A Primer on the Resource Adequacy Debate in Texas

What is the concern?

Texas population and economy has been growing fast, fueling significant growth in demand for electricity. Some are concerned about the ability of the competitive electricity market to provide sufficient incentives for investors to build enough generation capacity and/or consumers to reduce consumption when needed (during hot summer afternoons) so that the Texas economy have enough electricity to continue to grow at a healthy pace. The extremely hot summer of 2011 enhanced these concerns; on August 3, 2011 when a new record for electricity consumption in Texas was set, the grid operator, ERCOT, had to cut power to large industrial users, most of whom volunteered to provide such demand response services in exchange for some compensation, and procured emergency power from neighboring grids. Otherwise, operations were mostly normal and in summer of 2012, there were no similar extreme conditions.

What is resource adequacy?

Resource adequacy is the availability of sufficient resources to meet peak demand in the electric power system with adequate amount of reserve margin to ensure the desired level of system reliability. These resources are typically generation units (power plants) but can also be supplied by voluntary demand reduction, or demand response.

What is peak demand?

Peak demand is the highest consumption of electricity in any hour of the year. In Texas, it typically occurs in summer (primarily July or August) afternoons when consumption of air conditioning increases with people returning home from work during the hottest part of the day, 3-7 PM. The current record for the ERCOT grid in Texas was set on August 3, 2011 with 68,294 MW.

What is reserve margin?

Reserve margin is the percentage of available resources above peak demand. On August 3, 2011 the reserve margin was 7% with 73,715 MW of resources and 68,294 MW of peak demand. Between 2005 and 2010, reserve margin ranged between 13% and 19%. We focus on peak demand because, most of the year, demand is down to the 25,000 to 50,000 MW range and resources necessary to meet summer demand are not needed.

What is target reserve margin?

Electric grid operators, such as ERCOT, calculate a reserve margin based on the "1-in-10" reliability standard of the North American Electric Reliability Corporation (NERC). For ERCOT, the calculated figure is 13.75%; this is a target, it is not mandated.

What is "involuntary" demand curtailment (Load Shedding)?

When the electricity grid does not have sufficient resources to meet demand at any period of time, the system operator may curtail the electricity supply to some customers in order to maintain the reliability of the grid and flow of electricity to a majority of customers. The resources may fall short of demand due to weather related disruptions of generation, increases in load (for example, hotter than expected summer afternoons), transmission constraints, or a combination of these factors. Before shedding the load of some customers involuntarily, the system operator will seek the services of customers who signed up for voluntarily curtailing their consumption in exchange for some compensation.

What is "voluntary" demand curtailment (Load Shedding)?

Some customers sign up with the system operator to provide one of several load reduction services in case of system tightness or emergencies. The compensation for such services is primarily market-based as willing providers bid for them. Voluntary reduction of consumption, or demand response, can provide significant relief in Texas since most of our resource adequacy concerns relate to summer peak demand hours. Reduction of peak

demand can also reduce the need for less efficient generators and hence the emissions associated with peak generation.

Is there an "optimal" reserve margin?

The "1-in-10" reliability standard of NERC is applied differently by different system operators. ERCOT's interpretation of "1 load-shed event in 10 years" is more stringent than "1 day of outage in 10 years" interpretation of some other grids and yields a reserve margin of 13.75%. The target reserve margin used to be 12.5% until 2010. The optimality of a reserve margin can be evaluated based on the value of avoided demand curtailments, value of avoided high cost emergency purchases, and insurance value of reducing the likelihood of extremely high-cost outcomes. Such a comprehensive assessment has not been done in ERCOT. Rather, most of the previous ERCOT reserve margin calculations have been regular engineering studies. ERCOT is in the process of doing such a comprehensive study to calculate the optimal reserve margin.

What is an energy-only market?

Texas has a competitive electricity market both at the wholesale and retail levels. Generators compete in the wholesale market to supply electricity ("energy") to consumers. This wholesale market provides them revenues based solely on the price of electricity; this is called the "energy-only" market. Note that there is a market for ancillary services, which is managed by ERCOT for reliability purposes. This market can yield additional revenues to generators that sign up to provide some of these services but these revenues are typically small relative to revenues from selling electricity.

What drives the price of electricity, or the "energy" price?

