Development of Demand Response Mechanism

Baseline Consumption Methodology – Phase 1 Results

Australian Energy Market Operator
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Prepared by DNV KEMA
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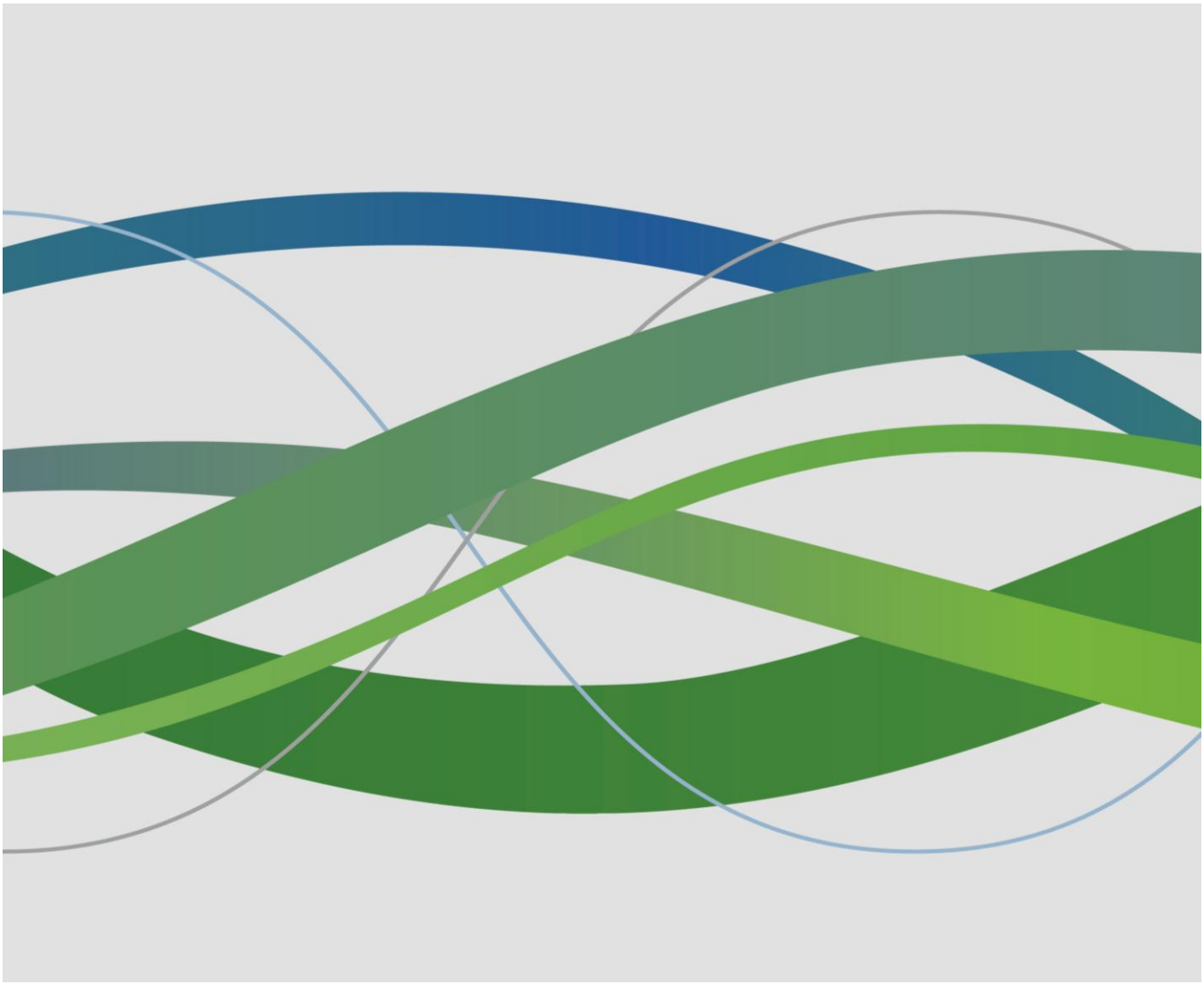

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1. Introduction

1.1 Purpose

The Australian Energy Market Operator (AEMO) hired DNV KEMA to provide advice on the construct and concepts surrounding the development and implementation of a baseline consumption methodology for the implementation of the Demand Response Mechanism (DRM) in the National Electricity Market (NEM). The purpose of this study is to provide AEMO with technical advice regarding the following:

- How has DRM and baseline consumption methodology been *implemented* in other electricity markets;
- Identify components of DRM and baseline consumption methodology that *perform well* and those that *need improvement* in other electricity markets;
- What *lessons can be learnt* to advise AEMO on the development of the baseline consumption methodology for the DRM implementation in the NEM; and
- *Test the efficacy* of potential baseline consumption methodology options using customer data provided by AEMO.

