FCITC = 4865 MW limited by Mt. Storm - Doubs 500 kV**
(This amounts to a 2412 MW increase in transfer capability from the basecase).

<table>
<thead>
<tr>
<th>Facility</th>
<th>Basecase FCITC (MW)</th>
<th>Alternative 24 FCITC (MW)</th>
<th>FCITC Change (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Storm - Doubs 500 kV</td>
<td>2454</td>
<td>4865</td>
<td>2412</td>
</tr>
<tr>
<td>Pruntytown - Mt. Storm 500 kV</td>
<td>2844</td>
<td>6466</td>
<td>3622</td>
</tr>
<tr>
<td>Hosensack - Elroy 500 kV</td>
<td>3490</td>
<td>9015</td>
<td>5525</td>
</tr>
<tr>
<td>Keystone - Airydale 500 kV</td>
<td>3519</td>
<td>6925</td>
<td>3406</td>
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<tr>
<td>Keystone - Conemaugh 500 kV</td>
<td>3604</td>
<td>6946</td>
<td>3342</td>
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<tr>
<td>Airydale - Juniata 500 kV #1</td>
<td>3706</td>
<td>6984</td>
<td>3278</td>
</tr>
<tr>
<td>Kammer 765/500 kV</td>
<td>3768</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Airydale - Juniata 500 kV #2</td>
<td>3820</td>
<td>7139</td>
<td>3319</td>
</tr>
<tr>
<td>Lexington - Dooms 500 kV</td>
<td>4018</td>
<td>5388</td>
<td>1370</td>
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</tbody>
</table>

* No significant 230 kV or 345 kV FCITC reduction identified
PJM also modeled Alternative 24 in the 2011 RTEP baseline case and determined the impact to the overloads identified through 2021.

- The majority of Northern New Jersey overloads were resolved through 2021 with this alternative.

- The Western and Central interface overloads were resolved with this alternative.
The ROW routes shown on this diagram are for illustrative purposes only and they may not depict the actual route that could eventually be selected. The substation locations may also be modified if a more beneficial connection is determined.
**Alternative 25a:**
Kammer / South Canton - Keystone 765 kV
Keystone - Sunbury 500 kV
Bossards - Jefferson - Roseland 500 kV

**FCITC = 4108 MW limited by Mt. Storm - Doubs 500 kV**
(This amounts to a 1655 MW increase in transfer capability from the basecase).

<table>
<thead>
<tr>
<th>Facility</th>
<th>Basecase FCITC (MW)</th>
<th>Alternative 25a FCITC (MW)</th>
<th>FCITC Change (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Storm - Doubs 500 kV</td>
<td>2454</td>
<td>4108</td>
<td>1655</td>
</tr>
<tr>
<td>Pruntytown - Mt. Storm 500 kV</td>
<td>2844</td>
<td>5110</td>
<td>2266</td>
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<tr>
<td>Hosensack - Elroy 500 kV</td>
<td>3490</td>
<td>7875</td>
<td>4385</td>
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<tr>
<td>Keystone - Airydale 500 kV</td>
<td>3519</td>
<td>6673</td>
<td>3154</td>
</tr>
<tr>
<td>Keystone - Conemaugh 500 kV</td>
<td>3604</td>
<td>6794</td>
<td>3190</td>
</tr>
<tr>
<td>Airydale - Juniata 500 kV #1</td>
<td>3706</td>
<td>6825</td>
<td>3119</td>
</tr>
<tr>
<td>Kammer 765/500 kV</td>
<td>3768</td>
<td>5842</td>
<td>2074</td>
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<tr>
<td>Airydale - Juniata 500 kV #2</td>
<td>3820</td>
<td>6985</td>
<td>3165</td>
</tr>
<tr>
<td>Lexington - Dooms 500 kV</td>
<td>4018</td>
<td>5635</td>
<td>1617</td>
</tr>
</tbody>
</table>

* No significant 230 kV or 345 kV FCITC reduction identified
PJM also modeled Alternative 25a in the 2011 RTEP baseline case and determined the impact to the overloads identified through 2021.