Like in any market, demand and supply of electricity determine the price of electricity. The cost of fuel used to generate the last unit of electricity consumed at any time typically sets the price of electricity at that time. In Texas, natural gas fuels more than 40% of electricity consumed, and most importantly, marginal units; hence fluctuations in the price of natural gas are very important indicators of the electricity price. Note that since the electricity market is "instantaneous" (roughly speaking, electricity is supplied when it is demanded) and demand changes significantly within a day and across days and seasons, there is much more volatility in the price both within a day and across days and seasons.

What is a capacity market?

Texas does not have a capacity market at this time. In other markets, there is an Installed Capacity (ICAP) market where in addition to "energy" sales, generators may also collect "capacity" payments, which can be direct payments or based on an auction-style capacity market. These payments are for making capacity, or resources, available to the grid whether any electricity is generated from that capacity or not. A "mandated" rather than "target" reserve margin is necessary to induce investors to bid into the capacity market.

What is system-wide offer cap (SWOC), or energy price cap?

Electricity price fluctuates within a day and across seasons due to fluctuations in demand within a day and across seasons, changes in the price of natural gas, generation maintenance (scheduled or unscheduled), fuel supply bottlenecks, or lack of wind among other reasons. As a result, like in any market, there might be times when the demand-supply balance pushes prices higher than average levels; these are also known as "scarcity prices." In the Texas market, there is a cap on how high these prices can go: $3,000 until August 1, 2012, $4,500 currently, and to gradually increase to $9,000 by June 2015. In August 2011, what was called "1-in-100 year" weather (100 days of above 100^{o}F) led to about 17 hours when the price hit the $3,000 cap; and the price was higher than average levels for many more hours.

Why the increase in energy price cap?

In an energy-only market, investors track energy prices, especially "scarcity prices," to decide on whether to build a new power plant or not. The "scarcity" price signals have become more important in Texas in recent years for several reasons. For example, the price of natural gas fell after the 2008 economic crisis, which led to lower wholesale electricity prices; competitive pressures in the Texas market further eroded revenues for generators. Wind energy supplied to market at negative prices at times also contributed to keeping average

wholesale prices low. Until the summer of 2011, there were infrequent scarcity periods. Price cap increases are designed to provide additional revenues to potential investors even if scarcity periods remain rare.

Will the increase in price cap lead to higher prices?

Not necessarily. Higher price caps will generate same total revenue signal with fewer scarcity periods than lower price caps. Also, increasing revenues during regular operations (for example, due to growing base demand), improved availability of wind (for example, after the completion of transmission lines under construction), and de-mothballing of some power plants can also help keep prices low. It is important to note, however, that there are many developments external to the Texas market, which will influence it. For example, EPA regulations on various emissions and water use can lead to retirement of some plants, which would push prices higher in the short term until new generation capacity replaces the retired units; a significant increase in the price of natural gas will increase the price of electricity; elimination of tax credits for renewables will also increase the price.

What is the right price cap?

Most energy economists suggest that the efficient price cap is set at the price, which induces a consumer to curtail demand voluntarily rather than pay that price to continue using electricity. This is known as value of lost load, or VOLL. For example, in Australia, the price cap is set at $12,500 per megawatthour or $12.5 per kilowatthour. ERCOT is in the process of completing a study to determine the VOLL for Texas customers.

What is the difference/link between wholesale and retail prices?

Since there is also retail competition in Texas, any change in the wholesale prices does not have to be reflected on retail prices one to one. For example, long-term contracts with fixed rates may offer customers some protection. Similarly, retail providers that can procure their needs via long-term contracts can protect themselves against price volatility.

What is demand response?

If more consumers can respond to the market by reducing their electricity consumption during summer peak demand hours (primarily, 3-7 PM in July and August) or during emergency conditions, the system will be helped greatly. This is known as demand response, and will also help consumers reduce their electricity bills. There is an increasing number of retail electricity providers offering products or services that allow consumers to save by switching their consumption from peak hours to non-peak hours. There are also public awareness efforts, including those by ERCOT (http://www.ercot.com/) and PUCT (http://www.powertosavetexas.org/), to encourage conservation and reduce energy use during peak hours. ERCOT also has an “Energy Saver” app for smart phones.