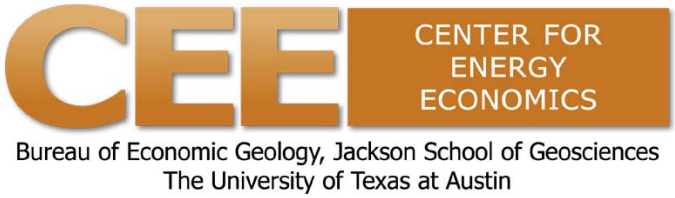

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Lessons Learned from Renewable Energy Credit (REC) Trading in Texas

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Lessons Learned from Renewable Energy Credit (REC) Trading in Texas

Executive Summary

This study provides an evaluation of the Texas renewables portfolio standard (RPS) program and associated trading of renewable energy credits (RECs). The evaluation is based on market and literature research, interviews with market participants and an online survey.

When judged by the amount of new renewables capacity built in Texas, the state's RPS program has been quite successful. The amount mandated in Senate Bill 7 of 1999 was surpassed in 2005, four years before the target date. The extended target of Senate Bill 20 of 2005 was surpassed in 2007, eight years before its target date. Almost all of the new renewable generation capacity has been wind. In addition to a reasonably well-designed and well-run RPS program, the key success factors were identified as follows:

- The availability of high quality wind resources in western parts of the state,
- Federal production tax credit (PTC),
- Competitive market in Electric Reliability Council of Texas,
- Ease of siting and standard interconnection procedures, and
- State's tax abatement policies implemented by host municipalities.

But, this success had some unintended consequences. Building more renewables than the mandates led to the collapse of the REC price, especially given the absence of a large enough voluntary market for RECs and lack of depth in regional or national trading. Recently, shortage of transmission capacity forced wind generators to routinely submit negative bids in order to get dispatched and collect their PTC and REC revenues. Some other issues and challenges lie ahead.

- Completion of new transmission lines under the Competitive Renewable Energy Zones (CREZ) process is the biggest challenge facing the wind industry. CREZ lines will not be finished until 2012-13 timeframe at the earliest. Combined with the current economic conditions, it is not surprising to see that investment in wind has slowed down.
- Increasing amount of wind generation capacity in a transmission constrained part of the state has raised reliability concerns. ERCOT is working on improving its wind forecasting abilities and developing mechanisms to mitigate reliability impacts of large percentages of wind on the grid. Under direction from PUCT, ERCOT formed the Renewable Technologies Working Group, which is studying various relaibility challenges and possible solutions.
- Lack of diversification in renewables generation is an issue to many survey participants. Alternatives remain more expensive and seem to need additional incentives. Many in the state, including members of the legislature, are concerned about the cost impact on end users of promoting

these alternatives. Possible federal carbon regulation may help their economics.

- In all likelihood, a federal RPS will have some good and some bad implications on the Texas RPS market. For example, a federal RPS could offer a larger market for Texas RECs and hence help raise their price. These impacts need to be identified and well understood.

Finally, there were some interesting feedback from those surveyed or interviewed that warrant attention by policy makers as well as stakeholders in the RPS market.

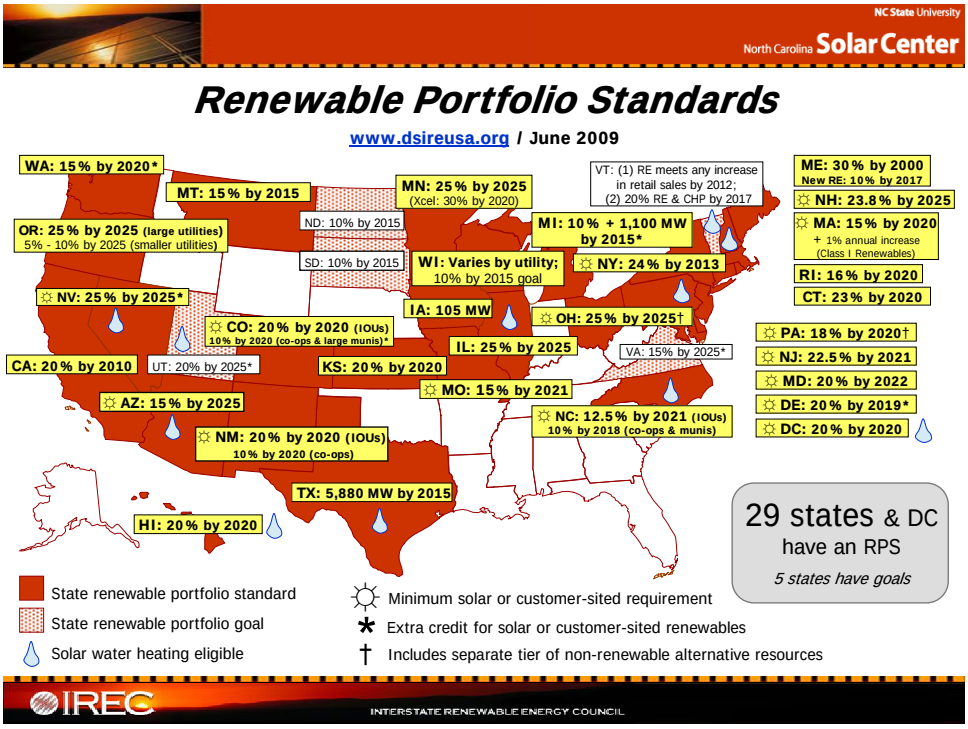
- Storage technologies, especially compressed air storage, are offered as a solution to many of the reliability problems. Some market mechanism to incent large-scale storage investment will probably be needed, if these technologies are proven technically viable.
- Cancelling the three-year banking provision and requiring immediate retirement of RECs associated with “green” products sold to customers by REPs (beyond the mandated amounts) could help lift REC prices. Pros and cons of these ideas require further investigation.

Lessons Learned from Renewable Energy Credit (REC) Trading in Texas

Background

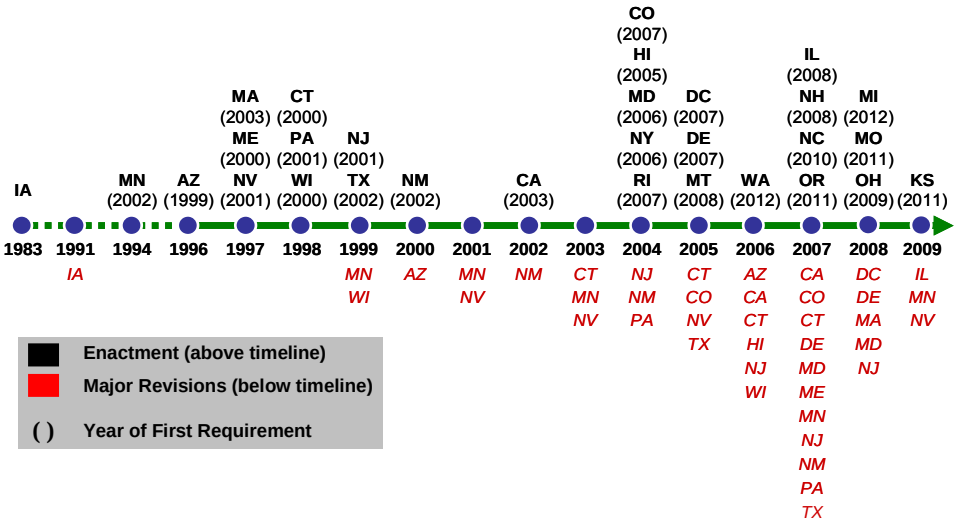
As of June 2009, 29 states, including Texas, and the District of Columbia have implemented Renewables Portfolio Standard (RPS) programs to support the expansion of renewable energy (Figure 1). The Texas RPS program was established by the electricity sector restructuring legislation, Senate Bill 7 passed in 1999; implementation started in January 2002. As such, the Texas RPS program is one of the oldest; only seven other states had a program that started before 2002 (Figure 2). Currently, the U.S. Congress is working on a federal version.

Figure 1 – RPS programs in the U.S.



In recent years, more states adopted RPS programs and many others modified their existing programs, often increasing targets or adding provisions to increase diversity of renewable sources or technologies. After a dry spell in 2000-03, 16 more states and D.C. adopted RPS programs since 2004. In other words, more than half of existing programs have been instituted since 2004. Among many other jurisdictions, Texas carried out two major revisions in 2005 and 2007; these are discussed in more detail later in this report.

Figure 2– History of RPS programs in the U.S.



Source: *Renewables Portfolio Standards in the United States: A Status Report*, presentation by Galen Barbose, Lawrence Berkeley National Laboratory, 32nd IAEE Conference, San Francisco, June 23, 2009.

In Table 1 we compare analysis from an April 2008 report and a June 2009 presentation, both by researchers from the Lawrence Berkeley National Lab. State-level mandatory RPS programs announced by the end of 2007 were estimated to cover about 46% of total electricity sales in the U.S. according to the April 2008 report. In that report, the authors calculated that about 60 gigawatts (GW) of new renewable capacity would be needed by 2025 to comply fully with the mandates; but this estimate was updated to 77 GW in June 2009, including RPS programs announced since the end of 2007. The earlier requirement translated into an estimated 4.7% of total U.S. sales in 2025, and 15% of demand growth between 2000 and 2025. The updated numbers account for about 6% of total U.S. sales in 2025 and, most significantly, 42% of load growth between 2006 and 2025. This considerable increase in load growth share is due to downward revision of overall electricity demand in Annual Energy Outlook 2009 by the Energy Information Administration,[1] presumably as a result of the economic crisis and new regulations and programs on energy efficiency and conservation.

Table 1 – Impacts of state RPS programs

	April 2008*	June 2009**
Total electricity sales	46%	56%
New renewables by 2025	60 GW	77 GW
Share of U.S. generation in 2025	4.7%	6%
Share of demand growth	15% (2000-2025)	42% (2006-2025)

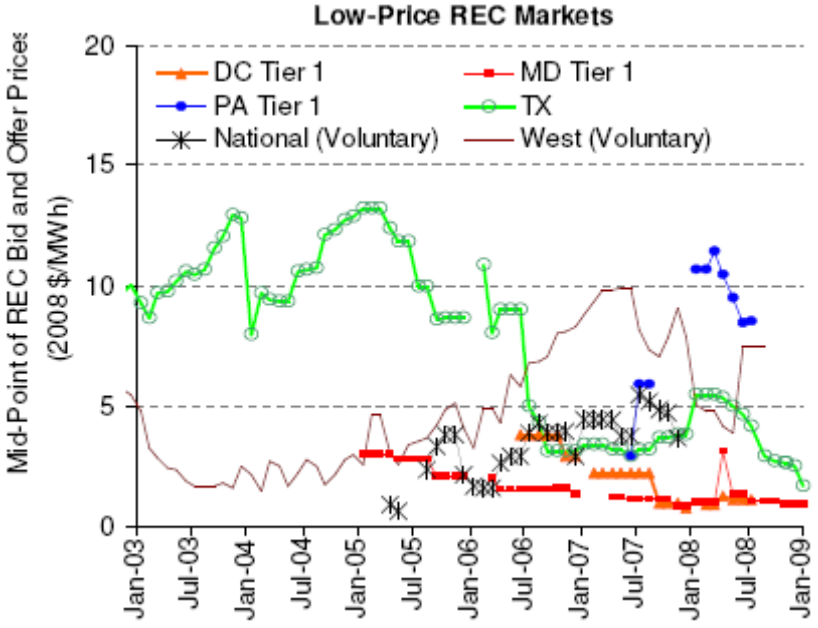
* *Renewables Portfolio Standards in the United States: A Status Report with Data Through 2007*, Ryan Wiser and Galen Barbose, Lawrence Berkeley National Laboratory, April 2008.
** *Renewables Portfolio Standards in the United States: A Status Report*, presentation by Galen Barbose, Lawrence Berkeley National Laboratory at the 32nd IAEE Conference, June 23, 2009; and follow-up communication with Galen Barbose.

[1] The report can be obtained at http://www.eia.doe.gov/oiaf/aeo/.

Most states with an RPS program, including Texas, have created markets where generators or retailers trade Renewable Energy Certificates, or Credits, known in short as RECs, or green tags. As a market-based mechanism, REC trading is expected to allow meeting renewables goals most efficiently. Typically, a REC represents one MWh of metered power produced by a renewable generator, which has to be certified as such by organizations such as Environmental Resources Trust and the Center for Resource Solutions (Green-e) among others. Each REC has a unique serial number and usually is valid in a specific jurisdiction. With the federal RPS, nationwide REC trading should be available.

