May 4, 2012

Australian Energy Market Commission
PO Box A2449
Sydney South NSW 1235

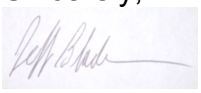
4 May 2012

Dear Commissioners,

EPR0022: Submission to Power of Choice review

Please find attached a brief review of the PJM and ERCOT wholesale markets, comparing their structures, degrees of retail competition and levels of demand response participation. EnerNOC commissioned KEMA to undertake this review so as to provide additional context when considering the options to improve the opportunities for DSP in the NEM.

Sincerely,



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Review of PJM & ERCOT Demand Response Market Design Elements and Participation Rates

Prepared for EnerNOC
Prepared by Jeff Bladen
KEMA Inc
May 4, 2012

Table of Contents

1. Purpose and Scope of Review

1.1 Purpose

The purpose of this analysis is to describe the major demand response design similarities and differences of the two market regions in the U.S. that most closely resemble the wholesale power market of eastern Australia. Further, this review will identify market design elements that may warrant additional investigation.

1.2 Scope of Review

- Review the core demand response wholesale market design elements of the two markets in the U.S. that are commonly held up as the most highly competitive in the U.S. and most similar to eastern Australia; the PJM Interconnection and ERCOT.

- Review the level and vibrancy of retail competition in the regions covered by ERCOT and PJM based on proprietary KEMA data.

- Review the level of demand response participation in PJM and ERCOT at an aggregate level based and provide a qualitative assessment of demand response participation rates and factors that warrant further study as potentially causative.

- Indicate where opportunities exist to test anecdotal evidence providing a proposed roadmap for how best to support the Australian Commission's effort to " improve the opportunities for DSP" in eastern Australia.

2. PJM and ERCOT Demand Response Market Elements

The PJM interconnection and Electric Reliability Council of Texas (ERCOT) wholesale markets are considered the most competitive organized electricity markets in the United States. These markets and control areas have many similar elements starting with their reliance on a security constricted centralized dispatch model that levers location marginal prices to produce the most economical power prices given the resources available at any given time and location. In recent years, both market operators have focused on the development of demand elasticity within their regions as a means to further facilitate the most economically efficient dispatch.

As described below, likely the most substantive distinction between the approaches taken by PJM and ERCOT relates to the method for end-users to respond to energy prices under non-emergency and non-ancillary service related conditions. In PJM, end-users are provided the opportunity to work with an aggregator other than their retail provider to facilitate response to wholesale hourly spot market prices. The end-user is, in turn, compensated on the basis of those same wholesale market rates for verified demand response. In ERCOT, by contrast, the only way end-users can respond to such prices is through the use of that end-use customer's retailer. No third party method for this sort of non-emergency offering is provided for in the ERCOT market design at this time although it remains under consideration. Under current market rules, if the end-user in ERCOT has not negotiated a retail contract that passes through wholesale market rates, any demand response activity would only accrue benefits based on the retail rate otherwise in use.

2.1 PJM Interconnection

PJM Interconnection is a regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia. Acting as a neutral, independent party, PJM operates a competitive wholesale electricity market and manages the high-voltage electricity grid to ensure reliability for more than 60 million people comprising almost 20% of U.S. energy consumption.

PJM's wholesale electricity markets provide opportunities for end-use customers to realize value for reducing their demand for electricity. Demand response is an integral part of PJM's markets for energy, day-ahead scheduling reserve, capacity, synchronized reserve and regulation. *Demand response can compete equally with generation in these markets.*

In PJM's Energy Market, end-use customers participate in demand response by reducing their electricity use either during an emergency event or when locational marginal prices (LMPs) are high on the PJM system. End-use customers participate in demand response in PJM through members called curtailment service providers (CSPs), who act as agents for the customers. Under this market design, end-use customers have the ability to both hedge their long term energy requirements while also providing demand response energy back to the wholesale market when spot market prices provide such an incentive. Under this construct the magnitude of spot market price spikes is not muted to end-use customers when those customers have previously hedged their long-term energy requirements at a predictable level.

The methods for scheduling and settling directly offered demand response in PJM are available publically, but not reviewed in this report. However, KEMA has previously produced exhaustive research into the validity and operational requirements associated with using such methods including the settlement method known as demand response baselines.

