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THE BOTTOM LINE

Texas leads the United States with 9,528 MW of installed wind power capacity—a level exceeded by only four *countries.* The state needed more infrastructure to transmit electricity generated from renewable sources, but the regulator could not approve transmission expansion projects in the absence of financially committed generators. To solve the problem, Texas devised a planning process that quickly connects energy systems to the transmission system. The system is based on the designation of "competitive renewable energy zones."

Marcelino Madrigal (mmadrigal@worldbank.org) is a senior energy specialist in the World Bank's Energy Practice.

With

Rhonda Lenai Jordan (rjordan@worldbank.org) is an energy specialist in the same practice.

Transmitting Renewable Energy to the Grid: The Case of Texas

Why is this case interesting?

Texas needed to prioritize and accelerate development of remote wind sites

During much of the twentieth century, Texas was a major producer of petroleum in the United States. The state is now taking advantage of a major renewable energy resource: wind. It currently leads the United States with 9,528 MW of installed wind power capacity (ERCOT 2011) and, if it were a country, would rank fifth in wind generation worldwide.

When Texas reformed its energy program in 1999, it vowed to increase the role of renewables in its energy mix. It now uses a renewable portfolio standard to require energy utilities to increase their energy generation from eligible renewable sources. To minimize costs to the taxpayer, the state's renewable energy program created competitive renewable energy zones that rely on the private sector to provide infrastructure and operations for generation and transmission, while the state provides planning, facilitation, and regulation (figure 1).

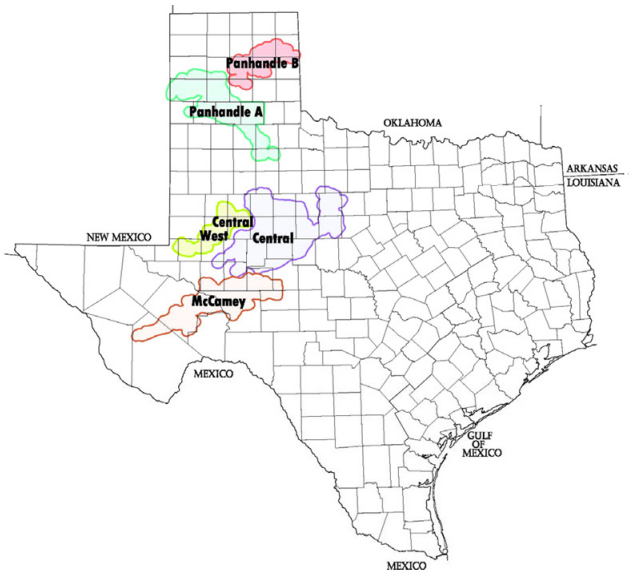
The renewable portfolio standard mandated that electricity providers generate 2,000 MW of additional renewable energy by 2009. This 10-year target was met in just over six years and was followed up in 2005 by Senate Bill 20, which raised the targets and mandated that the state's total renewable energy generation must reach 5,880 MW and 10,000 MW by 2015 and 2025 respectively. Furthermore, the legislation required that 500 MW of the 2025 renewable energy target be derived from renewable sources other than wind.

What challenge did they face?

Transmission investment was contingent on generation commitments yet needed to precede it

Texas faced the challenge of meeting tremendous needs for transmission infrastructure triggered by the scale-up of generation

Figure 1. Texas's five competitive renewable energy zones



Source: ERCOT 2008.

Note: The 5 CREZs are the highlighted areas; the nonlabeled shapes are counties.

"Texas faced the challenge of meeting tremendous needs for transmission infrastructure triggered by the scale-up of generation from renewable sources."

from renewable sources. Transmission infrastructure can take longer to plan and build than the renewable generation plant. But under existing regulations, the regulator would not approve transmission expansion projects in the absence of financially committed generators or assurance that the transmission project would meet the needs of specific generation projects. Therefore, the challenge of developing renewable energy in Texas was to devise a cohesive plan to synchronize the efforts of generators and transmission companies and thereby connect energy systems to the transmission system as quickly as possible. A key part of the plan was to identify the best locations for appropriate energy technologies in a large and rugged state.

What solution was adopted?

The state regulator coordinated and synchronized private investment in generation and transmission

Texas adopted a proactive transmission planning process based on competitive renewable energy zones to provide the transmission infrastructure needed to carry the fast-growing loads generated from renewable sources.

Managed and regulated by the Public Utility Commission of Texas, the process (illustrated in figure 2) identifies geographic zones that have the best potential to supply wind power and, thus, to meet the state's renewable portfolio standard. The commission works with developers of renewable energy to see that wind farms are built and with transmission companies to provide the connecting infrastructure. It works with both groups to coordinate their efforts so that, by the time wind farms are ready to produce electricity, the transmission infrastructure is available to distribute it.

