Houston Import Project – ERCOT Independent Review update

RPG Meeting
February 18, 2014

Status of Houston Import Project Review

- ERCOT is conducting the Independent Review (IR) to increase the import capability into the Houston area
  - Current status:
    - ERCOT presented the results of various studies done for selected options in the January RPG meeting
    - ERCOT has completed additional reviews for the comments from the stakeholders to provide appropriate responses to the stakeholders
    - ERCOT IR has identified the best option to address both the near-term and long-term reliability needs and serve the load in the area

ERCOT Review on NRG's Comment

- **ERCOT has reviewed the comments from NRG presented in the January 21 2014 RPG meeting**

  - Based on the fact that the SSWG case models non-coincident peaks for all areas throughout the system and it is not reasonable to expect that all areas will hit their coincident peaks at the same time, it is a reasonable variation of load to scale load down in areas outside of the study area. This should not be construed as being the same as scaling generation

  - Roughly 15.3 % of the total load in North Central weather zone were scaled down from its peak load (25895 MW) modeled in the SSWG 2018 case in order to build a reasonable SE base case

  - NRG's indication that 26% total load in North Central weather zone was scaled down from its peak load is not correct (NRG was comparing against ERCOT 90/10 load level)

Average % of peak load of each weather zone during the top ten hourly peak load conditions at the Coast Weather Zone							
Year	East	South	South Central	Far West	West	North	North Central
2011	97.46%	98.21%	96.38%	93.75%	83.70%	67.86%	93.37%
2012	96.32%	95.58%	96.08%	93.23%	92.93%	78.55%	85.56%
2013	76.77%	98.62%	97.42%	95.81%	78.23%	90.88%	88.81%

ERCOT Review on NRG's Comment

- **ERCOT performed power flow analyses per NRG's Slide #6**
  - NRG's comment on Slide #6:
    - "Should peak loads in other regions be based on "average" coincident peaks? **A closer review shows maximum coincident peaks are closely aligned.** Isn't the HIP analysis supposed to be a "peak" case?
  - In order to address NRG's comments ERCOT analyzed additional load variation sensitivities:
    - Case 1: 2018 SSWG case (2018 SUM1 Final 10/15/2013) with no changes to load or generation (Total Wind output: 3065 MW)
    - Case 2: 2018 SSWG case with weather zone load scaled to the highest (Max) percentage load level between 2011 and 2013 when the Coast weather zone was at its peak (the yellow row per NRG's comment) (Total Wind output:281 MW)
    - Case 3:2018 SSWG case with weather zone load scaled to the percentage of load level when the Coast weather zone was at its peak in 2013 (the blue row). (Total Wind output: 0 MW)
    - For Case 2 and 3, the load/generation balance was achieved by scaling down the wind generation modeled in Case 1

	Average % of peak load of each weather zone during the top ten hourly peak load conditions at the Coast Weather Zone						
Year	East	South	South Central	Far West	West	North	North Central
2011	97%	98%	96%	94%	84%	68%	93%
2012	96%	96%	96%	93%	93%	79%	86%
2013	77%	99%	97%	96%	78%	91%	89%
Average	90%	97%	97%	94%	85%	79%	89%
Max	**97%**	**99%**	**97%**	**96%**	**93%**	**91%**	**93%**
Min	77%	96%	96%	93%	78%	68%	86%

ERCOT Review on NRG's Comment

- The result of the G-1+N-1 analysis showed either overload or heavy flow on the existing 345 kV lines from the north into Houston

- The results confirm that the reliability need exists under several different reasonable variations of load

Overload Element (under G-1+N-1)	Case 1	Case 2	Case 3*
Singleton-Zenith double circuit	122%	128%	137%
Roans Prairie-Bobville #75	99%	104%	110%
Bobville-Kuykendahl #75	99%	103%	110%
Jewett North-Singleton #1	93%	99%	106%
Jewett South-Singleton #1	91%	97%	103%
Gibbons Creek-Singleton #75	92%	94%	101%
Gibbons Creek-Singleton #99	92%	94%	101%
Jack Creek-Twin Oak #1	92%	100%	102%
Singleton-Tomball #74	Below 90%	93%	99%
Gibbons Creek-Twin Oak #1	Below 90%	92%	95%
Gibbons Creek-Jack Creek #2	Below 90%	Below 90%	Below 90%

* Low voltage issue (below 90%) at Tomball 345 kV bus

ERCOT Review on NRG's Comment

- **ERCOT reviewed NRG's comment on mothballed units**
  - NRG's slide #3 indicated that the HIP analysis included mothballed generation outside the Houston region, but excluded mothballed generation inside the Houston/Coastal region
  - ERCOT reviewed the comment based on the May 2013 CDR report and state the following assumptions used in the HIP study base case:

    Out of total 1,994 MW of mothballed units,
    - 196 MW of mothballed units turned-on in the Coast weather zone and
    - 109 MW of mothballed units turned-on in the East weather zone
    - All other mothballed units in the remaining zones were kept offline
  - ERCOT concluded that the mothball assumption in the HIP study case would not significantly impact on the reliability need

ERCOT Review on NRG's Comment

- **ERCOT reviewed NRG's comment on generation interconnection table**
  - Regarding NRG's comment on generation interconnection, ERCOT found no changes with the future generation model included in the HIP study case
  - It is consistent with the Planning Guide Section 6.9 (Addition of Proposed Generation Resources to the Planning Models)

(a) A signed Standard Generation Interconnection Agreement (SGIA) from the Transmission Service Provider (TSP) and a written notice from the TSP that the IE has provided:

(i) A notice to proceed with the construction of the interconnection; and

(ii) The financial security required to fund the interconnection facilities; or

(b) A public, financially binding agreement between the IE and the TSP under which the interconnection for the Generation Resource will be constructed along with:

(i) A written notice from the TSP that the IE has provided notice to proceed with the construction of the interconnection; and

(ii) The required financial security; or

(c) A letter from a duly authorized official from a Municipally Owned Utility (MOU) or Electric Cooperative (EC) confirming the Entity's intent to construct and operate a proposed Generation Resource and interconnect such Generation to its own transmission system.