• The majority of Northern New Jersey overloads were resolved through 2021 with this alternative.

• The Western and Central interface overloads were resolved with this alternative.
The ROW routes shown on this diagram are for illustrative purposes only and they may not depict the actual route that could eventually be selected. The substation locations may also be modified if a more beneficial connection is determined.
Alternative 25b:
Kammer / South Canton - Keystone 765 kV
Keystone - TMI 500 kV
Bossards - Jefferson - Roseland 500 kV

FCITC = 4522 MW limited by Mt. Storm - Doubs 500 kV
(This amounts to a 2068 MW increase in transfer capability from the basecase).

<table>
<thead>
<tr>
<th>Facility</th>
<th>Basecase FCITC (MW)</th>
<th>Alternative 25b FCITC (MW)</th>
<th>FCITC Change (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Storm - Doubs 500 kV</td>
<td>2454</td>
<td>4522</td>
<td>2069</td>
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<tr>
<td>Pruntytown - Mt. Storm 500 kV</td>
<td>2844</td>
<td>5703</td>
<td>2859</td>
</tr>
<tr>
<td>Hosensack - Elroy 500 kV</td>
<td>3490</td>
<td>8824</td>
<td>5334</td>
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<tr>
<td>Keystone - Airydale 500 kV</td>
<td>3519</td>
<td>6731</td>
<td>3212</td>
</tr>
<tr>
<td>Keystone - Conemaugh 500 kV</td>
<td>3604</td>
<td>6931</td>
<td>3327</td>
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<tr>
<td>Airydale - Juniata 500 kV #1</td>
<td>3706</td>
<td>6504</td>
<td>2798</td>
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<tr>
<td>Kammer 765/500 kV</td>
<td>3768</td>
<td>5887</td>
<td>2119</td>
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<tr>
<td>Airydale - Juniata 500 kV #2</td>
<td>3820</td>
<td>6653</td>
<td>2833</td>
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<tr>
<td>Lexington - Dooms 500 kV</td>
<td>4018</td>
<td>5817</td>
<td>1799</td>
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</tbody>
</table>

* No significant 230 kV or 345 kV FCITC reduction identified
PJM also modeled Alternative 25B in the 2011 RTEP baseline case and determined the impact to the overloads identified through 2021.

- The majority of Northern New Jersey overloads were resolved through 2021 with this alternative.

- The Western and Central interface overloads were resolved with this alternative.
The ROW routes shown on this diagram are for illustrative purposes only and they may not depict the actual route that could eventually be selected. The substation locations may also be modified if a more beneficial connection is determined.
**Alternative 26:**
Kammer - Prexy 765 kV
Prexy - White Valley - Conemaugh - TMI 500 kV
Bossards - Jefferson - Roseland 500 kV

**FCITC = 4863 MW limited by Mt. Storm - Doubs 500 kV**
(This amounts to a 2410 MW increase in transfer capability from the basecase).

<table>
<thead>
<tr>
<th>Facility</th>
<th>Basecase FCITC (MW)</th>
<th>Alternative 26 FCITC (MW)</th>
<th>FCITC Change (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Storm - Doubs 500 kV</td>
<td>2454</td>
<td>4863</td>
<td>2410</td>
</tr>
<tr>
<td>Pruntytown - Mt. Storm 500 kV</td>
<td>2844</td>
<td>6255</td>
<td>3411</td>
</tr>
<tr>
<td>Hosensack - Elroy 500 kV</td>
<td>3490</td>
<td>8760</td>
<td>5270</td>
</tr>
<tr>
<td>Keystone - Airydale 500 kV</td>
<td>3519</td>
<td>8192</td>
<td>4673</td>
</tr>
<tr>
<td>Keystone - Conemaugh 500 kV</td>
<td>3604</td>
<td>6446</td>
<td>2842</td>
</tr>
<tr>
<td>Airydale - Juniata 500 kV #1</td>
<td>3706</td>
<td>7225</td>
<td>3519</td>
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<tr>
<td>Kammer 765/500 kV</td>
<td>3768</td>
<td>6757</td>
<td>2989</td>
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<tr>
<td>Airydale - Juniata 500 kV #2</td>
<td>3820</td>
<td>7379</td>
<td>3559</td>
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<tr>
<td>Lexington - Dooms 500 kV</td>
<td>4018</td>
<td>5897</td>
<td>1879</td>
</tr>
</tbody>
</table>