The study is being conducted in two phases. Phase 1 includes research into the baseline methodologies in use at the various United States (US) Independent System Operators (ISOs). Phase 2 involves the testing of the efficacy of potential baseline consumption methodologies for use in NEM.

This report presents the results of Phase 1.

1.2 Overall Approach

For Phase 1, DNV KEMA conducted a literature review and interviewed managers or directors of six ISOs on their development and administration of demand response customer baseline methodologies. The research gathered information on the demand response baseline methodologies at the following six US ISOs:

1. California Independent System Operator (CAISO),
2. Electric Reliability Council of Texas (ERCOT),
3. Midwest Independent System Operator (MISO),
4. Independent System Operator of New England (ISO-NE),
5. PJM Interconnection (PJM), and
6. New York Independent System Operator (NYISO).

1.2.1 Literature Review

The literature review focused on publicly available business and technical process manuals published by each of the ISOs. In addition to the manuals, several reports compiling statistics were available from federal agencies such as the Department of Energy (DOE) and the Federal Energy Regulatory Commission (FERC) and other sources such as the Independent System Operator/Regional Transmission Operator Council (ISO/RTO Council). A complete list of sources is provided in Appendix A - Bibliography.

1.2.2 ISO Interviews

The purpose of the interviews was to gather information not necessarily found in the technical manuals. The interviews focused on four broad areas including:

1. Current and Future Baselines
    - Methodologies and adjustment mechanisms;
    - Method of calculation, i.e., retrospectively or prospectively;
    - Reasons for selecting the specific method;
    - Challenges associated with the selected methodology; and
    - Evaluation of baseline performance.
    - Plans for examining or making modifications to the existing baseline
2. Participants
    - Process for selecting a specific baseline for a participant;
    - Dispute resolution process;
    - What to do if there is no historical data available for a participant; and
    - Level of ISO interaction with participants.
3. Data Administration
    - Submission of data;
    - Entity responsible for data submission and administration;
    - What happens to "questionable" data;
    - Rules for excluding data; and
    - Software used to process/administer the data.
4. Baseline Performance and Gaming
    - Triggers for baseline review;
    - Audits for performance;
    - Changes to baselines, i.e., when, why, and how often;

- Public reporting requirements;
- Timing of Notification, and
- Concerns/observations regarding gaming.

The interview guide of questions was initially developed by DNV KEMA with additional questions posed by AEMO staff incorporated into the final guide. The interviews were conducted over the phone, and were about an hour in length (with one exception where the respondent preferred to provide written responses). Results from the interviews are presented in Section 4 and individual interview responses are included in Appendix B - Interviews.

2. Overview of ISO Demand Response Products

Figure 1 presents a map of ISO/RTO operating regions. The map is provided to include some geographic perspective with regards to the areas governed by the ISOs. CALISO, ERCOT, and NYISO cover single states. The MISO covers the largest geographical area. PJM reaches from Illinois to the New Jersey shore with ISO-NE covering the entire Northeast. It is important to note that the ISO coverage areas continue to evolve, e.g., MISO will expand south into Louisiana this year.

Figure 1 – Map of US and Canadian ISO and RTOs[1]

Figure 2 presents a graph of the demand response subscribed into each of the ISOs in 2010. The top of the graph presents the total MWs of enrolled DR. The bottom of the graph normalizes the enrolled DR based on the size of the respective systems. PJM had the greatest amount of subscribed load with over 13,000 MW representing just over 10% of their system. MISO is second in terms or total MWs of enrolled DR. ISO-NE, MISO, and NYISO all have between 7-8% of their system supported by DR. In the U.S. only ISO-NE sets its peak demand in the winter with all other ISO/RTOs setting their peaks

[1] http://www.isorto.org/site/c.jhKQIZPBImE/b.2604471/k.B14E/Map.htm

during summer hot weather conditions. However, more recently, ISO-NE has begun to have dual peaks in summer and winter that are nearly equivalent.