Although there are voluntary markets for RECs, markets created by policy are significantly larger. In Texas, the voluntary market is much smaller than the mandated market. States generate incentives for REC markets by either requiring utilities to produce a certain amount of their power from renewable sources or retail electric service providers to supply a certain percentage of their markets with electricity produced from renewable sources. In competitive electricity markets like that of Texas, where even the residential users can choose their electricity supplier, creating demand for renewable energy through the retail providers appears desirable and useful. By relieving buyers of renewable electricity from the obligation of arranging for physical delivery of such power (which would be geographically and technologically impossible for many customers connected to large grids), RECs promote a greater demand for electricity generated from renewable sources.

Figure 3 – REC prices have fluctuated widely



Source: *2008 Wind Technologies Report*, Energy Efficiency and Renewable Energy, DOE, July 2009. Main authors are Ryan Wiser and Mark Bolinger from Lawrence Berkeley National Laboratory. Data comes from Evolution Markets and Spectron.

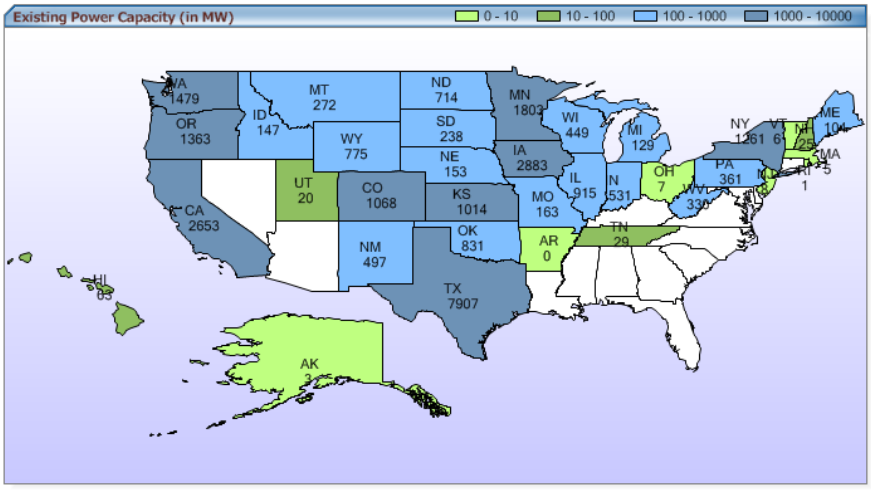
However, REC prices have not been helpful in all jurisdictions; in most markets, they have been volatile and in many, including Texas, they have been too low to

incent new renewables investment (Figure 3). REC prices around or below $10 as seen in Texas, Maryland, New Jersey (Class 1) and D.C. are not strong signals to developers of renewables capacity. On the other hand, prices in Rhode Island, Massachusetts and Connecticut have been quite high, albeit highly volatile in the case of Connecticut. These differences reflect significant variations in the design of RPS programs (e.g., aggressiveness of goals and definition of resource eligibility) and availability of resources. For example, Texas benefited greatly from the large potential of highly prospective wind resources, especially given the fact that wind technology is the most advanced and competitive with conventional generation. With prices above $200, New Jersey's solar program underscores the relative high cost of the solar technology.

Texas RPS and REC market

Texas was one of the first states to enact an RPS. The Senate Bill 7 (SB 7) that was passed by the Texas Legislature in May 1999 mandated 2,000 MW of additional renewable generation capacity to be built by 2009.[2] This mandate was supported by creating a REC market. Retail electricity providers (REPs) were required to acquire and retire RECs based on their share of state-wide retail electricity sales. This requirement created demand for renewable electricity and helped Texas achieve SB 7 target of 2,000 MW of new renewable generation in 2005, four years earlier than the target date stipulated in the bill. Tradable RECs, issued quarterly, allowed electricity retailers from anywhere in the state to search for the lowest cost renewable resources in the state with no obligation to take physical delivery of electricity. The most prolific wind capacity in Texas is in West Texas away from load centers in the north and east of the state. Thanks to unbundled REC trading, REPs were able to meet their RPS obligations while new wind generation capacity was built in the west. Texas leads the nation in installed wind capacity since 2006 (Figure 4).

Figure 4 – Installed wind capacity in the U.S. (as of 6/27/2009)



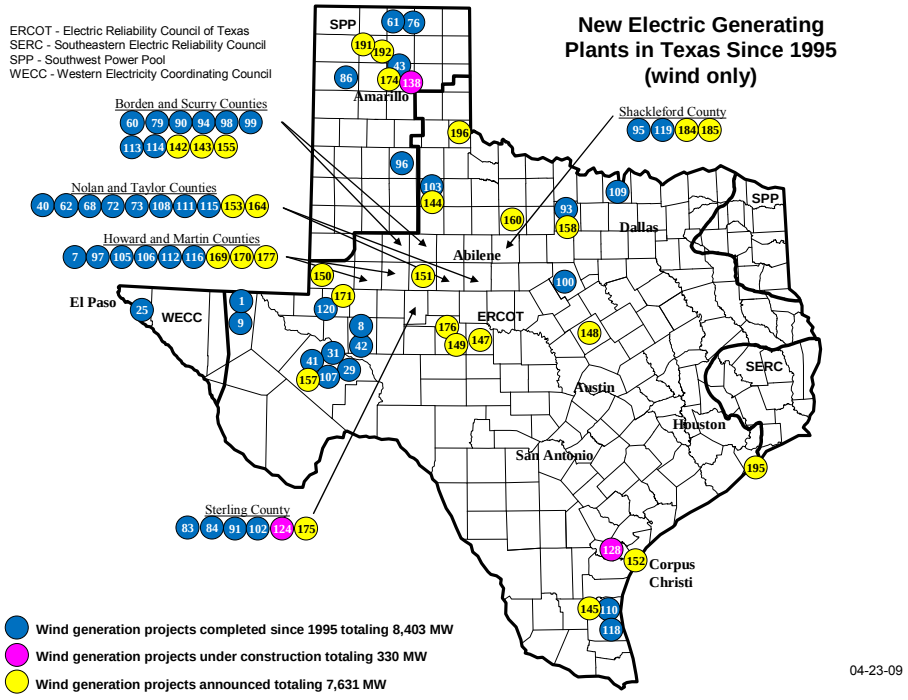
Source: American Wind Energy Association (www.awea.org/projects/)

[2] Texas had 880 MW of renewable resource capacity, including hydro plants, in 1999 when Senate Bill 7 was signed by then Governor George W. Bush.

The REC market is administered by the Electric Reliability Council of Texas (ERCOT), the independent system operator (ISO). The Public Utility Commission of Texas (PUCT) has the authority to cap the price of RECs,[3] and, in consultation with ERCOT, may suspend the RPS requirements if necessary to protect the reliability and operation of the grid. The PUCT also enforces penalties for non-compliance with the RPS requirements.

Based on the success of the REC market leading to satisfaction of SB 7 RPS requirements in few years, the Texas Legislature expanded the RPS goals of the state significantly in 2005 with the passage of Senate Bill 20 (SB 20), which set a goal of 5,880 MW of renewable generation capacity by 2015. In order to diversify renewable sources, SB 20 set a non-binding target of 500 MW of non-wind renewable capacity. The bill's renewables generation capacity target for 2025 is 10,000 MW. Again, the developers were eager and the 2015 goal of SB 20 has already been surpassed. According to the PUCT, there is 8,403 MW of installed wind capacity in Texas; another 330 MW is under construction and another 7,631 MW is announced (Figure 5).[4] In fact, additional interconnection interest has been more than 50,000 MW.

Figure 5 – Wind plants in Texas (as of 4/23/2009)



Source: PUCT (http://www.puc.state.tx.us/electric/maps/index.cfm)

Despite this positive and encouraging record, the REC market in Texas went through some revisions, offering valuable lessons. For example, as a result of building large amounts of new wind capacity in a short period of time, REC prices

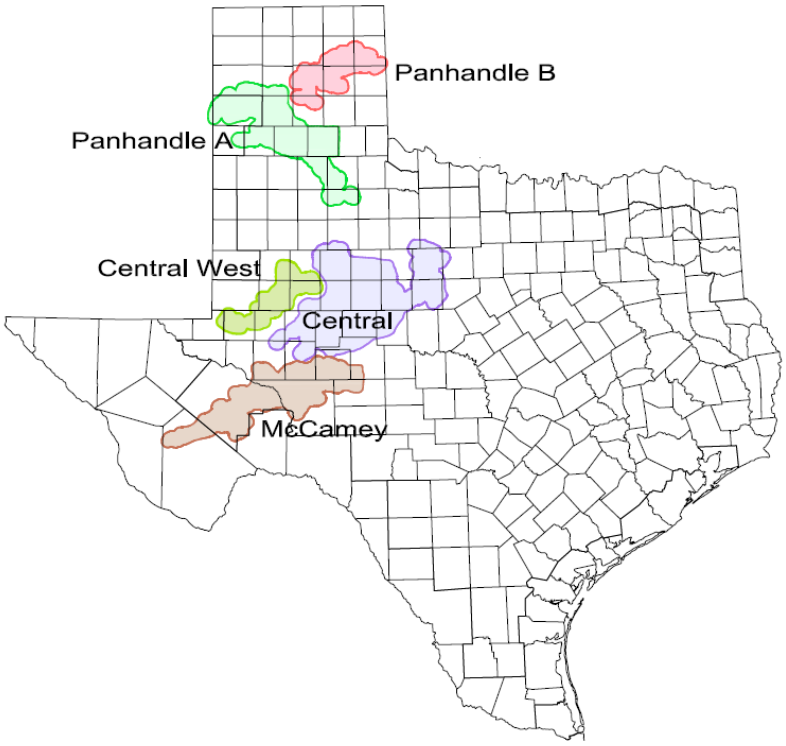
[3] Senate Bill 20, Section 3 (n).
[4] Note that PUCT reported figures on installed wind capacity in Figure 5 are larger than those reported by AWEA in Figure 4. PUCT numbers should be more accurate.

collapsed and did not provide much incentive (Figure 3);[5] rather it was the federal production tax credit (PTC) and high quality of wind resources in West Texas that fueled investment.

The 2005 bill, SB 20, included some language that led Green-e, a certification company, to declare RECs originating from Texas ineligible for its certification: "Notwithstanding any other provision of law, the commission shall ensure that all renewable capacity installed in this state and all renewable energy credits awarded, produced, procured, or sold from renewable capacity in this state are counted toward the renewable energy goal."[6] This language was deemed to undermine the goal of adding new renewables capacity; because it would enable load serving entities (LSEs) to count voluntary green power purchases by customers towards their RPS obligations. Green-e and others consider voluntary green power purchases as additional support to mandates that should lead to more renewable energy generation. This language was eliminated by the Texas Legislature in 2007 via the House Bill 1090 (HB 1090); and Green-e repealed its ineligibility warning.

Most significantly, transmission limitations slowed down the development of wind capacity in West Texas and Panhandle areas. PUCT developed the Competitive Renewable Energy Zones (CREZ) process to address this challenge (Figure 6).

Figure 6 – CREZ zones



Source: *Report on Existing and Potential Electric System Constraints and Needs*, ERCOT, December 2008.

[5] In 2008, 17.2 million MWh of renewable energy was generated whereas REC requirements were only 3.4 million. See the annual report submitted to PUCT by ERCOT: https://www.texasrenewables.com/staticReports/Annual%20Report/2008_Report.doc.
[6] Section 3 (m), SB 20.