The steps in the process are as follows:

Designate competitive renewable energy zones. The utility commission holds a hearing at which interested parties may nominate a region for designation as a CREZ (competitive renewable energy zone). Simultaneously, the Electric Reliability Council of Texas (ERCOT), which operates the electric grid and manages the deregulated market for 75 percent of the state, initiates a study to identify the top 25 wind regions in the state. Commissioned by the utility commission, the study is prepared in consultation with the independent system operator, regional transmission operators, utilities, the Department of Parks and Wildlife, and other organizations. The CREZ designation process unfolds in successive iterations over the ensuing six months, incorporating the input of all stakeholders on the proposed regions. In the course of the process, ERCOT develops several transmission scenarios to connect the regions, and the financial commitment of the generators is assessed. Various parties may intervene during the proceedings.

After considering the sufficiency of the renewable resources, the availability of nonrenewable resources for backup services, the anticipated reliability of the system, environmental impacts, economic feasibility, and geographic diversity, the utility commission formally bestows the CREZ designation. In so doing, it specifies the geographic extent of the CREZ and the major transmission improvements needed to deliver the renewable energy in a cost-effective manner. It also issues an estimate of the maximum generating capacity of the region that the transmission infrastructure will have to accommodate.

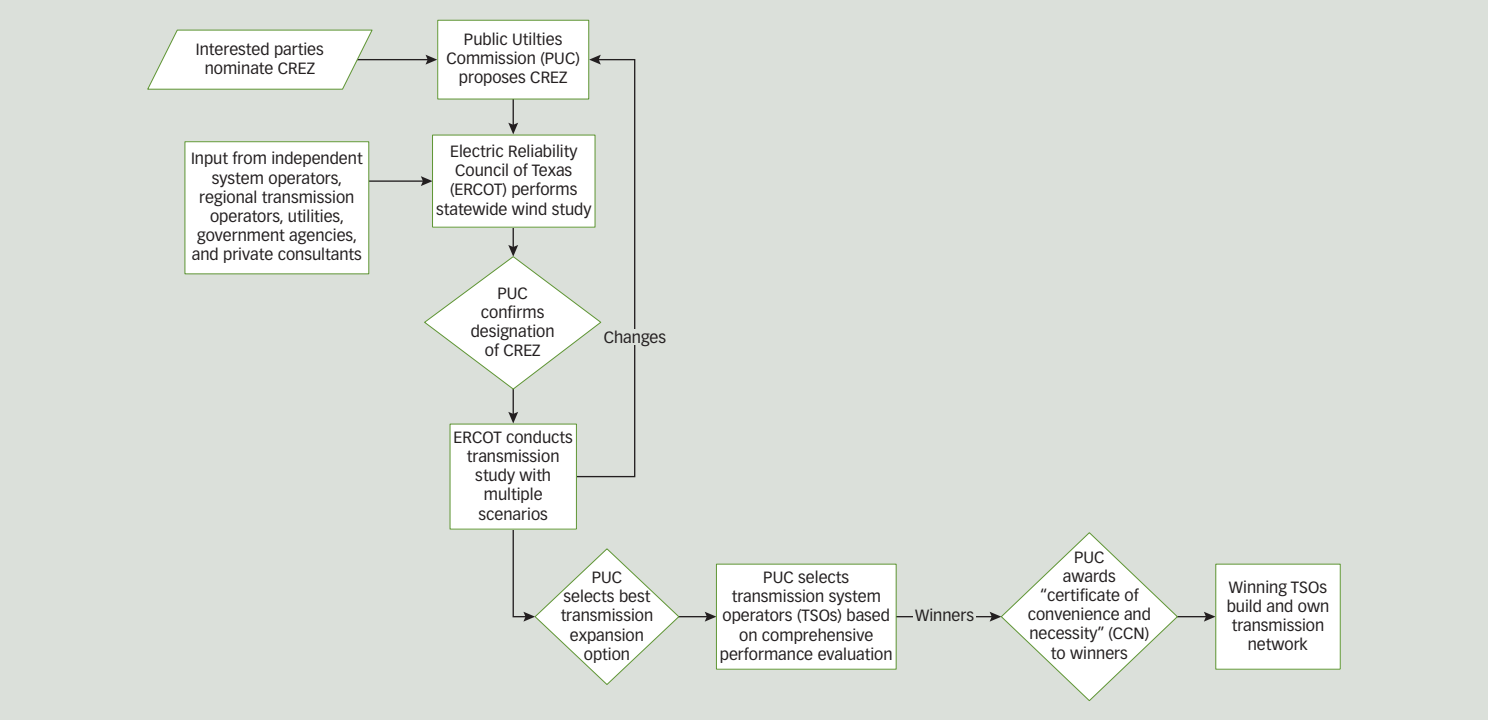
Develop a transmission capacity expansion plan. Once the CREZs have been designated, interconnection agreements, leasing agreements, and other documents are reviewed to determine the financial commitments of the generators. At the same time, financial commitments from investors to build transmission facilities are reviewed. The utility commission then develops an expansion plan to accommodate the designated CREZs in a manner that is most beneficial and cost-effective to consumers. The plan is based on a comprehensive study that assesses alternative scenarios, wind capacity calculations, total and incremental costs, transmission system capacity, congestion, economies of scale, environmental benefits, and fuel-cost savings.