* No significant 230 kV or 345 kV FCITC reduction identified
PJM also modeled Alternative 26 in the 2011 RTEP baseline case and determined the impact to the overloads identified through 2021.

- The majority of Northern New Jersey overloads were resolved through 2021 with this alternative.

- The Western and Central interface overloads were resolved with this alternative.
The ROW routes shown on this diagram are for illustrative purposes only and they may not depict the actual route that could eventually be selected. The substation locations may also be modified if a more beneficial connection is determined.
Alternative 27:
Possum Point - Vienna - Salem 500 kV
Amos - Kemptown 765 kV

FCITC = 7410 MW limited by Airydale - Juniata 500 kV
(This amounts to a 4956 MW increase in transfer capability from the basecase).

<table>
<thead>
<tr>
<th>Facility</th>
<th>Basecase FCITC (MW)</th>
<th>Alternative 27 FCITC (MW)</th>
<th>FCITC Change (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Storm - Doubs 500 kV</td>
<td>2454</td>
<td>7646</td>
<td>5193</td>
</tr>
<tr>
<td>Pruntytown - Mt. Storm 500 kV</td>
<td>2844</td>
<td>7959</td>
<td>5115</td>
</tr>
<tr>
<td>Hosensack - Elroy 500 kV</td>
<td>3490</td>
<td>7591</td>
<td>4101</td>
</tr>
<tr>
<td>Keystone - Airydale 500 kV</td>
<td>3519</td>
<td>8177</td>
<td>4658</td>
</tr>
<tr>
<td>Keystone - Conemaugh 500 kV</td>
<td>3604</td>
<td>8654</td>
<td>5050</td>
</tr>
<tr>
<td>Airydale - Juniata 500 kV #1</td>
<td>3706</td>
<td>7410</td>
<td>3704</td>
</tr>
<tr>
<td>Kammer 765/500 kV</td>
<td>3768</td>
<td>7903</td>
<td>4135</td>
</tr>
<tr>
<td>Airydale - Juniata 500 kV #2</td>
<td>3820</td>
<td>7567</td>
<td>3747</td>
</tr>
<tr>
<td>Lexington - Dooms 500 kV</td>
<td>4018</td>
<td>10183</td>
<td>6165</td>
</tr>
<tr>
<td>Brighton 500/230 kV</td>
<td>19043</td>
<td>3790</td>
<td>-15253</td>
</tr>
</tbody>
</table>
PJM also modeled Alternative 27 in the 2011 RTEP baseline case and determined the impact to the overloads identified through 2021.

- Most of the overloads in Northern New Jersey were not resolved with this alternative.

- The Western and Central interface overloads were resolved with this alternative.
The ROW routes shown on this diagram are for illustrative purposes only and they may not depict the actual route that could eventually be selected. The substation locations may also be modified if a more beneficial connection is determined.
**Alternative 28:**
Possum Point - Vienna - Salem 500 kV
Joshua Falls - Possum Point 500 kV

**FCITC = 3533 MW limited by Pruntytown - Mt. Storm 500 kV**
(This amounts to a 1079 MW increase in transfer capability from the basecase).