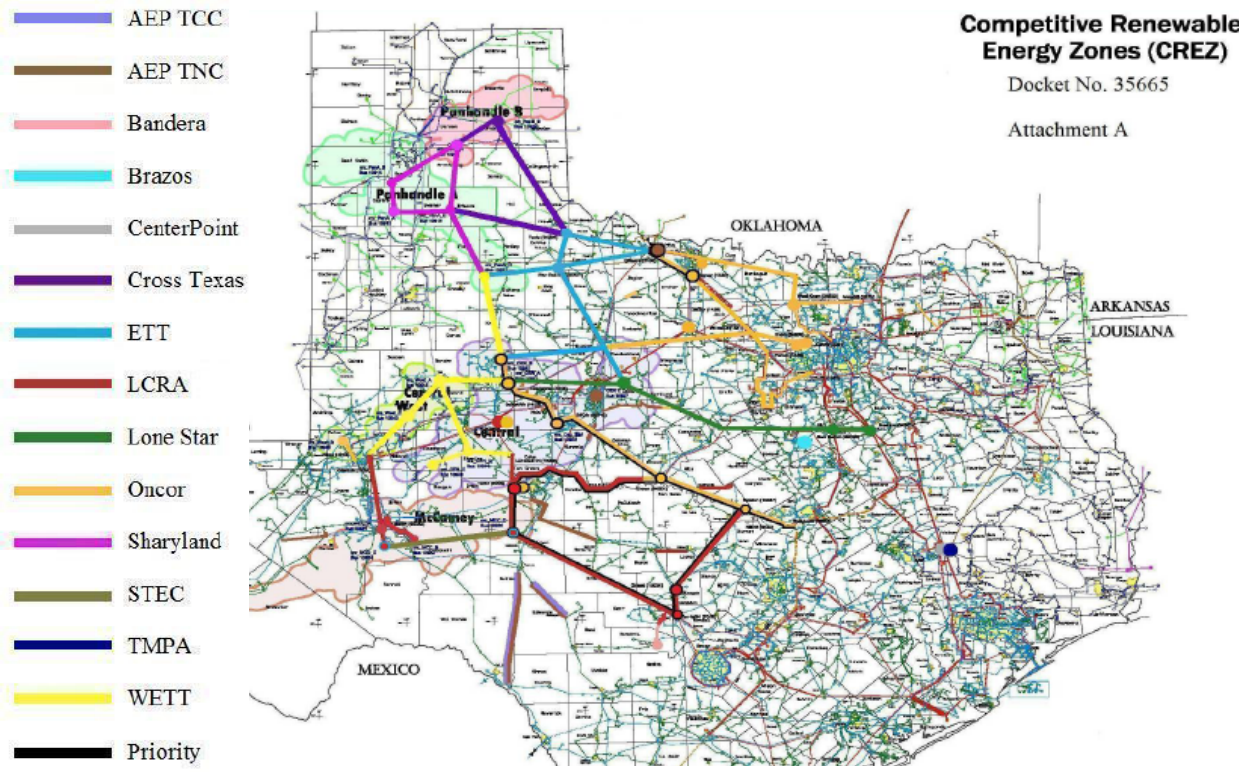
Under CREZ, four scenarios of transmission capacity expansion plans were developed by ERCOT and one of them, Scenario 2, was approved with some modification by PUCT (Table 2). Companies to construct the lines of the first phase have been chosen (Figure 7).

Table 2 – Capacity of new CREZ wind by scenario (MW)

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Panhandle A	1,422	3,191	4,960	6,660
Panhandle B	1,067	2,393	3,720	0
McCamey	829	1,859	2,890	3,190
Central	1,358	3,047	4,735	5,615
Central West	474	1,063	1,651	2,051
Total*	12,053	18,456	24,859	24,419

* Based on 6,903 MW of existing wind capacity in 2007.
Source: *Where We Are in the CREZ Process: a TSP's Perspective*, Bill Bojorquez, VP of Planning, Hunt Transmission Services, Gulf Coast Power Association, Dallas Luncheon, May 14, 2009. (http://www.gulfcoastpower.org/default/bojorquezmay09.pdf)

Figure 7 – CREZ lines to be built



Source: PUCT (http://www.puc.state.tx.us/electric/maps/CREZ_Map_Attach_A.pdf).

Some wind developers are arguing for dispatch priority once these lines are built; these companies have made certain investments in identifying and securing their sites and they would like to avoid losing market share to latecomers, some of whom

could also be traditional generation facilities.[7] Allowing certain generators priority dispatch is fundamentally inconsistent with the open access transmission grid established by SB 7. The open access rule is crucial to making the competitive market work, especially as the ERCOT market moves into a nodal design.

Finally, some are concerned that wind dominated the renewables expansion and the state has not done enough to promote solar, biomass and other technologies. Increasing amounts of intermittent, non-peak coincident wind power also raise operational challenges to ERCOT. Perhaps most significantly, the first set of lines under Scenario 2 will not be completed until the end of 2012; all Scenario 2 projects will be completed by the end of 2013.[8]

In this project, via interviews and survey of industry stakeholders, we investigated the significance of these and any other issues that may not be as widely discussed in the media or even industry circles. In our inquiries, we covered the history of Texas RPS to place the evaluation results within the proper context. In the rest of this report, we summarize the results of our research.

Evaluating the Texas RPS program

In addition to fundamental research, as part of this project, we interviewed 21 individuals, some of them more than once, and developed a web-based survey, to which we collected 49 responses. The survey questions and summary of answers are provided in **Appendix 1**; salient points from the survey are incorporated into discussions below. We adapted work done by the National RPS Collaborative[9] on 'best practices' among the RPS programs around the nation to reflect the history and current state of the Texas RPS program. We also investigated issues going forward as perceived by various stakeholders. The following sections summarize the findings.

Purpose of the RPS

The main goal of any RPS program is to increase new renewables capacity. Texas has been successful in this respect, surpassing the goals of both SB 7 and SB 20 in much shorter periods of time than allowed in the bills. About 83% of survey participants concurred (70% finding Texas RPS "very successful" in building new renewables capacity). But many qualify this success: 1- transmission constraints limit the usefulness of much of this new capacity, which happens to be wind in restricted West Texas; 2- too much reliance on wind may create problems for grid reliability (hence the need for promoting other renewables); and 3- rather than the Texas RPS program, it was the federal PTC that provided incentives to invest in wind as REC prices collapsed fairly quickly. These are recurring themes throughout the survey and interviews.

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[7] This issue has been under review at the PUCT (Project 34577); for further details, see the discussion in Current Issues and Challenges section below.

[8] Based on ERCOT analysis of CREZ lines. See Proceeding to Sequence Certificate of Convenience and Necessity Applications for Priority Projects for the Competitive Renewable Energy Zones (CREZ), Docket 36801, and Proceeding to Sequence Certificate of Convenience and Necessity Applications for the Subsequent Projects for The Competitive Renewable Energy Zones (CREZ), Docket 36802.

[9] For more information, visit http://www.cleanenergystates.org/JointProjects/State-Federal-RPS.htm.

According to more than 60% of the survey participants, the RPS program has been encouraging development of new and clean technologies. However, additional comments in the survey and our interviews indicate that almost everyone realizes that only wind benefited so far due to its relative cost advantage, leaving other technologies behind. Hence, multiple proposals were introduced in the 81st Texas Legislative Session in 2009 to create additional incentives, such as a tiered REC market, feed-in tariffs or carve-outs, for non-wind technologies. Many bills were put forward to support alternative technologies, especially solar, but they were not passed. Going forward, the PUCT may still implement a tiered pricing for RECs differentiating primarily three categories: wind, solar and biomass. A federal cap-and-trade program as proposed in HR 2454 by Representatives Waxman and Markey may also help with the economics of alternative technologies as carbon-based fuels and generation will become more expensive.

Not explicitly stated in SB 7 as a goal of the RPS program, local economic development for certain areas in West Texas and protecting and enhancing the environment were important aspects that were quickly recognized as benefits associated with new renewable generation investment. When SB 7 was being debated in early 1999, there were already numerous wind projects under various stages of development for West Texas worth roughly $150 million. Some believe that this economic value was essential to garnering support for RPS provisions to be included in SB 7. About 65% of respondents to our survey thought that the RPS program successfully promoted economic development.

The restructuring bill had broader objectives and was presenting consensus among diverse interest groups who were addressing the restructuring of electric industry, requiring the inclusion of other requirements such as energy efficiency and emission reduction that helped with environmental benefits.[10] More than half of the survey participants consider RPS program successful in emission reduction with another 28% thinking that Texas is making progress in this front thanks to the RPS program.

Although generally speaking local economic and environmental benefits of renewables investment are acknowledged, there is no formal measurement of such benefits. The exemption is energy efficiency goals. SB 7 included efficiency requirements in parallel with the RPS. Investor Owned Utilities (IOUs) were required to reduce their growth in demand by 10% through energy efficiency programs approved and monitored by the Commission. In 2007, this goal was raised by the Texas Legislature to 15% and 20% for 2008 and 2009, respectively.

Design specifics

Goals

There are basically two views on the original RPS target of 2,000 MW in SB 7. According to one view, the Texas target was not ambitious, especially when compared to RPS programs initiated by other states and the renewable resource potential in Texas. The 2,000 MW of additional renewable capacity set for 2009

[10] These interest groups included Environmental Defense Fund, Public Citizens, Texas Rose, and the IOUs among others.

would raise the share of renewable resources in total peak demand from 1.3% in 1999 to 3-4% in 2009. In comparison, other states have set targets that reach much higher percentages, well in the 15% to 30% range by 2020. California is shooting for 20% in 2010 and 33% by 2020.[11] But, California is falling short of these goals (today, a year before the 2010 target, only 13% of generation is from renewables other than hydro), demonstrating the risk of setting targets that are not consistent with market realities such as cost of technologies, the challenges of scaling up, transmission constraints, and capital limitations. In contrast, today, 5-6% of load in Texas is met by renewables generation depending on season and transmission constraints; such share in 1999 was less than 1%.[12]

The opposing view holds that given the history of low levels of investment in renewables and the lack of transmission capacity from West Texas, the goal was ambitious. It is also worth noting that the goal of 2,000 MW was more than the wind capacity operating in California, the leading wind state, at the time.

Regardless of these views, the SB 7 mandate was achieved four years earlier than stipulated (2005 instead of 2009); the SB 20 goal (5,880 MW by 2015) was achieved in 2008. Almost all of the survey participants agreed that annual targets have been met with new renewable capacity. But, some believe that setting conservative targets has not been without negative consequences; the REC market was undermined as more capacity than the mandated target was built and, as a result, the price of a REC collapsed. Today, REC prices are not considered to be a factor in investment decisions by renewable developers. Federal RPS will likely help if it creates a nationwide market for RECs. Requiring municipal utilities and electric cooperatives that are currently exempt from RPS mandates to comply would also help. In the meantime, we received a couple of specific suggestions from our survey and interviews that may help render the Texas REC market more robust:

1. elimination of three-year banking of RECs and
2. requiring mandatory retirement of RECs associated with electricity sold to end users under “green” products even if these amounts are beyond RPS mandate of the REP.

Short of increasing the RPS mandates further, these strategies may help but pros and cons of each need to be evaluated carefully. We will address these suggestions further later in the report.

Resource definition

Generally speaking, the resource definition is considered clear in SB 7, PUCT rule and ERCOT protocols: “technology that does not rely on energy resources derived from fossil fuels, waste products from fossil fuels, or waste products from inorganic sources.” About 62% of survey participants agreed and another 28% somewhat agreed that resource/technology definition and eligibility were clear.

[11] For more, please see: http://www.pewclimate.org/what_s_being_done/in_the_states/rps.cfm.
[12] According to the annual report submitted to PUCT by ERCOT, share of renewables within the competitive load, which is obligated by RPS mandates, was 7% in 2008: https://www.texasrenewables.com/staticReports/Annual%20Report/2008_Report.doc.

However, there were restrictions on hydro, originally counting only those less than 2 MW. This limit has been increased to 25 MW later. Facilities existing prior to September 1999 could not earn RECs. But, PUCT allowed these entities (mostly large hydro facilities) to receive REC offsets, based on their historical energy production that can be used by competitive REPs that had long-term contracts in place with the offset generators.

Also, there are some potential issues regarding qualifications of various feedstocks for biomass and biogas but these have not been fully defined yet as there are only a handful of biomass projects in Texas that are part of the RPS market.

In SB 7 and implementing rules, there was no technology preference; but wind has been the predominant choice by investors because of low relative cost, maturity of technology, ability to construct large capacities, short construction time, and high quality of wind in West Texas. In SB 20, a 500-MW of non-wind target was put in place; but this target was not mandatory and since 2005 passage of that bill, not much has been built. Two biomass projects are expected to come online in the near future: 50 MW at Lufkin and 100 MW at Nacogdoches.[13] PUCT is considering adding second tier and third tier renewable resources, third tier being mainly solar, as this technology, although very promising in terms of resource potential, remains the most expensive option.

In 2009 session of the Texas legislature there were several bills to create incentives for non-wind renewables. For example, one bill tried to set a 1,500 MW mandate mainly for solar under the name of Emerging Technology Renewable Standard (SB 541). Another bill aimed to create a $500 million solar incentive program (SB 545). There was also a bill for utilities and REPs buying excess renewable power from consumers at fair rates (HB 1243). However, all of these bills failed to pass either at the Senate or the House. Fundamentally, concerns about these technologies increasing the cost of electricity to consumers dampened the support for these bills.