Select transmission system operators (TSOs). Once the plan to expand transmission capacity is complete, the utility commission selects TSOs based on a comprehensive performance evaluation that considers their proven ability to build, operate, and maintain the facilities identified in the CREZs.

Issue certificates. Each selected TSO is required to apply for a "certificate of convenience and necessity," which guarantees that all costs associated with building and maintaining the network will

"The process identifies geographic zones that have the best potential to supply wind power and, thus, to meet the state's renewable portfolio standard."

Figure 2. Texas's system of competitive renewable energy zones



Source: Authors.

be passed through to consumers via tariffs (based on the "postage stamp method" that allocates costs equally among all users of the infrastructure). The utility commission ensures that generators have demonstrated a sufficient financial commitment before issuing the certificate. The generators must pay a security deposit to protect the TSOs in case they back out. The deposit is refunded once the plant has been completed and is ready to supply power as planned. The certificate is what allows the TSOs to proceed with construction.

Texas has managed to achieve comprehensive development of renewable energy through private participation and investment, with the state government using its regulatory authority and facilitative role to guide CREZ projects and to optimize their efficiency and productivity (figure 3). ERCOT's 2009 annual report projected that transmission investment in Texas would rise significantly in 2012 and 2013, mainly because of the increase in investments in new 345 kV rights of way in the region, investments driven chiefly by the scale-up of renewable energy generation, especially wind power. Across Texas, $5.78 billion has been invested in new transmission since 1999, and $8.2 billion will be spent under the current five-year plan, including $5 billion solely to accommodate 18,000 MW of wind power capacity. As of June 2009, requests to connect 72,500 MW of new generation were under review. That new generation is comprised of wind (61 percent), nuclear (8 percent), natural gas (19 percent), coal (7 percent), and other renewables (5 percent), including solar and biomass.

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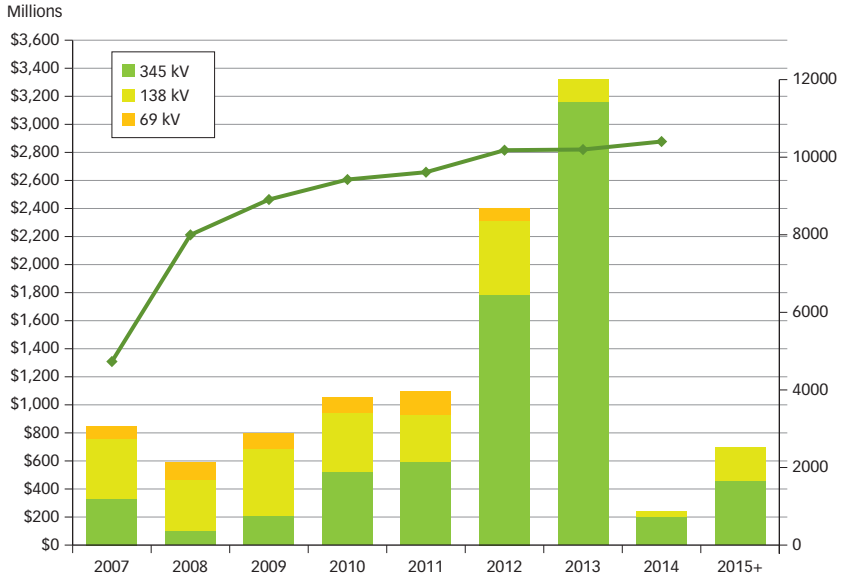
Figure 3. Transmission investments in Texas, 2007–15 (left axis), and cumulative installed capacity in MW, 2007–14 (right axis)



Note: Transmission investment figures are based on projects scheduled to be completed in the designated year and may not reflect actual investment in that year. Costs may be spread over several years. Capacity figures from 2011 to 2014 include cumulative planned capacity with a signed interconnection agreement.

Source: ERCOT 2010a and 2010b.

What have we learned?

Proactive and transparent planning ensured optimal expansion of the transmission network

The Texan experience shows that state government can play an effective role in catalyzing and managing the scale-up of renewable energy in concert with private operators. Texas uses a proactive approach determined on the basis of a renewables portfolio standard that sets the state's renewable energy targets. The same standard forces regulators to make plans for cost-efficient transmission five years in advance and overall generation and transmission costs will be as low as possible.

The keys to Texas's success have been (i) realistic goals, (ii) a planning process that incorporates input from all participants in generation and transmission, as well as the public, and (iii) a transparent system to determine costs and a reasonable consumer tariff. The proactive process ensures optimal network expansion, benefitting TSOs, generators, and consumers alike. Madrigal and Stoft (2011) provide further information.

References

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