<table>
<thead>
<tr>
<th>Facility</th>
<th>Basecase FCITC (MW)</th>
<th>Alternative 28 FCITC (MW)</th>
<th>FCITC Change (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Storm - Doubs 500 kV</td>
<td>2454</td>
<td>4033</td>
<td>1580</td>
</tr>
<tr>
<td>Pruntytown - Mt. Storm 500 kV</td>
<td>2844</td>
<td>3533</td>
<td>689</td>
</tr>
<tr>
<td>Hosensack - Elroy 500 kV</td>
<td>3490</td>
<td>6054</td>
<td>2564</td>
</tr>
<tr>
<td>Keystone - Airydale 500 kV</td>
<td>3519</td>
<td>5275</td>
<td>1756</td>
</tr>
<tr>
<td>Keystone - Conemaugh 500 kV</td>
<td>3604</td>
<td>5430</td>
<td>1826</td>
</tr>
<tr>
<td>Airydale - Juniata 500 kV #1</td>
<td>3706</td>
<td>5342</td>
<td>1636</td>
</tr>
<tr>
<td>Kammer 765/500 kV</td>
<td>3768</td>
<td>5110</td>
<td>1342</td>
</tr>
<tr>
<td>Airydale - Juniata 500 kV #2</td>
<td>3820</td>
<td>5479</td>
<td>1659</td>
</tr>
<tr>
<td>Lexington - Dooms 500 kV</td>
<td>4018</td>
<td>9858</td>
<td>5840</td>
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</tbody>
</table>

* No significant 230 kV or 345 kV FCITC reduction identified
PJM also modeled Alternative 28 in the 2011 RTEP baseline case and determined the impact to the overloads identified through 2021.

- Most of the overloads in Northern New Jersey were not resolved with this alternative.

- The Western and Central interface overloads were resolved with this alternative.
The ROW routes shown on this diagram are for illustrative purposes only and they may not depict the actual route that could eventually be selected. The substation locations may also be modified if a more beneficial connection is determined.
**Alternative 29:**
Possum Point - Vienna - Salem 500 kV
Joshua Falls - Ladysmith 500 kV

FCITC = 3578 MW limited by Mt. Storm - Doubs 500 kV
(This amounts to a 1125 MW increase in transfer capability from the basecase).

<table>
<thead>
<tr>
<th>Facility</th>
<th>Basecase FCITC (MW)</th>
<th>Alternative 29 FCITC (MW)</th>
<th>FCITC Change (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Storm - Doubs 500 kV</td>
<td>2454</td>
<td>3578</td>
<td>1125</td>
</tr>
<tr>
<td>Pruntytown - Mt. Storm 500 kV</td>
<td>2844</td>
<td>3747</td>
<td>903</td>
</tr>
<tr>
<td>Hosensack - Elroy 500 kV</td>
<td>3490</td>
<td>5913</td>
<td>2423</td>
</tr>
<tr>
<td>Keystone - Airydale 500 kV</td>
<td>3519</td>
<td>5111</td>
<td>1592</td>
</tr>
<tr>
<td>Keystone - Conemaugh 500 kV</td>
<td>3604</td>
<td>5256</td>
<td>1652</td>
</tr>
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* No significant 230 kV or 345 kV FCITC reduction identified
PJM also modeled Alternative 29 in the 2011 RTEP baseline case and determined the impact to the overloads identified through 2021.

• Most of the overloads in Northern New Jersey were not resolved with this alternative.

• The Western and Central interface overloads were resolved with this alternative.
The ROW routes shown on this diagram are for illustrative purposes only and they may not depict the actual route that could eventually be selected. The substation locations may also be modified if a more beneficial connection is determined.
Transmission Alternatives

**Alternative 14:**
Amos - Kemptown 765 kV
Bossards - Jefferson - Roseland 500 kV

**Alternative 15:**
Kammer / South Canton - Keystone 765 kV
Amos - Kemptown 765 kV
Keystone - Sunbury 500 kV
Bossards - Jefferson - Roseland 500 kV

**Alternative 16:**
Kammer / South Canton - Keystone 765 kV
Amos - Kemptown 765 kV
Keystone - TMI 500 kV
Bossards - Jefferson - Roseland 500 kV