ERCOT Review on NRG's Comment

- **NRG's comment on impact of retirement older units inside Houston area**
  - On NRG's slide #12, NRG asked "What is basis for assumption that only >50 year old units in the Houston area will retire and others outside of Houston won't?"
    - The older units retirement scenario is not a base case assumption and the reliability need was identified including all generation in the ERCOT region regardless of their age
    - ERCOT performed the analysis for the impact of the potential retirement of older units inside Houston area in order to evaluate the robustness of each select option

Selected Options for final analysis

- **Eight selected options**
  - Option 1: Twin Oak-Zenith 345 kV with 25% series compensation
  - Option 2: Twin Oak-Zenith 345 kV with 50% series compensation
  - Option 3: Limestone-Ragan Creek-Zenith 345 kV
  - Option 4: Limestone-Gibbons Creek-Zenith 345 kV
  - Option 5: Jewett-Jack Creek-Zenith 345 kV
  - Option 6: Jewett-Jack Creek-Zenith 345 kV with 25% series compensation
  - Option 7: Jewett-Jack Creek-Zenith 345 kV with 50% series compensation
  - Option 8: Navarro-Gibbons Creek-Zenith 345 kV

- **Few upgrades of existing lines are also included as part of the options**
  - For all options above, upgrade
    - T.H. Wharton-Addicks 345 kV line (~10.7 miles)
  - For Option 6 and 7, upgrade
    - Jack Creek-Twin Oak double-circuit 345 kV line (terminal upgrade)
  - For Option 8, upgrade
    - Jack Creek-Twin Oak 345 kV #1 (terminal upgrade)

Overall Comparison of the selected Options

Description	Option 1 (TWZ-25comp-TA)	Option 2 (TWZ-50comp-TA)	Option 3 (LRZ-TA)	Option 4 (LGZ-TA)	Option 5 (JJZ-TA)	Option 6 (JJZ-25comp-TATJ)	Option 7 (JJZ-50comp-TATJ)	Option 8 (NGZ-TATJ)
System Performance (2018) (All options addressed the reliability need)	Met criteria	Met criteria	Met criteria	Met criteria	Met criteria	Met criteria	Met criteria	Met criteria
Capital cost in 2018 dollar ($ Million), (Based on $3.78 million per mile for T-cost)	554.8	572.0	610.2	590.1	596.3	617.1	629.1	805.9
NPV of the set of future upgrades under each option in 2018 dollar ($ Million)	387.0	390.6	399.5	383.1	652.9	419.5	435.2	537.5
Overall cost impact: Sum of the cost of each option and NPV of future upgrades in 2018 dollar ($ Million)	941.8	962.6	1009.7	973.3	1249.3	1036.6	1064.4	1343.4
Voltage stability Analysis (Estimated 2028 load level in Coast zone = 27931 MW)	28105 MW (beyond 2028)	28095 MW (beyond 2028)	28105 MW (beyond 2028)	28025 MW (beyond 2028)	27905 MW (2028)	28075 MW (beyond 2028)	28205 MW (beyond 2028)	28125 MW (beyond 2028)
Performance with the old units offline (AC power flow under N-1)	4 overloads	2 overloads	0 overload	0 overload	6 overloads	2 overload	0 overload	3 overloads
Amount of generation reduction from the old units without causing overload under G-1+N-1 (MW)	900.6	911.1	1061.3	1020.0	400.0	773.8	662.6	652.6
NERC Category C and D	Good	Good	Good	Good	Good	Good	Good	Good
Economic Benefit (Relative annual production cost savings in $ million, referenced to Option 8)	4.3	3.4	3.2	1.7	2.1	2.2	1.7	0.0
System Loss Reduction at Peak (MW)	44.7	38.8	47.6	31.2	38.2	44.8	35	32.7
Potential Public Impact (Significant new right of way)	117 mi	117 mi	130 mi	129.9 mi	128.9 mi	128.9 mi	128.9 mi	177.9 mi
Sub-Synchronous Resonance (SSR) concern	Yes	Yes	No	No	No	Yes	Yes	No

ERCOT's Recommendation

- **ERCOT recommends the following project (Option # 4) as the best option to address both the near-term and long-term reliability needs and to serve the future load in the Houston area:**
  - Construction of a new Limestone-Gibbons Creek-Zenith 345 kV double circuit to achieve 2988 MVA of emergency rating for each circuit. The line length assumed for the cost estimate is approximately 129.9 miles.
  - Upgrade of the substations at Limestone, Gibbons Creek and Zenith to accommodate the terminations of new transmission lines.
  - Upgrade of the existing T.H. Wharton-Addicks 345 kV line to achieve 1450 MVA of emergency rating (~10.7 miles).

Next Step(s) on the ERCOT IR

- Houston Import Project EIR final report – Feb. 20, 2014
- Present ERCOT recommendation to TAC - Feb. 27, 2014
- Seek ERCOT Board of Directors endorsement - April 8, 2014

ERCOT sincerely thanks all the RPG stakeholders and participants for their comments and feedback on the Houston Import Project review

Questions?