X4-018 Hudson 230kV

Generation Interconnection

Network Impacts

The Queue Project #X4-018 was studied as a(n) 110.0MW(Capacity110.0MW) injection at Hudson 230kV substation in the PSEG area. Project #X4-018 was evaluated for compliance with reliability criteria for summer peak conditions in 2015. Potential network impacts were as follows:

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

1. The Hudson 1-6-South Waterfront P 230 kV line (from bus 217000 to bus 217117 ckt 2) loads from 96.06% to 100.61% (DC power flow) of its normal rating (512 MVA) for non-contingency condition. This project contributes approximately 23.29 MW to the thermal violation.

Multiple Facility Contingency

(Double Circuit Tower Line, Line with Failed Breaker and Bus Fault contingencies for the full energy output)

No problems identified.

Short Circuit

No problems identified

Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

2. The North Bergen X-Bergen 230 kV line (from bus 217091 to bus 217100 ckt 1) loads from 100.11% to 100.71% (DC power flow) of its normal rating (247 MVA) for non-contingency condition. This project contributes approximately 9.21 MW to the thermal violation.

3. The Bergen-Athenia 230 kV line (from bus 217100 to bus 216900 ckt 1) loads from 110.98% to 118.04% (DC power flow) of its normal rating (305 MVA) for non-contingency condition. This project contributes approximately 21.52 MW to the thermal violation.

4. The Hudson 1-6-South Waterfront P 230 kV line (from bus 217000 to bus 217117 ckt 2) loads from 115.92% to 121.41% (DC power flow) of its normal rating (789 MVA) for the single line contingency ('PS26'). This project contributes approximately 43.31 MW to the thermal violation.

```
CONTINGENCY 'PS26'
  DISCONNECT BRANCH FROM BUS 217000 TO BUS 217117 CKT 1          /* HUDSN1-6
S WTRFRP 230 230
  END
```

5. The Hoboken R-Bergen 230 kV line (from bus 217073 to bus 217100 ckt 1) loads from 117.36% to 124.86% (DC power flow) of its normal rating (398 MVA) for non-contingency condition. This project contributes approximately 29.85 MW to the thermal violation.

6. The Hoboken R-Bergen 230 kV line (from bus 217073 to bus 217100 ckt 1) loads from 121.78% to 128.61% (DC power flow) of its normal rating (581 MVA) for the tower line contingency ('24PS'). This project contributes approximately 39.7 MW to the thermal violation.

```
CONTINGENCY '24PS'                                  /* HUDSON-PENHORN 230KV DCTL
  TRIP LINE FROM BUS 217072 TO BUS 217074
  TRIP LINE FROM BUS 217074 TO BUS 217117
  TRIP LINE FROM BUS 217001 TO BUS 217092
  TRIP LINE FROM BUS 217092 TO BUS 217091
  TRIP LINE FROM BUS 217001 TO BUS 217093
  TRIP LINE FROM BUS 217093 TO BUS 216999
  TRIP LINE FROM BUS 216999 TO BUS 217072
  TRIP LINE FROM BUS 217091 TO BUS 217100
  TRIP LINE FROM BUS 217001 TO BUS 216909                  /* PENHORN - KNGLND
G 230KV / BUS 217084 -> 216909
  TRIP LINE FROM BUS 216909 TO BUS 217098 CKT 2          /* BELLEVILLE T2
  MOVE 100 PERCENT LOAD FROM BUS 217037 TO BUS 217036          /* N. BERGEN
T1 T2
  MOVE 100 PERCENT LOAD FROM BUS 216977 TO BUS 216976          /* HOBOKEN
T2 T1
  MOVE 100 PERCENT LOAD FROM BUS 216979 TO BUS 216978          /* KNGLNDT2
LOAD TO KNGLNDT1
  END
```

7. The Newpoer R-Hoboken R 230 kV line (from bus 217075 to bus 217073 ckt 1) loads from 124.75% to 132.25% (DC power flow) of its normal rating (398 MVA) for non-contingency condition. This project contributes approximately 29.85 MW to the thermal violation.

8. The South Waterfront P-Newport R 230 kV line (from bus 217117 to bus 217075 ckt 1) loads from 127.01% to 134.2% (DC power flow) of its normal rating (415 MVA) for non-contingency condition. This project contributes approximately 29.85 MW to the thermal violation.