Distributed generation (DG) renewable resources have been eligible since SB 7 but at typically small units (e.g., solar PV). Legislation in 2005 enhanced the role of REC Aggregation companies allowing generation sites smaller than 1 MW in size (e.g., home and business solar) to be able to participate in REC trading. Only PV units qualify and passive solar thermal units used for water heating do not because, by definition, they must produce electricity. The level of interest has been low so far. Austin Energy is the first utility that did some aggregation and voluntarily retired 700,000 RECs in 2007 although as a municipal utility that did not opt in the retail competition Austin Energy did not have any renewable obligations. Both Austin Energy and CPS Energy (municipal utility in San Antonio) are procuring solar electricity from concentrated solar thermal (CST) companies. Gemini Solar Development Company will construct, own and manage a 30-MW PV-panel facility for Austin Energy in a city-owned property 20 miles from downtown. Tessera Solar will develop a 27-MW plant based on SunCatcher dish technology in West Texas for CPS Energy.

[13] But, the construction of the Lufkin facility was stopped early in 2009 by an order from the EPA.

Duration

Under the RPS program, each compliance period is one year, January 1 – December 31. Each REC has a serial number that indicates:

- the facility where the electricity was generated;
- the type of renewable resource;
- the year and quarter of generation; and
- a unique identifier for specific MWh produced by the facility that quarter.

Each REC is valid for three years. This period was set to balance the need for creating incentive for new renewables investment and the need to make the REC trading liquid. Within three years, a REC may be terminated to meet a retailer's RPS requirement; or retired voluntarily by the REC owner at any time.

The duration of the program has been long enough to encourage long-term contracting. SB 7 target covered 10 years (1999-2009); and SB 20 in 2005 had a 2015 target and further targets. Almost 72% of survey respondents agreed that long-term targets have been encouraging new projects. Also, the competitive market in Texas is often credited along with the RPS targets for making it easier to get into long-term bilateral contracts for renewable power as well as conventional generation. According to 33% of survey participants, load serving entities (LSEs) have been offering long-term contracts for renewable power at sufficient levels; but 29% disagreed with this statement, indicating that there are significantly different experiences. At the least, we should realize that, in an environment of excess renewable capacity over the mandate, some renewable developers have been finding it increasingly more difficult to find off-takers who are willing to sign long-term contracts for their power, in the absence of which financing their project becomes more difficult.

Participation requirement

Not all load serving entities were required to participate in the RPS program; municipal utilities and electric cooperatives that did not opt in the competitive market did not have renewables obligations. This exclusion has been somewhat of a concern to some market participants as these entities represent about one quarter of electricity use in Texas. LSE participation requirements of the RPS program were thought to be equitable by 75% of the respondents to our survey (45% agreed, 30% somewhat agreed); but those who disagreed were vocal in their desire to have municipal utilities and electric cooperatives, which serve close to 25% of load in Texas, participate in the RPS requirements.[14] This would definitely increase the demand for renewables and would help reduce the current oversupply of RECs.

[14] Incidentally, according to *Recommended Principles and Best Practices for State Renewable Portfolio Standards* developed by the State/Federal RPS Collaborative, RPS requirements should apply to all LSEs including municipal utilities, cooperatives, and even suppliers of last resort; in restructured markets, all suppliers to retail load should be required to comply. The document is available at http://www.cleanenergystates.org/JointProjects/RPS/RPS_Principles_and_Best_Practices_Final_012609.pdf.

But at the time of negotiating SB 7 with a goal of 2,000 MW of new renewables, this exemption of municipal utilities and electric cooperatives was deemed necessary for securing the passage of SB 7. Going forward, with the addition of non-wind requirements and perhaps increasing RPS targets, this immunity may have to be reconsidered. In the meantime, some municipal utilities such as Austin Energy and CPS of San Antonio are procuring significant amounts of renewables generation voluntarily.

Program administration & tracking

ERCOT is responsible for administering the RPS program and keeping track of the REC trading and retirement. The program has been fairly simple to administer although changes in laws, rules and protocols over time required additional software development; this has been the main but manageable challenge. The program administration has also been very cost effective. The program requires 1.5 FTE to administer; their expenses are recovered through the ERCOT fees approved by the PUCT. At this time, there is no cost for market participants to establish trading accounts and participate in the program. Administration of the program has been operating well according to 80% of survey participants.

ERCOT tracking verification of retirement and level of authentication (especially in non-ERCOT areas) has been quite successful. Verification is controlled in that Texas RECs can only be retired in the Texas REC trading program regardless of the purpose of the retirement (in compliance with the mandates or voluntarily). The program will only allow retirement to occur one time and for one purpose. Once retired, a REC no longer exists. Authentication is accomplished by gathering generation and load data from ERCOT EPS meters. Since about 90% of all generation and load in Texas is metered in ERCOT (and the meter data are very timely and accurate as they are used for financial settlement), the system operator has one of the highest levels of authentication in the U.S.

Those entities not metered in ERCOT but in the Texas market are obligated to self report their MWh of production. There has been concerns raised about accuracy of the self reported data but they are subject to random audits at the discretion of the PUCT and ERCOT. ERCOT is also working with Southwest Power Pool (SPP) to develop standards to meter increasing amounts of wind in the Texas Panhandle. Overall, compliance verification has been working well according to 80% of survey participants. REC tracking has been working well according to 75% of survey participants.

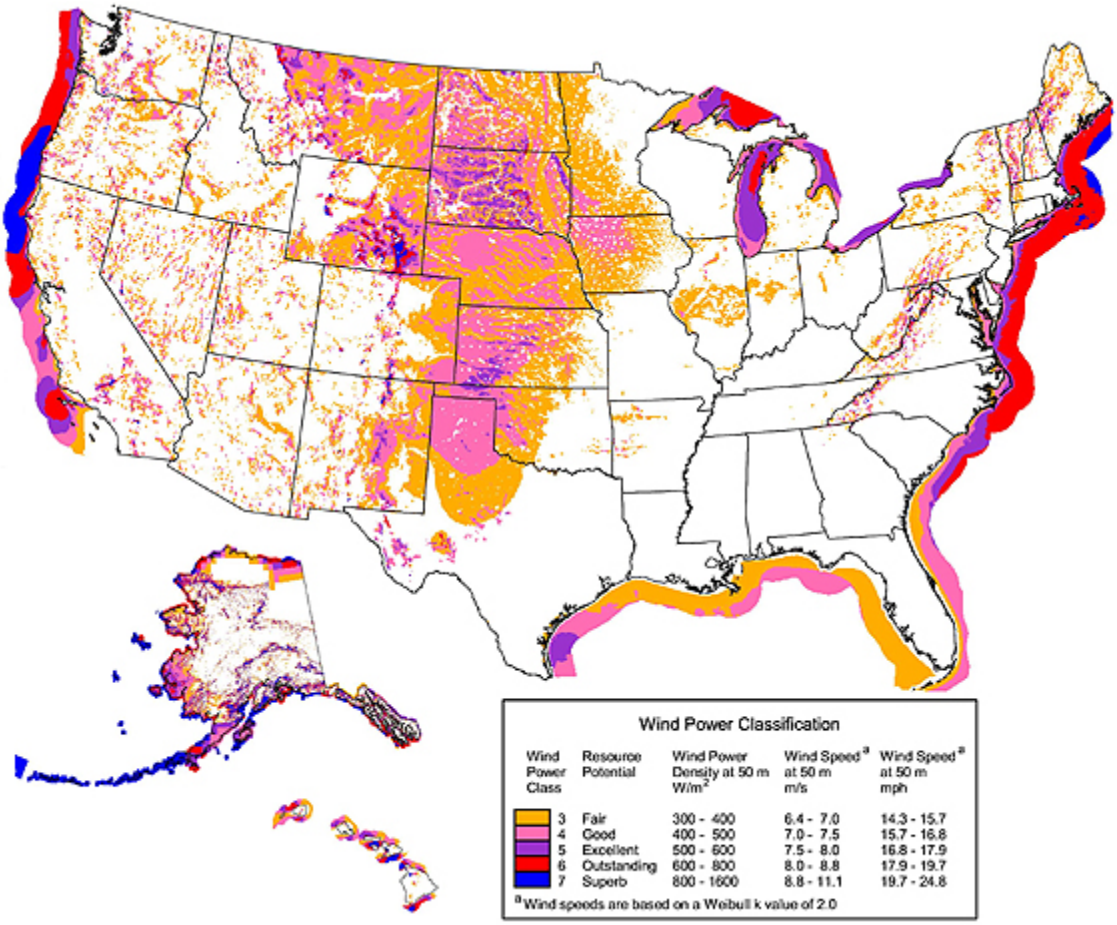
The tracking system (registry) in Texas is mainly used to meet regulatory requirements and does not provide any other benefits to the REC holders. This is different from some other markets where more than one state is covered by tracking system. In such markets, given recent climate change initiatives in the Northeast and Western United States, transferability of RECs across state boundaries will become more valuable to market participants. In addition, the current tracking systems in those markets allow market participants to manage their environmental balance sheets, which may include RECs, energy efficiency

certificates, or credits (EECs), emission reduction certificates, or credits (ERCs), and other forms of carbon offsets, more effectively.[15]

There have been non-compliance penalties but only in a handful of cases, most of which involved REPs that went out of business. The penalty is $50 per REC that is not retired for compliance. This penalty was considered reasonable by 70% of survey participants. Almost 74% thought that enforcement was working well.

There is a compliance payment associated with solar projects, which is equivalent to 1 REC. Hence, 1 MWh of solar project will get credit for 1 REC and 1 CP (=1 REC); in other words, there is a multiplier of 2 for solar in Texas. But, this multiplier does not provide sufficient revenues relative to cost of solar and has not encouraged investment in solar yet.

Figure 8 – Wind resource map (50 meters)



Source: Wind & Hydropower Technologies Program, U.S. Department of Energy, http://www.windpoweringamerica.gov/wind_maps.asp

[15] APX Inc. is the main registry covering most of the REC markets in the United States. For more information on such REC Registries, see http://www.apx.com/environmental/renewable-energy-market-infrastructure.asp .

Some other factors

Overall, the Texas RPS program is considered well designed, easy to administer and straightforward to participate. But, there were other factors, some of which probably more significant than the design elements discussed above, that contributed to the rapid expansion of wind capacity in Texas.

1. **Good Wind Sites:** If Texas did not have some of the best sites with good wind speed, the state would not have as much renewables development. Fair to good resources are available in western and offshore parts of the state; some excellent resources are available offshore further south towards Mexico (Figure 8). At 90 meters, Texas wind resources are estimated to be even more prolific.[16] Wind developers in West Texas report capacity factor of 35% or more. The availability of such high quality resources was very important for 60% and important for 35% of survey respondents. Due to transmission constraints, however, generation had to be curtailed, lowering capacity factor in practice.
2. **Federal Investment Tax Credit:** Our survey results are not clear regarding the importance of federal ITC; 37.5% of respondents claimed it was not a factor while 37.5% claimed it was very important. The answers may reflect experiences with different technologies; but for the majority of renewables investment in Texas, which has been in wind farms, ITC was probably not as important as PTC. Typically, ITC is available for small wind systems (less than 100 kW) installed at consumer sites.[17] The American Recovery and Reinvestment Act of 2009 (ARRA 2009) extended the PTC for wind through 2012; provided an option to elect a 30% ITC or cash grant in lieu of the PTC, and allowed for the expansion and enhancement of a federal loan guarantee program managed by the DOE. There is a new eight-year ITC for solar in Energy Independence and Security Act of 2007. ITC could also apply to biofuel or biomass facilities.
3. **Federal Production Tax Credit:** PTC has been the single most important factor according to survey participants, more than 86% of whom thought PTC was very important and another 11% thought it was important. Looking at wind construction data (Figure 9), one can see the decline in project activity in 2000, 2002 and 2004 as the Congress allowed PTC entitlement to expire in 1999, 2001 and 2003; and picking up again after the renewal of PTC. Despite the high quality of resources in Texas, PTC has been crucial for developers in Texas as in other locations.
4. **Statewide Tax Abatement Program:** This program has been used by some cities to create additional incentives to wind developers. In particular, Tax Code 312 (Property Redevelopment and Tax Abatement Act) & 313 (Texas Economic Development Act) provisions have been quite helpful for project developers as well as host communities. About 49% of survey

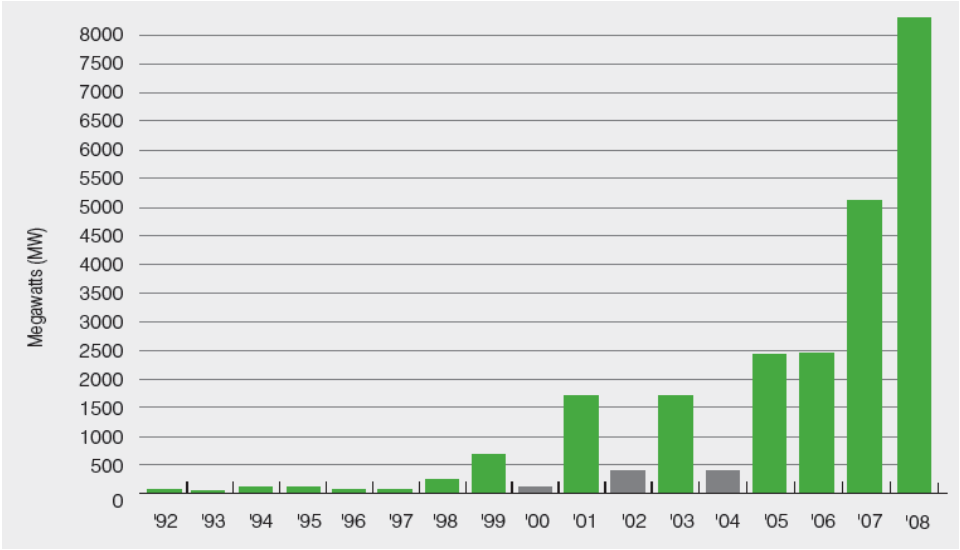
[16] at http://firstlook.3tiergroup.com/ one can generate wind speed maps with more details than shown in Figure 8

[17] For details, please see http://www.awea.org/legislative/#SW.

participants thought state incentives were important and another 33% thought they were very important.

