Texas Interconnection Long-Term Study Update

Regional Planning Group

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Project Background

ERCOT received a grant in April, 2010 from the Department of Energy to improve our Long-Term Study process.

- **Three primary study goals:**
  - **To provide relevant and timely information on the long-term system needs in the ERCOT Region to inform nearer-term planning and policy decisions**
  - **To expand ERCOT long-term planning capabilities by developing new tools and processes that can be used in this and future studies**
  - **To enhance stakeholder involvement and input into the ERCOT long-range planning process in a manner that is consensus-seeking, sustainable and consistent with the established ERCOT stakeholder framework.**

Project History - LTSTF

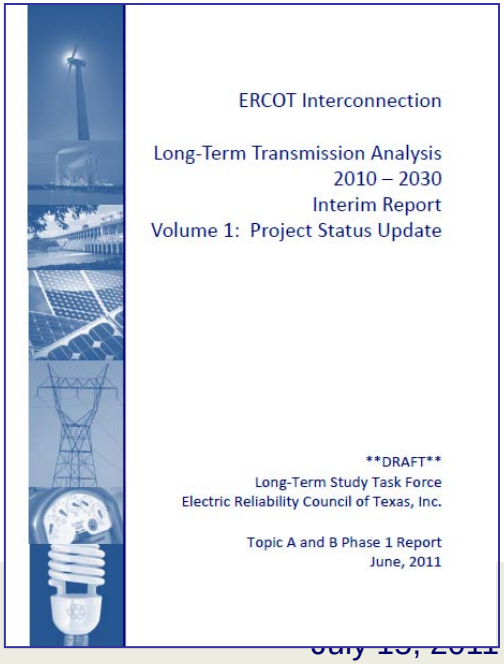
- **The Long-Term Study Task Force (LTSTF) was created in April, 2010. The Task Force has met 12 times.**
- **Initial meetings were primarily informational. Topics included:**
  - **Load forecasting**
  - **Water demand projections**
  - **Demand response programs**
  - **Smart grid**
  - **Generation technologies**
  - **Environmental regulations**
- **Recent meetings have focused on descriptions of tools being used for the study, development of initial scenario and sensitivities for analysis and preliminary results of Business as Usual scenario analysis.**

Project Timeline

Timeline	April, 2010	June, 2011	August, 2011	December, 2012	April, 2013	June, 2013
Work Product	Initial Development Business as Usual Case (BAU) & Modeling		Alternative Scenario Development & Modeling		Final work product	
Stakeholder Process	Monthly introductory meetings		Quarterly LTS meetings with interim workgroup meetings			

Current Status

- ERCOT has developed the base tools to evaluate resource expansion and transmission needs for future scenarios
- Stakeholders have defined a Business as Usual (BAU) scenario – continuation of current market conditions and several sensitivities (with the Production Tax Credit and with higher natural gas price)
- ERCOT has provided an initial analysis of resource expansion for BAU and sensitivities
- Work to-date is summarized in an Interim Project Report (http://www.ercot.com/committees/other/lts/)
- Project facilitator is meeting with stakeholders to increase participation



Long-Term Study Task Force – Immediate Needs

- Stakeholder efforts to develop a robust set of alternative scenarios
- Direct input of constituencies around (for example):
  - Solar generation technology and modeling
  - Demand-side resources and energy-efficiency potential
  - Energy storage technology
  - Forecast of EV demand

- Base tools are built – we now need stakeholders to step forward and both critique those tools while helping to build models of alternative futures