9. The South Waterfront P-Newport R 230 kV line (from bus 217117 to bus 217075 ckt 1) loads from 129.63% to 135.16% (DC power flow) of its normal rating (624 MVA) for the single line contingency ('PS30'). This project contributes approximately 34.52 MW to the thermal violation.

```
CONTINGENCY 'PS30'
  DISCONNECT BRANCH FROM BUS 217001 TO BUS 217093 CKT 1          /* HDSN7-12
PENHRN Y 230 230
  DISCONNECT BRANCH FROM BUS 217093 TO BUS 216999 CKT 1          /* PENHRN Y
49TH ST 230 230
  DISCONNECT BRANCH FROM BUS 216999 TO BUS 217072 CKT 1          /* 49TH ST
HOBKN Y 230 230
  DISCONNECT BRANCH FROM BUS 217072 TO BUS 217074 CKT 1          /* HOBOKN
Y NEWPRT Y 230 230
  DISCONNECT BRANCH FROM BUS 217074 TO BUS 217117 CKT 1          /* NEWPRT Y
S WTRFRP 230 230
  MOVE 37 PERCENT LOAD FROM BUS 217035 TO BUS 217034             /* PENHRN Y
T2 T1
  MOVE 21 PERCENT LOAD FROM BUS 217035 TO BUS 216980             /* PENHRN Y
T2 HOMSTD T2
  MOVE 21 PERCENT LOAD FROM BUS 217035 TO BUS 216983             /* PENHRN Y
T2 HOMSTD T2
  MOVE 21 PERCENT LOAD FROM BUS 217035 TO BUS 216977             /* PENHRN Y
T2 HOBOKN T1
  MOVE 100 PERCENT LOAD FROM BUS 216977 TO BUS 216976            /* HOBKN Y T2
T1
  MOVE 100 PERCENT LOAD FROM BUS 217033 TO BUS 217032            /* NEWPRT T2
T1
  END
```

10. The Newport R-Hoboken R 230 kV line (from bus 217075 to bus 217073 ckt 1) loads from 131.85% to 138.69% (DC power flow) of its normal rating (581 MVA) for the tower line contingency ('24PS'). This project contributes approximately 39.7 MW to the thermal violation.

```
CONTINGENCY '24PS'                                   /* HUDSON-PENHORN 230KV DCTL
  TRIP LINE FROM BUS 217072 TO BUS 217074
  TRIP LINE FROM BUS 217074 TO BUS 217117
  TRIP LINE FROM BUS 217001 TO BUS 217092
  TRIP LINE FROM BUS 217092 TO BUS 217091
  TRIP LINE FROM BUS 217001 TO BUS 217093
  TRIP LINE FROM BUS 217093 TO BUS 216999
  TRIP LINE FROM BUS 216999 TO BUS 217072
  TRIP LINE FROM BUS 217091 TO BUS 217100
  TRIP LINE FROM BUS 217001 TO BUS 216909                /* PENHORN - KNGLND
G 230KV / BUS 217084 -> 216909
  TRIP LINE FROM BUS 216909 TO BUS 217098 CKT 2          /* BELLEVILLE T2
  MOVE 100 PERCENT LOAD FROM BUS 217037 TO BUS 217036    /* N. BERGEN
T1 T2
  MOVE 100 PERCENT LOAD FROM BUS 216977 TO BUS 216976    /* HOBOKEN
T2 T1
```

MOVE 100 PERCENT LOAD FROM BUS 216979 TO BUS 216978 /* KNGLNDT2 LOAD TO KNGLNDT1
END

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

1,4,5,6,7,8,9,10. Hdsn - S. Waterfrnt Reinforcement includes building a new underground line between Hudson 230kV and Southwaterfront 230kV. Estimated Cost: **$27M**

3. The Bergen-Athenia circuit is a future underground project for O66 MTX project (n1035). It has not been constructed and is currently being engineered. Similar to what was stated for T107 (see reinforcement n2135), if construction can be coordinated with the O66 project, it may be possible to install a large cable accomodate the needs of all three projects (O66, T107, & X3-004). If the two cannot be coordinated, a second cable will be required. Total Cost estimate: **$93.4M.**

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)
(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

2. The overload on the North Bergen-Bergen 230kV circuit will be mitigated by the F&E Ckt Conv. *F & E circuit conversion includes converting the E-1305 and F-1306 line from Marion138kV to Homestead138kV to Bergen 138kV. Estimated cost **$7.3M**.