2.2 ERCOT

The Electric Reliability Council of Texas (ERCOT) manages the flow of electric power to 23 million Texas customers – representing 85 percent of the state's electric load. As the independent system operator for the region, ERCOT schedules power on an electric grid that connects 40,500 miles of transmission lines and more than 550 generation units.

ERCOT also performs financial settlement for the competitive wholesale bulk-power market and administers retail switching for 6.6 million premises in competitive choice areas. ERCOT's members include consumers, cooperatives, generators, power marketers, retail electric providers, investor-owned electric utilities (transmission and distribution providers), and municipal-owned electric utilities.

ERCOT has developed demand response products and services for customers that have the ability to reduce or modify electricity use in response to instructions or signals. Loads may

participate by offering directly into the ERCOT markets or indirectly by voluntarily reducing their energy usage in response to wholesale prices.

ERCOT procures Emergency Response Service (ERS) by selecting qualified loads and generators (including aggregations of loads and generators) to make themselves available for deployment in an electric grid emergency. ERS is a valuable emergency service designed to decrease the likelihood of the need for firm Load shedding (a.k.a, “rolling blackouts”). Customers meeting ERS criteria may offer to provide the service through their qualified scheduling entities (QSEs).

In addition to ERS, commercial and industrial customers with interruptible loads that can meet certain performance requirements can qualify to become Load Resources and provide operating reserves in the ERCOT ancillary services (AS) markets. In the AS markets, the value of a Load Resource’s load reduction is equal to that of an increase in generation by a generating plant. Load Resources that are scheduled or selected in the ERCOT Day-Ahead AS Markets are eligible to receive a capacity payment regardless of whether they are actually curtailed.

In ERCOT, A customer may also decide independently to reduce consumption from its scheduled or anticipated level in response to price signals or high demand on the ERCOT system. This is known as Voluntary Load Response. As described below, the vast majority of retail contracts, however, are crafted to provide a level and predictable price hedge to the end-use customer. As such, the magnitude of spot market price spikes is muted to end-use customers when those customers have previously hedged their long-term energy requirements at a predictable level.

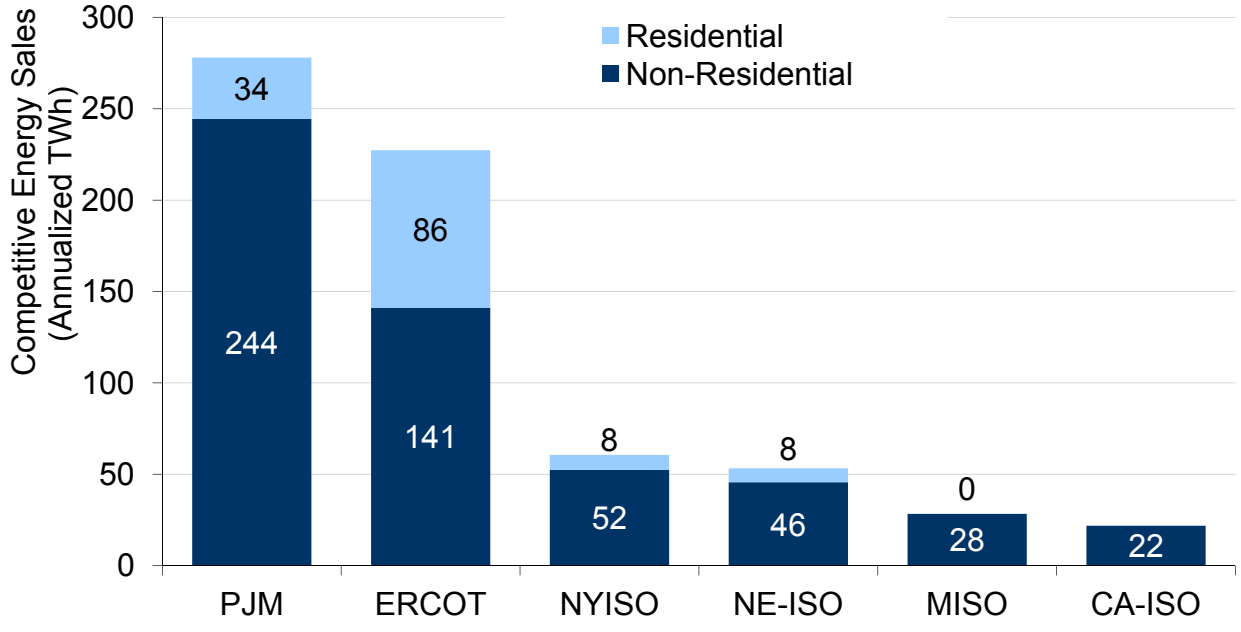
3. Relative levels of Retail Competition