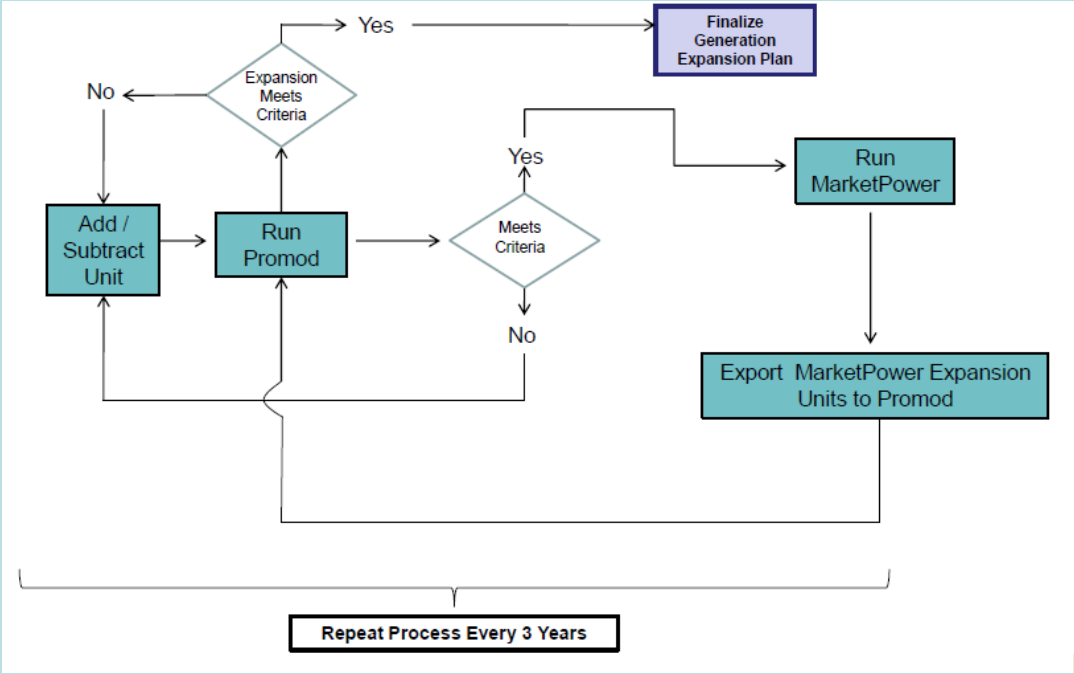
Interim Report - Overview

The Interim Report describes the work completed to date on this project. Major topics include:

- **Technology Reviews – review of existing and emerging energy technologies**
  - **Generation resources (gas turbines, coal generation, Wind, solar, nuclear, geothermal, etc.)**
  - **Storage technologies (compressed air, batteries, flywheels)**
  - **Load resources (demand response, energy efficiency, electric vehicles)**
- **New Tools and Processes – Much of the work by ERCOT to date has focused on developing new sustainable tools and processes for use in this and future long-term studies**