**Alternative 17:**
Amos - Kemptown - Possum Point 765 kV
Possum Point - Vienna - Salem 500 kV

**Alternative 18:**
Amos - Kemptown - Deans 765 kV
Bossards - Jefferson - Roseland 500 kV

**Alternative 19:**
Open Dooms - Elmont at Cunningham 500 kV
Dooms - Cunningham - Ladysmith 500 kV
Joshua Falls - Elmont 500 kV
Bossards - Jefferson - Roseland 500 kV

**Alternative 20:**
Axton - Clover 765 kV
Bossards - Jefferson - Roseland 500 kV

**Alternative 21:**
Amos - Kemptown 765 kV
Calvert Cliffs - Indian River 500 kV

**Alternative 22:**
Bristers - Possum Point 500 kV
Possum Point - Vienna - Salem 500 kV

**Alternative 23:**
Kammer - 502 Junction 765 kV
502 Junction - Hampshire - Bedington
Bedington - Hunterstown - TMI 500 kV
Bossards - Jefferson - Roseland 500 kV

**Alternative 24:**
Kammer - 502 Junction 765 kV
502 Junction - Hunterstown - TMI 500 kV
Bossards - Jefferson - Roseland 500 kV

**Alternative 25:**
Kammer / South Canton - Keystone 765 kV
Keystone - TMI 500 kV
Bossards - Jefferson - Roseland 500 kV

**Alternative 25a:**
Kammer / South Canton - Keystone 765 kV
Keystone - Sunbury 500 kV
Bossards - Jefferson - Roseland 500 kV

**Alternative 25b:**
Kammer / South Canton - Keystone 765 kV
Keystone - TMI 500 kV
Bossards - Jefferson - Roseland 500 kV

**Alternative 26:**
Kammer - Prexy 765 kV
Prexy - White Valley - Conemaugh - TMI 500 kV
Bossards - Jefferson - Roseland 500 kV

**Alternative 27:**
Possum Point - Vienna - Salem 500 kV
Joshua Falls - Possum Point 500 kV

**Alternative 28:**
Possum Point - Vienna - Salem 500 kV
Joshua Falls - Ladysmith 500 kV

**Alternative 29:**
Possum Point - Vienna - Salem 500 kV
Joshua Falls - Ladysmith 500 kV
### Transmission Alternatives

#### FCITC Change (MW) For PJM West To PJM Mid-Atlantic Transfer

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## FCITC Change (MW) For PJM West To PJM Mid-Atlantic Transfer

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</table>

The alternative provides a significant benefit.
The alternative has some positive benefit.
The alternative provides a negative or minimal benefit.
Northern New Jersey Overloads

- The alternatives that provide a source into Roseland provide a significant benefit to the Northern New Jersey overloads.

- The alternatives that provide a source into Hope Creek or Salem provide minimal benefit for the Northern New Jersey overloads.
**Western / Central Interface**

- All alternatives except 19 and 20 provide some benefit to the Western/Central Interface.

- Alternative 14 results in increased loading on 230 kV lines between Conastone and Peach Bottom.

**AP South Interface**

- All alternatives except for 22 and 23 provide some benefit to the AP South Interface.

- Alternatives that connect back to the AEP 765 kV system provide the most benefit for the AP South Interface.
Next Steps

- PJM to produce short list of system upgrades to resolve Northern New Jersey overloads.
- PJM to refine system upgrades to resolve Western / Central Interface problems.
- Siting Feasibility Study for new options
- PJM to review impact of changing the source for FCITC transfers from Western Region to Western/Southern Region.
- Review of 500 kV, 765 kV or double circuit 500 kV construction
- Review impact of significant generation changes
- Market Efficiency Analysis
Next Steps

• 10 year reactive analysis

• Generation Interconnection studies – evaluate the extent to which projects may support interconnection requests (IGCC, Nuclear, other).

• Identify any underlying related network upgrades

• Refine project cost estimates for use in cost/benefit analysis

• Cost allocation procedures
  • reliability / market efficiency
  • generator interconnections