The fundamental retail market design in ERCOT requires that all customers select a Retail Electric Provider (REP). If no selection is made, customers are assigned to a REP that has contracted to be the default retail supplier. By contrast, in states within the PJM region where retail competition exists, customers that fail to choose a retail supplier remain on a utility tariff that often includes only limited market based adjustments and is not a fully realized retail contract nor is it indexed to spot market prices. For residential consumers who receive their commodity from a competitive supplier, nearly all receive fixed price/kwh rates. Rates may have some variance by time of year and more rarely by period of day. In neither ERCOT nor

PJM are hourly spot market indexed retail contracts common and might well be described as rare. Even for the largest industrial sites, contract prices indexed to the hourly spot market are the exception rather than the rule.

The PJM and ERCOT regions represent the two most vibrant regions in the U.S. for retail completion. Both regions individually have more energy supplied under competitive retail contracts than in all of the other organized wholesale markets in the U.S. combined (see Figure 1). With relatively minor differences in retail market design and common contract types, The ERCOT and PJM markets represent a reasonable baseline upon which to examine the potential for demand response participation given both a competitive wholesale and retail market construct.

Figure 1
Total ISO chart - Competitively Served (Migrated) Retail Sales Volume – 2011

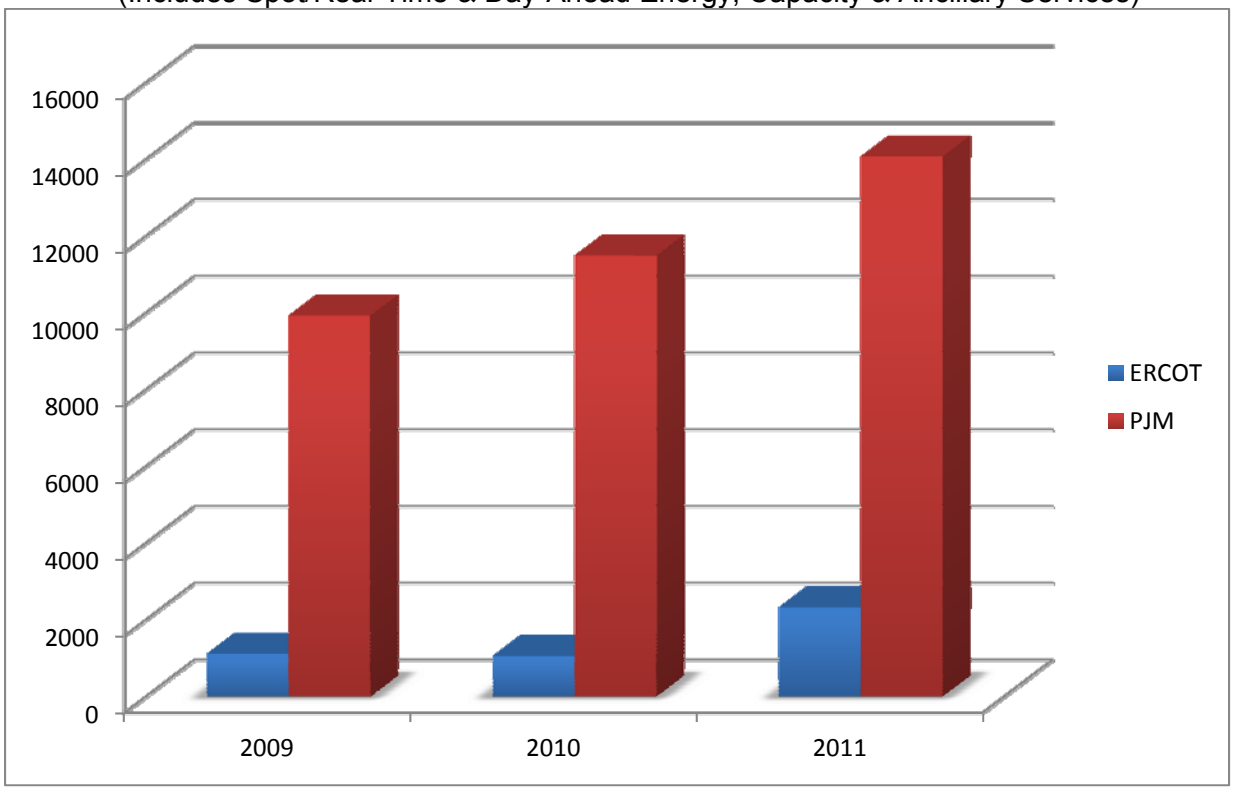


4. Relative Levels of Demand Response Participation

Given the vibrant levels of competitive electric switching in both the PJM and ERCOT regions, the relative difference in penetration of active demand response actively between the two markets is somewhat surprising. As noted in Figure 2, total demand response enrolled and participating in PJM is significantly greater than that in ERCOT.

This dichotomy suggests anecdotally that some element(s) of the wholesale market design may contribute to the different levels of demand response participation. As noted earlier, both PJM and ERCOT provide means for end users to directly participate as an emergency resource and an ancillary service. The primary area of wholesale market design difference lies in the ability in PJM for end users to voluntarily and at their own direction offer and be compensated at market rates for demand response scheduled through an aggregator into the wholesale energy market. Such activity can occur without concurrence from their retail service provider or the need to forgo a long-term retail price-hedging contract.

Figure 2.
Total MWs of Demand Response Enrolled
(Includes Spot/Real-Time & Day-Ahead Energy, Capacity & Ancillary Services)