5. **Competitive Electricity Market:** The competitive market structure in Texas that encouraged bilateral long-term contracting for power supplies helped renewables as well. Not only the RPS program created demand for renewables, some REPs such as Green Mountain specialized in green energy and many other REPs included renewable or green products for their customers. Close to 86% of participants in our survey thought that the competitive ERCOT market was either very important (58%) or important (28%). Also, non-discriminatory access to transmission network, another requirement of the competitive market design, was thought to be very important by 66% and important by 30% of survey respondents.

Figure 9 – Annual installed wind capacity and the impact of PTC



Source: data from American Wind Energy Association (AWEA) as reported on the web site of Union of Concerned Scientists. (http://www.ucsusa.org/clean_energy/solutions/big_picture_solutions/production-tax-credit-for.html)

6. **Regulatory Siting and Permitting Process:** Ease of obtaining regulatory permits for facilities in Texas has been a major factor. The streamlined siting and permitting process is not unique to renewable projects; it applies to all kinds of generation facilities. Nevertheless, 68% of respondents to our survey found the ease of siting and permitting very important and another 27% found it important. Minimum interconnection costs were found to be very important by 61% and important by 36% of survey participants.

7. **Standard Interconnection Procedures:** ERCOT's standard interconnection procedure helped to identify major transmission shortages, which was inputted into the CREZ process. The CREZ model has come about because of the rapid and massive development of wind generation in remote parts of Texas. Generation companies continued to build wind farms even when there was not enough transmission capacity, essentially forcing the CREZ process. Nevertheless, 47% of survey participants thought that proactive

transmission planning by ERCOT (separate from CREZ) was very important and another 42% thought it was important.

8. **Timely Regulatory Responses to Address Transmission Needs:** The CREZ approach demonstrates the ability to develop timely solutions to problems in Texas. The CREZ is not without its opponents; and the price tag of $4.93 billion for the first phase has been criticized. This cost, like that of other transmission projects, will be uplifted and paid by all Texas consumers. The previous experience with adding transmission to accommodate wind in the McCamey area has so far yielded mixed results: ERCOT continues to curtail wind generators for operational and reliability reasons, which not only limits wind sales and collection of PTC revenues but also keeps the capacity conversion factor lower than wind generators would like. Nevertheless, the CREZ model is commonly seen as successful and is under evaluation by other jurisdictions for possible adoption.[18] Many respondents to our survey remarked on the importance of the CREZ lines being developed in a timely manner throughout the survey. See below for further discussion of the transmission issue.

Current issues and challenges

Although Texas has been able to quickly surpass its RPS mandates, the rapid expansion of wind in the western parts of the state raised several issues, including the need for new transmission capacity and reliable integration of more wind into the ERCOT system. The desire to add diversity to the mix of renewables has been gaining momentum as well. Federal bills promoting a nationwide RPS program and cap-and-trade of GHG emissions and their impact on the Texas electricity market are also considerations going forward. In particular, the following issues related to the RPS program have been raised in various forums.

Transmission expansion

Today in Texas, timely expansion of transmission capacity to accommodate wind potential in West Texas is the single most important issue (indicated as such by 93% of survey participants). This is not surprising. Almost all of the new renewables capacity since 1995 has been wind in western parts of the state and more planned for the same region (Figure 5) where wind resources are most productive (Figure 8). But, this capacity has been curtailed by ERCOT on a regular basis going back to early developments in the McCamey area, forcing wind generators to bid negative prices to get dispatched and collect their PTC and REC revenues.

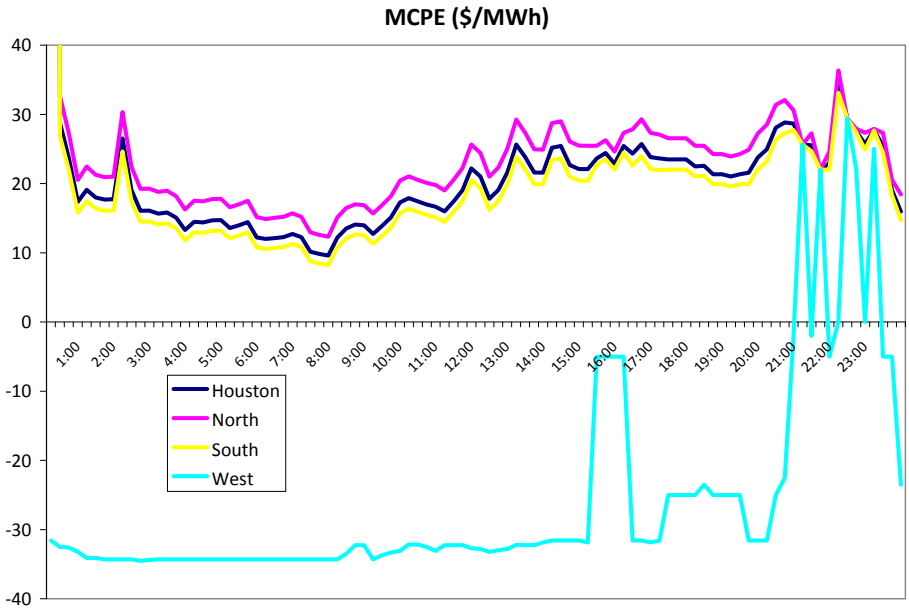
Perhaps surprisingly, high energy prices in ERCOT have not been a major factor in stimulating renewables development; at least one of the reasons is the shortage of transmission capacity. The average wholesale price of electricity in Texas has been relatively high over the recent years (above $50 per MWh since 2005 and peaking to $85 in 2008) due to high natural gas prices (the marginal generation fuel in

[18] In June 2009, Western Renewable Energy Zones Initiative, a joint effort of Western Governors' Association and the U.S. Department of Energy published its Phase 1 Report. The report and additional information can be found at the initiative's web site: http://www.westgov.org/wga/initiatives/wrez/.

Texas). But, Western Zone prices have not always been that high, reflecting transmission constraints relative to amount of wind capacity. In fact, the price has on occasions been negative, especially over the last two years: wind generators, which needed to be dispatched to collect PTC, submitted negative bids in certain hours (lowest bids were roughly equivalent to the negative of PTC + REC price – O&M cost, or about –$35/MWh).[19]

Figure 10 provides the market clearing price of electricity in four zones of the ERCOT balancing market for April 26, 2009. That day, the price for the West zone was negative 91 out of 96 intervals (15 minutes each). The minimum price was –$34.5 and the average price was –$25.7. In 2009, by May 31, there were 91 days (out of 151 total) with negative prices from the West zone. On average, each day during 15 intervals (out of 96), prices were negative.[20] As Dr. Baldick puts it, these negative prices represent a transfer of wealth from federal taxpayers to Texas market to take wind power when it is not needed.[21]

Figure 10 – Balancing Market Prices, April 26, 2009



Source: data from ERCOT (http://www.ercot.com/mktinfo/prices/mcpe)

Transmission expansion will remove the need for negative bidding unless of course a lot more wind or non-wind generation capacity is built in West Texas than the CREZ lines can handle. At the same time, the first phase of CREZ, which is

[19] For a formal description, please see *Wind Energy and Electricity* Markets, a presentation by Dr. Ross Baldick, Department of Electrical and Computer Engineering, University of Texas at Austin, June 8, 2009. Presentation available at http://www.ece.umn.edu/groups/power/monthsem/pres_baldick.pdf.
[20] In 2008, trends were similar. 192 days out of 366 had negative prices. In those days, there were, on average, 13 intervals with negative prices out of 96. In several days, more than 90 intervals were negative. Between June and October, there were only a handful days with negative prices.
[21] See presentation by Dr. Baldick referenced above.

estimated to cost about $5 billion, will add an average of $10/MWh to cost of electricity from wind according to Dr. Baldick.[22]

Reliable integration of wind into the ERCOT grid

Reliability considerations by ERCOT have been attracting more attention by more market stakeholders as more wind capacity is built. In our survey, 67% of participants indicated that these operational challenges of integrating more wind were very important; another 29% thought these were important. Even when the transmission constraints are resolved, ERCOT will have to improve its ability to forecast wind generation to avoid reliability issues such as those experienced in early 2008. The wind in West Texas blows strongest at night when the electricity demand is low. The increasing amount of wind will complicate system operations and will require adjustments to the way ancillary services markets are run. In early 2008, ERCOT commissioned GE Energy to analyze these issues.[23]

ERCOT formed the Renewable Technologies Working Group (RTWG), which, in its first report, identified a list of near-term, long-term and undetermined issues regarding market design, system operations and system planning. The full list is provided in Appendix 2; but key issues appear to be improving wind forecast, eliminating instantaneous ramp rates associated with congestion management, adjusting regulation requirements to accommodate increased wind, and implementing low voltage ride-thru (LVRT) requirement. ERCOT has been meeting with wind farm operators and Transmission and Distribution Service Providers (TDSPs) to improve understanding of capabilities of wind turbines and operations, and voltage management practices.

There are several protocol changes and ancillary services solutions under consideration.[24] The cost of these adjustments could be anywhere from few dollars per MWh to $40/MWh. This upper bound is set by the lead-acid battery based energy storage.[25] On our survey and interviews, we received several comments emphasizing the importance of storage, especially compressed air storage, for making the incorporation of increased wind a lot easier. Storage is also on the list of RTWG as a long-term consideration.

Recently, the Federal Energy Regulatory Commission (FERC) commissioned a new study focusing on frequency response to assess reliable integration of intermittent

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[22] See presentation by Dr. Baldick referenced above.

[23] The report titled *Analysis of Wind Generation Impact on ERCOT Ancillary Services Requirements* was prepared in March 28, 2008 and is available at http://www.ercot.com/news/presentations/2008/Wind_Generation_Impact_on_Ancillary_Services_-_GE_Study.zip.

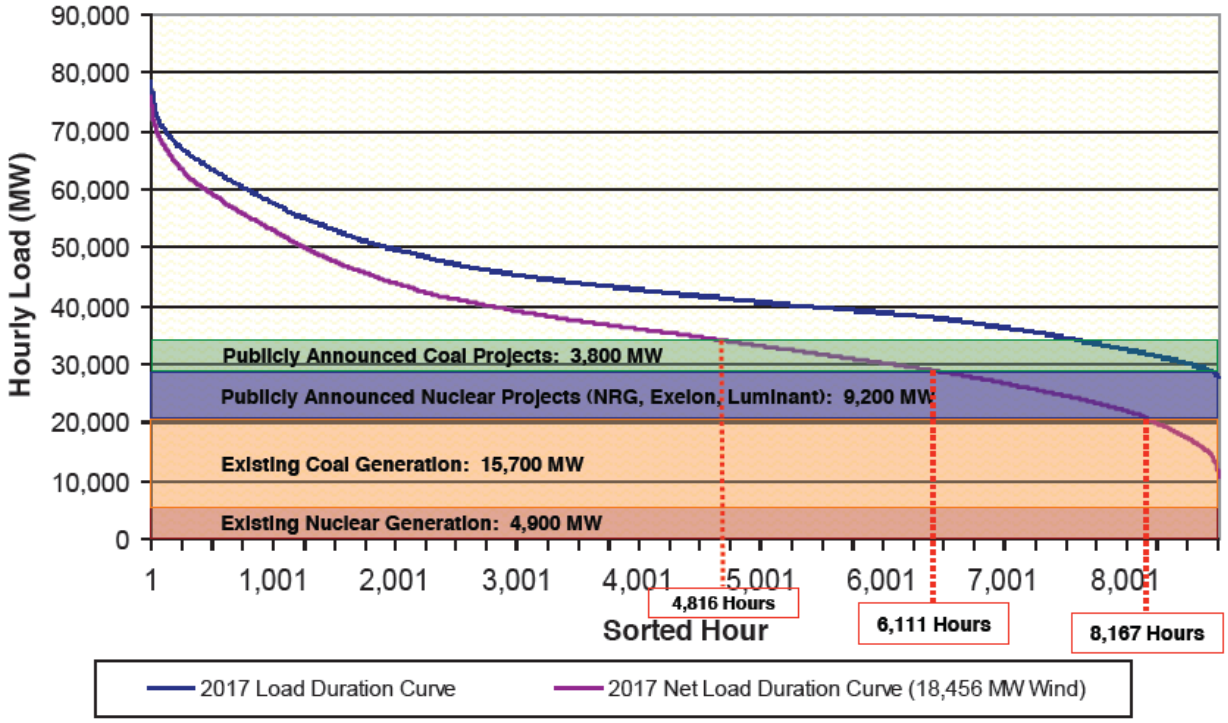
[24] Based on *Impact of Wind Generation on ERCOT Operations*, a presentation by John Dumas, Manager, System Operations, ERCOT, Gulf Coast Power Association, Fall Conference, Wind Workshop, September 29, 2008.