Interim Report – New Tools and Processes

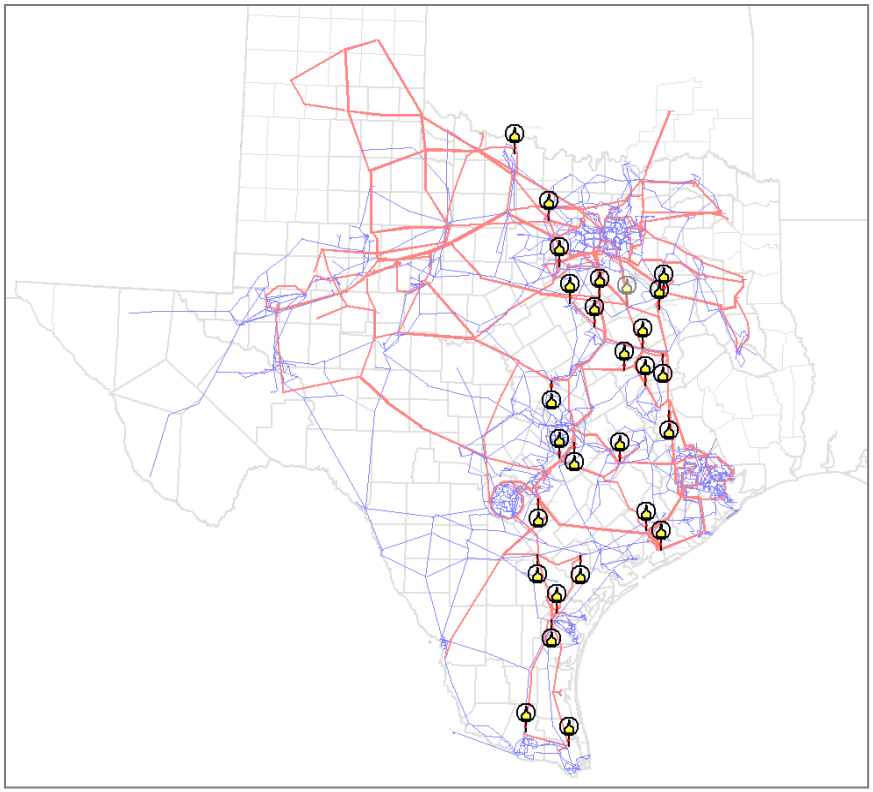
- **Resource Expansion**
  - **Intent is to develop likely resource outcomes consistent with the deregulated ERCOT market**
  - **Combination of MarketPower, Promod and financial pro forma analysis to evaluate economically viable generation under different market conditions**



  - **MarketPower is fast and evaluates multiple dispatchable technologies at the same time.**
  - **Promod evaluates system commitment and dispatch across all hours - it maintains chronology of renewable generation hourly patterns**

Interim Report – New Tools and Processes

- **Resource Siting**
  - **Counties in ERCOT were evaluated based on geographic criteria:**
    - Gas pipelines
    - Railroads
    - Water availability
    - Air quality non-attainment zones
    - Wind/solar conditions
  - **Counties with favorable characteristics for specific resource technologies were considered potential siting locations**



Siting Locations for Combined-Cycle Resources

Interim Report – New Tools and Processes

- **Transmission Simplification**
  - **A new process has been developed to simplify the ERCOT transmission system database**
    - to highlight long-term system needs
    - to mask load-growth issues typically resolved in near-term study horizons
- **Wind generation modeling**
  - **A description of mathematical analysis being conducted to incorporate wind generation forecasting error into planning models**
- **Water Availability**
  - **ERCOT is working with Sandia National Labs to develop a tool that will incorporate water resource availability into scenario development**

Interim Report – New Tools and Processes

- **Transmission Analysis**
  - **Recent long-range planning in ERCOT has been limited to a 10-year horizon. The 20-year horizon of this study requires new processes.**
  - **Transmission plans developed for this study must meet applicable reliability criteria**
  - **Future transmission needs will be defined by customer demand and by available resources**
  - **ERCOT and stakeholders need to enhance the existing long-range planning process**
    - To develop transmission plans that achieve long-term cost-effectiveness and provide adequate reliability without relying on specific generation resources in specific locations
    - To incorporate system stability considerations into long-range planning
    - To consider transmission siting limitations into the planning process

Interim Report – New Tools and Processes

- **Transmission Analysis (Cont.)**
  - **ERCOT has developed initial steady-state power-flow cases with 2030 peak loads**
    - Cases have been posted and provided to transmission companies
  - **Potential transmission solutions were evaluated assuming no development of new generation resources in urban areas (most extreme case for transmission needs)**
  - **Preliminary analysis of Dallas/Fort Worth, Houston, and Rio Grande Valley areas are described in the report**
    - Without resource development in these urban areas, DFW and Houston will likely require additional import capacity in the current study planning horizon

Initial Results – Business As Usual Scenario

- **Potential generation expansion for a business-as-usual scenario is described in the Interim Report**