*ERCOT data does not include "Voluntary Load Response" as it is not tracked or reported
**Some end-use sites are enrolled as multiple resource types

5. Conclusions and Recommendations

This report describes dramatic differences in levels of demand response participation in PJM and ERCOT; two markets with many similarities to those in Australia. Given this experience

and on the basis of our own experience working in the design and implementation of demand response in wholesale and retail markets, we believe it likely that PJM's market design elements play a material factor in the high levels of demand response participation in the PJM market region. While firm conclusions cannot be drawn solely on the basis of this report's review, it is reasonable to suggest that the primary differences described herein are at least a contributing factor in the different levels of participation noted in this report.

We recommend the Australian Energy Market Commission give serious weight to the clearly demonstrated performance of PJM's market design in attracting significant levels of demand response. Next steps in an investigation should include an examination of technical impediments to implementing direct market access for demand response of the sort described in the PJM region. The Commission should also assess the economic value that would accrue to consumers were levels of demand response in Australian markets to reach those experienced in PJM.

In addition, further study of the value of various market design elements should also be given serious consideration. KEMA recommends the Commission undertake a comprehensive assessment of wholesale market design elements for demand response used elsewhere. The purpose of this study is correlate design elements in markets with both high and low levels of demand response participation for their relative contribution to the participation rates. Such work would provide long-term benefit to the ongoing investigation into ways to improve DSP opportunities in Australia.

Some proposed areas of additional study could include:

- Assessment of major wholesale power markets' demand response participation rates including the development of a model for assessing correlation between market design elements and levels of demand elasticity in the market.
- Evaluation of effectiveness of demand response base-lining methodologies used to validate demand response activities in areas that provide direct wholesale market access or otherwise require such validation.
- Examination of demand response participation rates by retail rate types and correlation with wholesale market direct access option availability.
- Evaluation of end-use customer behavior when default retail rate option is spot market index.
    - Are hedge contracts actively used to mitigate risk and mute price signals?
    - Are customers more or less likely to participate as demand response?