[25] See presentation by Dr. Baldick referenced above. According to DOE/EERE's *2008 Wind Technologies Report* (July 2009) authored by Ryan Wiser and Mark Bolinger of the Lawrence Berkeley National Laboratory "Recent wind integration studies continue to show that wind integration costs rise with higher levels of wind penetration, but are below $10/MWh – and often below $5/MWh – for wind capacity penetrations of as much as 30% of the peak load of the system in which the wind power is delivered."

resources such as wind.[26] This study will likely address the ramp rate issue as it leads to significant frequency deviations; and will supplement ERCOT's own analyses on how much intermittent capacity can be reliably integrated into the ERCOT grid.

There are also economic impacts of increased wind on other generators and investment planning, which in turn may affect system planning and reliability. Comparison of load and net load (load – wind) duration curves for 2017 against all publicly announced projects underline the issues; the need for baseload plants will be less (Figure 11). With such expectations, financing large baseload plants could be more challenging; more of the load may need to be met by peaking and cycling units that have lower efficiency ratings (and more emissions).

Figure 11 – Load and Net Load Duration Curves



Source: *The Future Challenges of Wind Energy in Texas*, presentation by Warren Lasher, Manager, System Assessment, ERCOT, Gulf Coast Power Association, Fall Conference, Wind Workshop, September 29, 2008.

Priority dispatch on CREZ lines

There is a request for dispatch priority for wind facilities already in queue once the CREZ transmission is built. PUCT is currently reviewing this issue (Docket # 34577). With the first phase of CREZ under way, some wind developers argue that they should get priority dispatch as they have committed to the transmission project (in some cases, they put money down, which will be reimbursed in the form of congestion revenue rights once the transmission is built, or in full if transmission is not built). There are two issues with priority dispatch: 1- it conflicts with open

[26] For the study announcement, see http://www.ferc.gov/news/media-alerts/2009/2009-1/05-13-09-factsheet.pdf.

access rules of the grid (as dictated by SB 7 and implementing rules and protocols); and 2 – it will likely disrupt the nodal market by causing out-of-merit order dispatch and therefore possibly creating congestion and/or other operational challenges. A little over 62% of respondents to our survey thought that the priority dispatch issue was very important with another 31% marking it as important.

According to the proposal for publication of amendments to Substantive Rule 25.174 as approved at the July 2, 2009 open meeting of the PUCT, it is proposed that the Commission may initiate a proceeding to consider a dispatch priority mechanism if the security-constrained economic dispatch tool was deemed insufficient by the Commission to resolve the congestion caused by excess wind development. The PUCT staff also proposed the deletion of language linking financial commitment and dispatch priority.[27]

Capacity conversion factor calculation (wind)

The capacity conversion factor (CCF) is calculated by comparing the MWh of actual production over a specified time frame (last two years) against the installed capacity of the unit. The formula is provided in ERCOT protocols. However, the wind industry challenged this approach in 2004, claiming that it yields a lower value (27%) than warranted (35% or more – 35% was set for the first two years of the program) due to curtailment by ERCOT for operational reasons. The Commission voted to maintain 35% for two years despite staff recommendations to follow the formula. REPs appealed the decision that increased their REC obligations and the court ruled in their favor. When the CCF formula was applied, the market was flooded with excess RECs, contributing to the collapse of REC price. When the new CREZ transmission lines are built, some of these objections may fade as curtailment may be reduced. But as long as there is curtailment, ERCOT cannot justify a higher CCF. Perhaps with such considerations in mind, only 26% of participants in our survey thought CCF calculation as a very important issue although 62% thought it was important.

Diversification of renewables portfolio

Non-wind renewables seem to need additional incentives (e.g., feed-in tariffs, multipliers for RECs). There is a compliance payment for solar (essentially a multiplier of two on RECs); but this incentive has not led to much investment in solar. Bills on new renewables mandates that were introduced during the 81st Legislative Session (2009) failed to pass. Going forward, PUCT may implement a tiered approach, adding two more tiers to existing RPS mandate. One of them will target solar, and the other will cover the remaining technologies.

In our survey and interviews, the desire to diversify renewables portfolio came out strong. To 52% of survey participants, this was a very important issue and for another 32% it was important. Wind energy has a strong competitive advantage against most other renewable technologies; and it can even compete with conventional fuels, albeit with the help of PTC, REC and high natural gas prices.

[27] The exact language can be found in Page 13 of 14, paragraph (e) of the following document: http://interchange.puc.state.tx.us/WebApp/Interchange/application/dbapps/filings/pgSearch_Results.asp?TXT_CNTR_NO=34577&TXT_ITEM_NO=178.

Supporting significantly costlier alternatives would require tougher mandates, which would increase the price of electricity to end users.[28] But, there are considerations. Is distributed generation better than wind because it may avoid the need for large scale transmission development? Is solar thermal better because it is more coincident with load? Would it help if solar thermal facilities are built along with the wind facilities in West Texas so that transmission line usage can be maximized? Would impending carbon regulation help make these technologies more competitive? The answers to these questions can guide the nature of support for non-wind renewables.

Compatibility with a federal RPS

In early 2009, there were several federal RPS bills promoted by Senator Bingaman, Senator Udall, and Representative Markey. The latter was merged into the American Clean Energy and Security Act of 2009 (H.R.2454) sponsored by Representative Waxman, Chairman of the Energy and Commerce Committee, in addition to Representative Markey. This bill was approved by the House in June 2009. According to ACESA, renewables goal is gradual: 6% for 2012-13, 9.5% for 2014-15, 13% for 2016-17 and so on. The Udall bill did not progress; the Bingaman bill now forms the basis of the RPS portion of the Senate version of ACESA. According to the original Bingaman bill, renewables goal is again gradual, starting at 3% for 2011 rising to 15% by 2020.[29]

The 2008 share of renewables in total generation was around 4-5% in Texas. This share already satisfies the 3% target for 2011 of the Bingaman bill and is on track to meet ACESA target of 6% for 2012-13. With the CREZ transmission lines, more renewables capacity will come online and generation will increase. There may even be an opportunity for the state to sell RECs in other states if more renewables generation than mandated is built in the state. Some comments in our survey and interviews clearly indicate that there is an opportunity for REC owners in Texas to benefit from a nationwide market. Targets in the outer years can be difficult to achieve without new transmission lines, a more diversified renewables portfolio with statewide siting capabilities or counting energy efficiency applications towards mandates. In any event, Texas policy makers, regulators and market participants need to follow federal RPS developments very carefully. A little over 43% of participants in our survey, who gauged federal RPS as a very important issue, and another 36%, who considered it as important, seem to support these observations.

Carbon regulation

More than four fifths of our survey respondents thought that federal carbon regulation under development is either very important (41%) or important (41%). Several commented that federal carbon regulation has the potential to make some renewables technologies other than wind more competitive and make it easier to increase RPS mandates. However, the debate over the Senate version of ACESA is contentious. Studies showing the economic cost of the House version of ACESA are adding to existing resistance of many senators from states that stand to bear more

[28] For example, New Jersey solar RECs have been trading at prices above $200/MWh (Figure 3).
[29] As compared to some state mandates, the targets in any of these bills are not high; yet, there is opposition from some states.

of the costs.[30] Bundling of federal RPS, energy efficiency and cap-and-trade in one bill is probably lowering the chances of such a legislation passing the Senate. Many states remain opposed to federal RPS even if they may favor carbon regulation. Studies show that federal RPS provisions in ACESA will not add more renewables than either the existing state RPS programs or the cap-and-trade provisions of the bill.[31] The pending Senate version may fix some of these major problems; or it is possible that the bill will be taken apart into separate carbon regulation and federal RPS bills. In any case, it is promising to be an intricate process; any carbon legislation emerging from such a process will be significantly weakened in its mandates to yield the desired outcomes but may still have considerable cost impacts on hydrocarbon-heavy and fast growing states such as Texas.

Closing Remarks

Texas leads the nation in installed wind capacity. Most of this capacity was built since the passage of SB 7 in 1999, which initiated the Texas RPS program. The program design has been simple and was implemented competently by PUCT and ERCOT. These agencies have been proactive in transmission planning as demonstrated by the CREZ process. The general pro-business environment of the state that helped the competitive electricity market to evolve also helped renewables investors. But at the end of the day, the high quality of wind in West Texas, federal tax credits, and, to a smaller extent, state tax abatement programs are primarily responsible for the rapid expansion of wind capacity in the state. REC prices have been too low to be a significant factor especially in recent years with excess supply of renewables over the RPS mandate.

Other technologies such as solar, small hydro and biomass have not contributed much. The RPS program or federal tax credits did not provide sufficient incentives for these technologies to prosper. New incentive structures are under consideration both at the state and federal levels but all proposed renewable energy bills in the 2009 session of the Texas Legislature failed. Renewables investment has slowed down in 2009 and going forward, it will remain relatively low in the next few years due to transmission constraints (for wind) and lack of additional incentives (for solar and others) as well as general malaise in economic and financial markets. After the economic recovery, Texas will probably continue building more wind farms as long as federal tax credits continue and CREZ transmission expansion happens as planned.

[30] CEE-UT recently worked with Texas CPA to evaluate potential impacts of ACESA on the Texas economy. This study and links to other ACESA evaluations from around the country can be found at http://www.window.state.tx.us/finances/captrade/txpolicies_programs/tx_studies_reports.html.

[31] For example, see *The Merits of Combining a Renewable Electricity Standard with a Greenhouse Gas Cap-and-Trade Policy: An Analysis of the American Clean Energy and Security Act of 2009 (H.R.2454)* by Michael Neimeyer, Scott Bloomberg, and Ken Ditzel from CRA International, *USAEE Dialogue*, August 2009 (http://www.usaee.org/pdf/Aug09.pdf#d17)

APPENDIX 1 – Online Survey

The survey was made available online at SurveyMonkey web site from May 8 until June 9. We received 49 responses, which are summarized below. The respondents included 9 renewables developers, 8 trader/brokers, 7 consultants, 7 retail electric providers, 4 lawyers, 3 transmission utilities, and 2 technology providers. There was one respondent from each of the following: ERCOT, financial institution, municipal utility, NGO, state certified utility, energy company, state government agency, public power generator, and QSE (last 5 were self-identified).