Description	Units	2010 Actual	2011	2014	2017	2020	2023	2026	2030
CC Adds	MW			-	800	1,600	1,600	4,000	2,800
CT Adds	MW			-	400	3,000	700	500	1,100
Coal Adds	MW			925	-	-	-	-	-
Nuclear Adds	MW			-	-	-	-	-	-
Other Adds	MW			-	-	-	-	-	-
Wind Adds	MW			872	-	-	-	-	-
Annual Capacity Additions	MW			1,797	1,200	4,600	2,300	4,500	3,900
Cumulative Capacity Additions	MW			1,797	2,997	7,597	9,897	14,397	18,297
Reserve Margin	%	21.4	15.9	15.2	8.5	10.2	7.2	9.2	6.2
Coincident Peak	MW	65,776	65,206	73,375	78,869	81,665	85,928	88,318	94,318
Average LMP	$/MWh	34.41	37.42	42.51	56.76	63.23	73.69	81.50	87.75
Natural Gas Price	$/mmbtu	4.38	4.50	4.63	5.10	5.68	6.47	7.35	8.39
Average Market Heat Rate	MMbtu/MWh	7.86	8.32	9.18	11.14	11.14	11.38	11.09	10.46
Natural Gas Generation	%	38.2	41.3	45.8	47.0	49.3	51.0	53.0	59.3
Coal Generation	%	39.5	37.8	36.5	34.3	33.0	31.7	30.6	31.4
Wind Generation	%	7.8	9.2	7.3	8.4	8.0	7.7	7.4	7.6
Scarcity Hours	HRS	-	-	-	29	33	42	49	56
Unserved Energy	GWhs	-	-	-	24.1	39.9	63.9	60.1	68.8

  - **These draft results do not reflect potential ancillary service revenue and potential scarcity revenue.**

Initial Results – BAU Scenario with PTC*

- **Two sensitivities are described in the Interim Report – the following is for the BAU with the continuation of the PTC**

Description	Units	2010 Actual	2011	2014	2017	2020	2023	2026	2030
CC Adds	MW			-	-	1,600	1,600	800	2,800
CT Adds	MW			-	700	1,500	1,000	500	500
Coal Adds	MW			925	-	-	-	-	-
Nuclear Adds	MW			-	-	-	-	-	-
Other Adds	MW			-	-	-	-	-	-
Wind Adds	MW			872	3,250	7,500	5,000	3,500	6,000
Annual Capacity Additions	MW			1,797	3,950	10,600	7,600	4,800	9,300
Cumulative Capacity Additions	MW			1,797	5,747	16,347	23,947	28,747	38,047
Reserve Margin	%	21.4	15.9	15.2	8.3	9.0	6.9	5.8	2.9
Coincident Peak	MW	65,776	65,206	73,375	78,869	81,665	85,928	88,318	94,318
Average LMP	$/MWh	34.41	37.42	42.51	57.86	66.85	67.00	73.68	78.55
Natural Gas Price	$/mmbtu	4.38	4.50	4.63	5.10	5.68	6.47	7.35	8.39
Average Market Heat Rate	MMbtu/MWh	7.86	8.32	9.18	11.35	11.77	10.36	10.02	9.36
Natural Gas Generation	%	38.2	41.3	45.8	40.7	41.6	40.4	40.3	39.3
Coal Generation	%	39.5	37.8	36.5	34.2	32.3	30.6	29.2	27.3
Wind Generation	%	7.8	9.2	7.3	11.0	16.5	19.7	21.5	24.6
Scarcity Hours	HRS	-	-	-	32	52	37	40	37
Unserved Energy	GWhs	-	-	-	36.2	88.3	60.7	75.9	92.8

  - **These draft results do not include unit ramp limitations**

*** Federal Production Tax Credit for renewable generation**

Request for Feedback

- **We are asking for comments on the posted interim reports and participation in the ongoing study**
- **Comments can be submitted through August 10. Send comments to:**

  Longtermstudy@LISTS.ERCOT.COM

- **Additional meetings will be scheduled as needed.**
- **Questions?**