6. KEMA's qualifications

6.1 KEMA Staff Bio

Jeff Bladen, Principal

Mr. Bladen has more than 16 years of management experience in the energy sector. As VP and Leader for KEMA's Markets & Regulation practice Mr. Bladen ensures our clients receive the high caliber work product DNV KEMA is known for. Immediately Prior to DNV KEMA, Mr. Bladen served as an executive with Mark Group, a global leader in energy efficiency service delivery and Comverge, a leading demand response provider. Previously he led wind farm development strategy at Gamesa's North American division. As an officer and the number two business leader, he oversaw the business unit's investment committee and other responsibilities covering the gamut of the business from strategic planning to project development and sales efforts.

Prior to Gamesa, Mr. Bladen served as market strategy leader at PJM Interconnection; the largest electricity market operator in the world. In that role, he led PJM's market strategy sub-division directly overseeing departments focused on retail markets, demand response, alternative and renewable resources, and economic analysis. Achievements included development and permanent market design for demand response in energy, capacity and ancillary services markets. Mr. Bladen has other significant energy industry experience as he was one of the original employees that built New Energy Ventures from a start-up energy business into the most successful competitive retail electricity business in North America; today known as Constellation NewEnergy.

6.2 Recent Selected Experience

PJM Interconnection

Empirical Analysis of Demand Response Baselines (2011)

PJM established the Load Management Task Force to focus on improving capacity based demand response products. Based on practical experience gained with the first mandatory test requirement conducted in the summer of 2009, the LMTF had become concerned with the lack of specificity for the current guaranteed load drops methods. These methods are used to determine the load reduction under emergency conditions for DR resources with a firm capacity commitment. The Markets Implementation Committee, requested PJM staff to move forward with an empirical analysis of a variety of customer baseline ("CBL") methods used to measure performance in the energy and capacity markets.

KEMA performed a comprehensive examination of the issues surrounding the development of accurate baselines. Specifically, the project:

- Determined the accuracy and bias of a variety of CBL methods;

- Determined the feasibility of administering each CBL method for all market participants under consideration; and
- Identified objective criteria to associate a customer load with a specific CBL method if this will result in significantly improved accuracy, less bias and less variability.

NY ISO Impact of Dispatchable and Dynamic Demand Response.

KEMA worked with the NY-ISO to develop Demand Response Potentials by type of resource and identify potential penetrations of dispatchable demand response (DDR) and dynamic pricing demand response (DP) on NYISO's system by 2020. As part of the project, KEMA developed a model to assess Market Integration of Demand Response to examine real time energy markets and explore dynamics by capturing the timing of clearing and dispatch. As part of the project, KEMA determined impacts on market prices and supply dispatch and examined successful ways for integrating DP and DDR resources. Key findings from this analysis include:

- The technical and market impacts of integrating DDR & DP depend on: the penetration of each end use/technology; the frequency and timing of the price signal; and the relative duration & latencies of DDR & DP compared to the frequency of the market dispatch & price publication.
- Inefficiencies may be introduced by forecast errors related to sampling current load. This is because the current load includes DP responding to the last period's prices, but which will change according to the next period's prices. Whether DP shows up in the sampled load depends on its duration, latency, and what market price signal it is responding to. These load forecast errors can contribute to added volatility in the markets and dispatch.
- Accurately estimating actual demand elasticities can help dispatch processes correctly anticipate DP. Developing methods for adjusting elasticity estimates over time, similarly to how load forecast estimates are adjusted, would help limit the consequences of mis-estimating demand elasticity.
- Many demand resources are better suited to hourly or 15 minute prices than to real time (5 minute). As such, the relationship between the capability of demand resources and the prices they are subject to should be given consideration.
- Self-optimizing customers (SOC) can optimize their loads against day-ahead prices and have an impact on intra-day markets by creating a complex effect similar to not estimating elasticity correctly.

Automated Demand Response and Storage Integration Study, California Energy Commission. As a subcontractor to Lawrence Berkeley National Laboratory (LBNL), KEMA assisted with developing a framework to examine the potential for automated demand response to augment grid scale storage to maintain grid stability and reliability. Specifically, KEMA provided guidance on the ancillary services needed under the 33% renewable portfolio standard scenario. We examined how the necessary response times and duration of different California Independent System Operation (CAISO) products may correspond to various automated demand response shed strategies and characteristics. KEMA provided recommendations for

key areas of research to better understand mechanisms for incorporating automated demand response resources into the CAISO markets and grid operations.