1- What were the goals of the Texas RPS program? Please select from the list below and indicate how successful the program has been in achieving these goals. (47 survey participants answered this question)

	Very Successful	Successful	Making progress	Limited progress	No progress	Response count
Increase new renewables capacity	**70.2% (33)**	12.8% (6)	10.6% (5)	6.4% (3)	0.0% (0)	47
Support existing renewables	16.3% (7)	**32.6% (14)**	**32.6% (14)**	16.3% (7)	2.3% (1)	43
Promote economic development	28.9% (13)	**35.6% (16)**	24.4% (11)	11.1% (5)	0.0% (0)	45
Enhance energy security	13.6% (6)	**29.5% (13)**	**29.5% (13)**	22.7% (10)	4.5% (2)	44
Reduce emissions	21.7% (10)	**30.4% (14)**	28.3% (13)	17.4% (8)	2.2% (1)	46
Encourage new & clean technologies	22.2% (10)	**37.8% (17)**	24.4% (11)	11.1% (5)	4.4% (2)	45

Comments

- Much new renewable capacity, but a much of the potential is not useful or realized due to siting of much of the capacity being in the restricted West Texas area. Also, the success of new & clean technologies other than wind has been marginal to date.
- The RPS has been great for wind but has left solar behind. To promote the development of solar technology and diversity in the ERCOT system, a solar-specific carve-out would be necessary.
- Success to date is only because of: 1) A MERCHANT POWER FRIENDLY POOL / DEREGULATED. 2) GAS AT THE MARGIN. The rest of this is a farce. If you truly want to get to the heart of the matter - examine the total renewable energy capacity available (basis current technology, today) giving differentiation to resource types e.g. baseload, dispatchable, peak etc. Texas is an energy state. It can and should triple its renewable capacity.
- Other goals: Reduce water consumption; reduce natural gas demand and thus natural gas prices; lower electricity prices. Success: very.
- To achieve consensus among various stakeholders to successfully pass Senate Bill 7 in 1999.
- Reduction of emissions and encouragement of new and clean technologies is an opportunity. Also more varieties of clean energy (e.g. biomass, solar, and geothermal) are needed going forward. Too much reliance on wind generation can have unintended negative consequences to the reliability of the grid.
- A disappointment, of course, is that it hasn't fostered renewables other than wind as much as had been hoped.
- Too much focus on Wind, this is old technology that after over ten years is still getting over 90% of the dollars, so there is no support for any other renewable technologies. Wind is also counter cyclical to our demand profile. Waste heat should get the same $$ as Wind and a position in the RPS.
- Fuel Diversification - Very successful.
- Without adequate policy to support the development of transmission infrastructure in a timely fashion investors in wind resources are left stranded.
- The Texas RPS program has definitely been successful in getting new renewable generation on the grid. However, the point of issuing a renewable energy credit in an RPS program is to provide additional value to a developer of renewable technologies. With the huge influx of wind in the West Zone coupled with the 3 year banking provision, the TX REC market is now unnecessarily oversupplied making RECs trade close to zero and greatly decreasing the incentive and demand for new renewable capacity. I propose the 3 year banking provision be removed and also, in order to promote different types of technologies to further diversify the TX portfolio, TX should implement a tiered REC requirement much like New Jersey and other states in PJM do. This would provide further incentive for other types of technologies such as solar. This diversity of technologies will increase our energy security. For example: Solar produces the most power during hot sunny days which is the most prominent time that the wind does not blow.
- A larger degree of the goal achievement goes to the Production Tax Credit at the federal level. The state incentives have

been important, but in the shadow of the PTCs. Especially with RECs now tanking in the $1-$3 range. Even at $5, it's not near the $20 for the PTC, just extra gravy. More importantly, Texas also has the right blend of geographic features and economic convergence in a fairly functioning deregulated market for wind development than other states. This 'success' would have likely occurred w/o the state RPS program imho. However, I don't fault the state for trying to sweeten the pot to developers considering alternatives elsewhere.

- Until the CREZ lines get built, wind generation in West Texas is very constrained.

2- Please indicate whether you agree or disagree with the following statements. (47 survey participants answered this question)

	Not applicable	Agree	Somewhat agree	Disagree	Response count
Annual targets are being met with new renewable capacity	0.0% (0)	**83.0% (39)**	14.9% (7)	2.1% (1)	47
Long-term targets are encouraging new projects	0.0% (0)	31.9% (15)	**40.4% (19)**	27.7% (13)	47
Load Serving Entity (LSE) participation requirements are equitable	8.5% (4)	**44.7% (21)**	29.8% (14)	17.0% (8)	47
Mandated renewable share of total retail electricity sales is reasonable	6.4% (3)	**55.3% (26)**	21.3% (10)	17.0% (8)	47
Resource/technology definitions & eligibility are clear	2.1% (1)	**61.7% (29)**	27.7% (13)	8.5% (4)	47
The program is increasing resource diversity in renewable generation	0.0% (0)	23.4% (11)	31.9% (15)	**44.7% (21)**	47
Administration of the program is operating well	10.9% (5)	**56.5% (26)**	23.9% (11)	8.7% (4)	46
Compliance verification is working well	13.0% (6)	**63.0% (29)**	17.4% (8)	6.5% (3)	46
Enforcement is working well	21.7% (10)	**52.2% (24)**	21.7% (10)	4.3% (2)	46
Penalty for non-compliance is reasonable	20.5% (9)	**43.2% (19)**	27.3% (12)	9.1% (4)	44
Alternative compliance payments are needed to support new projects	15.9% (7)	22.7% (10)	29.5% (13)	**31.8% (14)**	44
REC tracking system is working well	22.7% (10)	**50.0% (22)**	25.0% (11)	2.3% (1)	44
Long-term contracts for power are being offered by LSEs	13.3% (6)	**33.3% (15)**	24.4% (11)	28.9% (13)	45

Comments

- LSE participation requirements are NOT equitable because municipal utilities and co-operatives are exempted from the requirements.
- Alternate compliance payments are not needed to support new projects because new projects are being developed in sufficient quantities without such payments.
- Most LSEs are not offering long-term power agreements.
- Munis & coops should be brought under the same statewide program.
- Should expand to nuclear power.
- Last 3,00 - 4,000 MW of wind capacity was not driven by renewable capacity targets, but rather based on high-price gas expectations and easy to build environment. Mandated share of renewables is too low for a state that has so much renewable potential (and existing capacity).
- Since we have exceeded the RPS goals, PPAs are harder to find. Also, solar has been entirely left behind.
- Biggest disappointment is the lack of diversity, but the RPS did not mandate diversity, so I guess it's to be expected.
- The last statement in this section is not related to RPS or RECs. Whether LSEs offer long-term contracts for power to end-use customers is a generally function of counterparty credit, the LSEs ability to hedge forward power, and liquidity in the wholesale power markets.
- There is insufficient support for investment in transmission infrastructure to support renewable generation resources located in remote areas of the state. Currently no means to move energy from renewable resource areas to load centers. Support for equitable treatment of renewable generators who make early commitment to Texas market from politicians, regulators, and individuals is poor or non-existent.
- There is so much Wind power coming online in TX, I am not sure that the targets or REC prices are driving much these days. The program is definitely not increasing resource diversity. In TX, there is only one type of REC that also happens to

be very oversupplied. With only one type of REC as an incentive to new renewable capacity, the cheapest of the renewable technologies, in this case Wind, is the only one that will get built. If TX put in a tiered REC requirement, TX can create greater incentives for those technologies that are more costly to build than wind such as solar. The folks at ERCOT who manage the RPS program are always very helpful over the phone.

3- Have any of the following emerged at any point in the history of the Texas RPS program as concerns? (32 survey participants answered this question).

	Comment if the listed item was a concern at any time	Response % (count)
Reasonableness of targets (given resource availability or market conditions)	• Since we have shot past the target, it would seem to be meaningless now. • 2000 by 2009 seemed miles away in 2004. whodathunk? • Yes, low prices threaten to render the program useless. • Too low. • Big industry fear at first, now seen as baseless. • Too low targets to ensure full success. • Reasonable, but should be more aggressive as to non-wind renewables. • Perhaps at start of dereg, but targets have been achieved. • Targets were met easily, could have been higher. • Targets are very small compared to potential and transmission improvements do not support them. • Not since wind is abundant in Texas.	43.8% (14)
Competition between voluntary and mandatory REC markets	• A problem until it was fixed in 2007 • While CPS & AE have been significant supporters of renewables, other public power participation has lagged. • This is healthy in our view. • More and fair competition needed. • Will voluntary REC demand outpace sources?	34.4% (11)
Lack of nationwide REC markets	• Great Concern. • Not a problem with Texas RPS, but a problem nationally. • Significantly depresses value of Texas RECs. • Lack of voluntary buyers in Texas. • It became apparent in recent years, particularly since 2005. • Some feel national trading capabilities would increase value of Texas RECs. • A Nationwide REC program would help the price of RECs. • Keep ERCOT Texas only. • YES!! Cross-border markets for excess renewables that go beyond the REP mandate. The guidelines on voluntary RECs are muddled.	50.0% (16)
Resource / technology eligibility (including existing renewables, DG, etc.)	• Uncertainty around treatment of storage technologies. • Should be expanded to include storage technologies. • No, but momentum of wind has blocked development of other alternatives. • Became apparent in the first few years of RPS when the share of wind resources overwhelmed new renewable resources. • Needs to be better defined and communicated. • Add nuclear. • Yes. Hydro.	28.1% (9)
Supporting diversity of renewable energy sources	• It's all been wind because of the economics, so this remains. • Wind has dominated - but is most cost effective. The system works. • Weak incentives/support for non-wind technologies. • Wind has been the clear winner. Lack of diversity. • Essentially, only a mandate to support wind technology. • This is not a byproduct of the Texas RPS program. • Lack of true market delineation. The horse traders were afraid to do the right thing. • Desired by "legislative intent", but not specified so not acted upon. • Existing RPS program is crowded out by wind. • Became an issue around 2005 when the share of wind resources overwhelmed	62.5% (20)

	new renewable resources. • Needs work on alternatives for solar, geothermal and biomass. • Too much reliance on wind generation. • Hasn't worked as well as had been hoped. • Add nuclear. • Yes, I don't think proper incentives exist to build a diverse renewable portfolio.	
Inadequate attention to distributed renewable resources at end-use locations	• Again, this is a cost-effectiveness issue. • Net metering remains an issue. • Desired by "legislative intent", but not specified so not acted upon. • Yes, but momentum for distributed model is growing. • A direct means of encouraging solar and biomass DRG needs to be found. • This is true. Also unfortunate as it has been a missed opportunity.	37.5% (12)
Lack of long-term contracts for renewable developers	• Only recently a problem. • Limited number of term off-takers further reduced due to financial crisis, transmission constraints, overbuild of wind, and weak incentives. • Contracts available but few from LSEs, typically PGCs. • Increasingly an issue. • It has been an issue in the last several years given significant increase in wind resources. • Need to link aggregators to long term contracts or major industrial users. • Need a centralized credit support mechanism.	43.8% (14)
Cost-effectiveness of RPS	• Very cheap here since supply > demand. • Big industry fear at first, now seen as baseless.	15.6% (5)
RPS rate impacts	• Concern, most power is bought wholesale so rates generally unaffected. • Minimal. • Big industry fear at first, now seen as baseless. • Has always been an issue for Industrial customers resulting in some new provisions in PURA. • Will become more of an issue when percentages increase. • The impacts rise as REC prices rise, cost to consumer.	25.0% (8)
Lack of compliance		6.3% (2)
Lack of enforcement	• Penalties need to be stiffer.	9.4% (3)
Participation of all LSEs	• Yes, municipal utilities and co-operatives are not required to participate. • Munis/coops should participate. • Small competitive LSEs primarily buying RECs and "coloring" their power green. • Yes, increased demand would aid the program. • Should include municipals and cooperatives. • Yes, exclusion of NOIEs hurts the overall program. • Co-Ops, especially, have not participated; again, not mandated so no reason to expect that they would. • Non-uniform. • It would be more uniform if all LSEs (even non-competitive ones) had equitable obligation.	37.5% (12)
Cost recovery	• Problematic for certain renewable technologies.	12.5% (4)
Treatment of out-of-state renewable generation	• The bigger issue is probably the inability to move Texas renewable generation out of Texas. • No. Competition is driving development and innovation. • Has received some attention in the last few years. • ERCOT/FERC issue that will need to be resolved for nationwide smart grid. • Excluded from Texas RPS. • Keep Texas separate.	21.9% (7)
Double counting (voluntary & mandatory markets, different attributes)	• Concern, are voluntary REC sales being retired? • Problem before 2007. • This was a concern. Unknown if it continues to be a concern. • Has been discussed in various occasions and resource owners may prefer to use RECs for different purposes.	34.4% (11)

	• Could be done better. • Compliance Premiums for non-wind technology. • Seems to be a more recognized concern now but was very problematic in the start. • Confusing topic to many.	
Transmission bottlenecks	• Transmission continues to be an issue; CREZ should help. • Great Concern, transmission is the key to unlocking the resource. • Problem since 2008 until CREZ transmission is built. • HUGE problem being alleviated as fast as regulation allows. • Will help utilize more of the West Texas wind capacity, but still lacking a good plan for developing a diverse system. • Yes, limits supply of RECs. • CREZ transmission will help. Need more lines into SPP. • Certainly an issue that is being addressed. • Extreme concern. Uncertain why TDSPs weren't already coming in for CCNs far ahead of CREZ. • Has always been an issue since 2003 when McCamey problems challenged ERCOT operators in managing congestion. • Transmission should be a legitimate expectation of all renewables. • CREZ process is slow and inadequate to adequately support investment in Texas renewable generation. • YES! The west zone congestion is a huge problem and one that would likely be very small if it were not for the large amount of wind capacity (uncontrollable resource) that has been allowed to come online in that region before the proper transmission has been built.	**84.4% (27)**
Electric system operational challenges	• It appears ERCOT is on top of this now. • Need to move from an attitude of accommodation to a well thought out integration plan for renewables - especially wind. • Variability at high penetration levels remain concern. • Becoming more of an issue as we get more wind on the system. • This is an extreme concern - ERCOT lacks the technical and operational experience to manage. • Definitely a concern, but downplayed by the wind industry for a long time. • Has always been an issue since 2003 when McCamey problems challenged ERCOT operators in managing congestion. • Little or no resources dedicated to solving market and operational problems such as existing grid stability issues. • Ancillary service need have increased and its relative price value to energy price has increased.	50.0% (16)
REC tracking & verification		6.3% (2)

Comments

- In our view, the low price of RECs threatens the programs effectiveness. Some REC generators are choosing to ignore the program because the price signal is not meaningful enough to manage. At $1, the entire compliance market, by some studies, is valued at less than $10 million for the entire state; Hardly enough to increase participation or encourage behavior change. Increasing participation and integration into the voluntary and other state markets would be useful in creating a meaningful price signal. Further it could provide increased REC Revenue into the State of Texas from elsewhere in the Country.
- (1) The CREZ approval process took too long because the PUC thought they could decide, then backtracked on that a year later. (2) The approved CREZ lines were too short sighted. The lack of inclusion of either a DC solution or 765kV lines says the PUC only looked to a minimal solution that was then thought to be adequate for 2012, but will prove to be way too little. (3) Since the 345kV only CREZ solution was concluded without a dynamic stability study, it is looking like its expected transfer capability was overstated.
- The ERCOT REC tracking system has many user limitations; in ability to select specific transactions to retire.

4- Texas RPS program is commonly considered successful, as RPS mandates were surpassed earlier than target dates mainly based on the large amount of wind generation that was built since 1999. Please indicate which of the following factors have played a role in this success and how important that role was. (44 survey participants answered this question)

	Very Important	Important	Not a factor	Response Count
RPS mandates	44.2% (19)	**51.2% (22)**	4.7% (2)	43
REC prices	21.4% (9)	**54.8% (23)**	23.8% (10)	42
Resource availability	**60.0% (24)**	35.0% (14)	5.0% (2)	40
Federal investment tax credit	**37.5% (15)**	25.0% (10)	**37.5% (15)**	40
Federal production tax credit	**86.4% (38)**	11.4% (5)	2.3% (1)	44
Texas incentives (state or local)	33.3% (13)	**48.7% (19)**	17.9% (7)	39
Competitive electricity market structure in ERCOT	**58.1% (25)**	27.9% (12)	14.0% (6)	43
Ease of siting & permitting facilities in Texas	**68.2% (30)**	27.3% (12)	4.5% (2)	44
Non-discriminatory access to transmission network	**65.9% (29)**	29.5% (13)	4.5% (2)	44
Minimum interconnection costs	**61.4% (27)**	36.4% (16)	2.3% (1)	44
Pro-active transmission planning by ERCOT	**46.5% (20)**	41.9% (18)	11.6% (5)	43
The likelihood of carbon regulation in the near future	14.0% (6)	41.9% (18)	**44.2% (19)**	43
Customer willingness to pay for Green Power	14.3% (6)	**52.4% (22)**	33.3% (14)	42

Comments

- RPS mandates were important early, but became rather irrelevant in high priced natural gas market era. Price of natural gas and resulting power prices, good wind regimes, and ease of development were the main drivers for bulk of the new wind capacity. REC prices help, but minimal compared to the values in other markets such as PJM and New England.
- REC prices are a joke. Cap & Trade will sort Texas out, albeit the hard given the inaction on behalf of our enlightened leaders.
- The overbuilding of the existing grid resulted from an expectation that CREZ would deliver transmission upgrades in a timely fashion which it has not. Expectations from investors further driven by high energy prices but not from RPS targets which have been set to be surpassed from early in the program. Lack a transparency in the interconnection process (i.e. interconnection agreements only made public at signing), coupled with strong culture of open access, makes it impossible for market participants to access the balance of supply and demand.
- ERCOT combine with the phrase 'Pro-Active', you're kidding, right?!
- However, due to the ease of electrical interconnection, so much wind generation has been built in West Texas that they have cut prices to the bone in order to get dispatched. Many are loosing money.
- More wind generation is available but at the expense of system reliability, increased cost and need for ancillary services, large and volatile interzonal price spreads, increased cost for local congestion, and a negative impact on the value of gas, coal and other generation resources in the west zone.

5- The following are some of the current issues faced by the Texas RPS program. Please indicate how important you think these issues are. (47 survey participants answered this question)

	Very Important	Important	Not an issue	Response Count
Capacity conversion factor calculation	26.2% (11)	**61.9% (26)**	11.9% (5)	42
Building CREZ lines	**93.3% (42)**	4.4% (2)	2.2% (1)	45
Priority dispatch on CREZ lines	**62.2% (28)**	31.1% (14)	6.7% (3)	45
Operational challenges due to incorporating more renewables into the grid	**66.7% (30)**	28.9% (13)	4.4% (2)	45
Diversifying renewables portfolio (solar, DG, etc.)	**52.3% (23)**	31.8% (14)	15.9% (7)	44
Federal RPS	**43.2% (19)**	36.4% (16)	20.5% (9)	44
Lack of strong customer willingness to pay for Green Power due to economic slow down	18.6% (8)	39.5% (17)	**41.9% (18)**	43
The likelihood of carbon regulation in the near future	**40.9% (18)**	**40.9% (18)**	18.2% (8)	44

Comments

- CREZ and priority dispatch are linked.
- Clearly the prospect of the Federal system has raised the Texas RPS system's profile on a national stage.
- Wind is going to encounter increasing problems integrating into the grid without storage. The greater the level of wind generation, the greater the issue of inefficiency (transmission overbuild, wind shutoff, conventional power turndown and associated issues, overbuild of gas peakers). CAES/pumped hydro are among the technologies available to address this, and the RPS ought to embrace them. Currently it does not.
- Current RPS does not strongly incentivize resource diversity.
- Texas has, on a positive note, been pro active with CREZ. I do not feel this was motivated by Green intentions, however the right decision was made. It also is the right economic decision. We, as a State have excellent sustainable resources which will not have to incorporate the impending CO2e cost.
- The two biggest challenges to more renewable generation in TX are: 1 - transmission constraints for wind, and 2 - no mandates for diversity. CREZ is answering the first; the second will not be addressed until either a mandate is provided by the legislature (state or federal) or carbon is taxed to a degree that makes other technologies more cost competitive. All existing programs are targeted primarily to the micro-generation level (under 10kW); large scale development will not occur without specific legislative/regulatory directive.
- It will be very interesting to see how anticipated federal legislation for carbon and renewables will impact state and/or regional programs already in effect.
- Wind has zero variable cost and that is the driver.
- Without any new wires, transfer capacity was maxed out two years ago. And more wind generation continues to be built every month in the West.

6- Please provide any additional comments below.

- I am astonished that you can consider your study comprehensive when there is no consideration -- mention, even -- of "storage." Of course, most generators using renewable technologies understand that they can deliver more energy to market and invest more to their benefit by building more renewable capacity. Storage offers opportunities to capture more renewable energy from installed capacity, make better utilization of transmission capacity, possibly make base-load coal units more efficient and cleaner, and deliver more renewable energy to consumers and cheaper energy overall to consumers. It takes some effort to understand these effects, and there are some trade-offs between them. It is a bit embarrassing that Texas isn't even asking the questions while New York, Iowa, Kansas, Montana, New Mexico and California (and probably others) recognize that there may be potential benefits to be gained from storage. Texas is different because it has natural assets that could lined themselves to storage, but most areas don't have the opportunity or the natural assets to bring to bear.
- RPS has been successful and will continue to play an important role given the likelihood of a carbon regulation in the near future. A Federal RPS may further increase the share of renewable resources in Texas given low percentage targets set by the Texas Legislation.
- Overall the TX RPS is a success because we have surpassed our capacity goals. Going forward though, there is now no significant incentive to build new renewables in TX other than the PTC since TX RECs trade so close to zero. A wind farm could now only get an additional $600K to $700K annually from their REC generation where in the past that amount could have been upwards from $3.25M annually. Second, since there is no tiered REC requirement, if TX RECs do increase in value, Wind will still be the primary technology built since it is the cheapest in TX; this does not help TX diversify its renewable energy portfolio.

APPENDIX 2 – Issues identified by Renewable Technologies Working Group in its First Report, March 2009

http://www.ercot.com/content/meetings/tac/keydocs/2009/0305/09._ERCOT_Report_to_PUCT_-_March_2009_Final_02-26-2009.doc

Near-Term Issues Related to Wind Generation

Market Design

- Ancillary Service Cost Allocations (MD1)
- Ancillary Service Procurement Optimization for 2009 (MD2)
- Zonal Protocols Non-Spin requirements (MD3)
- Zonal Protocols Reactive and voltage requirements (MD8)
- Nodal Protocols – Dispatch Response (MD9)
- Nodal Protocols – Performance Metrics (MD10)
- Nodal Protocols – Base Point Deviation Charges (MD11)

System Operations

- Accurate Wind Turbine Generator Technical Data (SO1)
- Response to Down Balancing Instructions (SO3)
- Testing of Reactive Capability (SO6)
- High System Frequency (SO7)
- SCADA Control of Circuit Breakers (SO9)
- Local and System Voltage Management Practices (SO10)
- Control of System Reactive Capability (SO11)
- Wind Generation Resource (WGR) Performance Metrics (SO13)
- Communications with Transmission Service Providers (TSPs)(SO15)
- ERCOT Manual Curtailment Practices (SO27)
- SPS Tripping due to N-0 (SO28)
- Transmission Outage Planning for CREZ Construction (SO29)
- Use of wind generation output forecast for the purposes of the Projected Assessment of System Adequacy (PASA) (SO30)

System Planning

- Verify Turbine Characteristics (SP1)
- Verify Turbine Computer Models (SP2)
- Fault Tolerance Studies (SP3)
- Voltage Transient and Small Signal Stability Study (SP4)
- Low Voltage Ride-Through (LVRT) Study (SP8)

Workshops/Training

- ERCOT Wind Workshop III (WT2)

Long-Term Issues Related to Wind Generation

Market Design

- New Ancillary Service Products to Support Reliability Needs (MD4)
- Potential Applications and Benefits of Storage Technology (MD5)

System Operations

- Potential Applications of Smart Grid Technology (SO4)
- Operational Studies of Impact of Ramp Rate, Forecasting, Time of Production (SO5)
- Impact on System Inertia (SO8)

- Minimization of Impact of Transmission Outages (SO14)
- Potential Applications and Benefits of Smart Meters and Demand Response (SO23)
- Potential Application for Plug-In Hybrid Vehicles as Storage (SO24)

System Planning

- System Inertia Study (SP5)
- Application of Variable Frequency Transformers (VFT) for Improved System Stability (SP6)
- Voltage Control Study (Related to CREZ Lines)(SP7)

Workshops/Training

- Wind Generation Resource Operator Training (WT3)

Issues of Undetermined Priority Related to Wind Generation

Market Design

- Potential Ancillary Services Provided by Wind (MD7)

System Operations

- Nodal Protocols – Tools to Better Integrate Wind (SO2)
- Wind Turbine Generator Governor Response (SO25)

System Planning

- **NONE**

Workshops/Training

- Updating Resource Plans and Schedules of WGR-Only QSEs (WT 1)

Issues Completed This Quarter

Market Design

- Ancillary Service Procurement Methodology for 2009 (MD6)
- WGR Low Sustainable Limit (LSL) as a Percentage of High Sustainable Limit (HSL) (MD12)
- Use of AWS Truewind 80% Confidence Band Wind Generation Forecast (MD13)

System Operations

- Low Voltage Ride Through (LVRT) Requirement for WGRs (SO12)
- WGR Ramp Rate Limitations (SO16)
- Incorporate Weather Sensitivity into ERCOT's Short-Term and Mid-Term Load Forecasts (SO17)
- Use of Multiple CSC Limit Studies for Congestion Management (SO19)
- Incorporate Dynamic Line Ratings into Operational Planning (SO20)
- Revise Emergency Electric Curtailment Plan (EECP) Steps (SO21)