Figure 2 – 2010 Available Demand Response by ISO

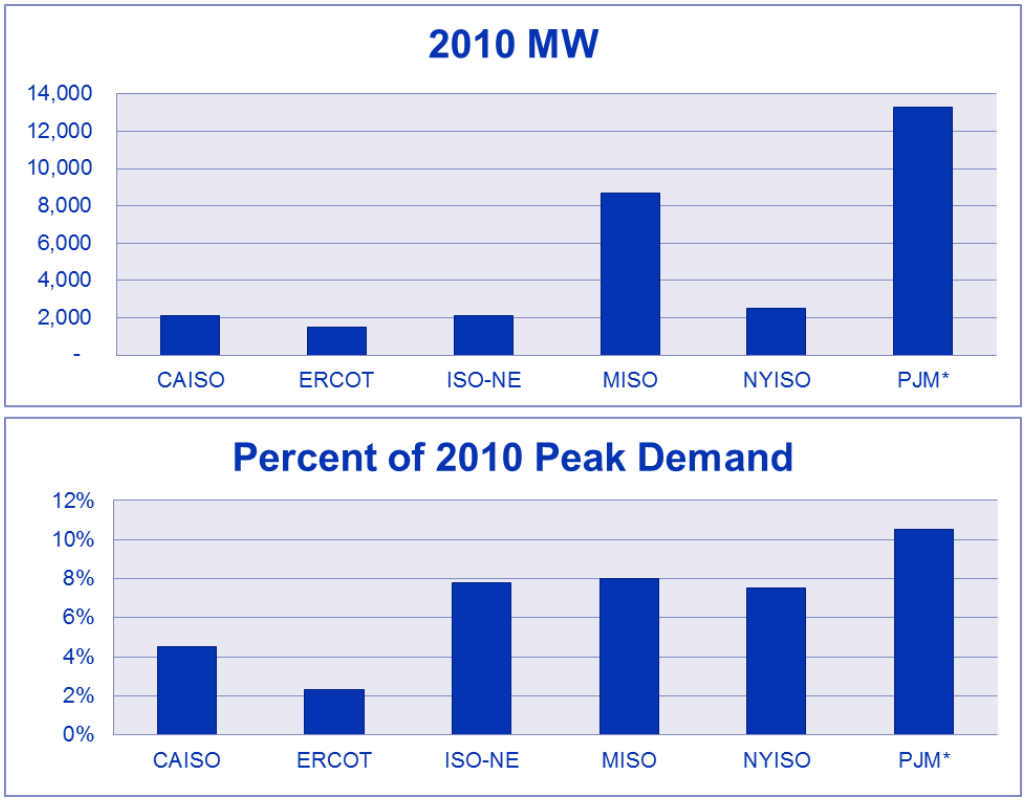

Table 1 outlines the functional role of each of the ISOs as outlined by the North American Electric Reliability Corporation (NERC) whose mission it is to ensure the reliability of the bulk power system in North America.

Table 1 – NERC Functional Model Registration by ISO[2]

NERC Functional Model Registration	CAISO	ISO-NE	MISO	NYISO	PJM
Balancing Authority	X	X	X	X	X
Interchange Authority		X	X	X	X
Planning Authority	X	X	X	X	X
Reliability Coordinator		X	X	X	X
Resource Planner		X		X	X
Transmission Operator	X	X		X	X
Transmission Planner		X		X	X
Transmission Service Provider	X	X	X	X	X

2.1 California ISO

The California ISO energy markets (day-ahead, hour-ahead and real-time) use a full network model that models transmission losses and reactive power load and produces prices at every point in the system. The day-ahead market determines hourly market-clearing prices and unit commitments, analyses unit must-run needs and mitigates bids if necessary, which produces the least cost energy while meeting reliability needs. The real-time market is a spot market to procure energy (including reserves) and manage congestion in the real-time after all the other processes have run. This market produces energy to balance instantaneous demand, reduce supply if demand falls, offer ancillary services as needed and in extreme conditions, curtail demand.[3]

The California ISO (CAISO) currently offers two demand response products as presented in the table below.

[2] NERC Functional Model registrations submitted effective as of the end of 2009. 2010 ISO/RTO Metrics report. ERCOT registrations were not available.

[3] http://www.caiso.com/market/Pages/MarketProcesses.aspx

Table 2 – CAISO Demand Response Products[4]

Name	Service Type	Minimum Eligible Resource Size	Aggregation Allowed	Primary Driver
Proxy Demand Resource Product	Energy	100 kW	Yes	Economic
Proxy Demand Resource Product	Reserve	500 kW	Yes	Economic

Aside from determining capacity requirements and operating wholesale markets, the CAISO has a relatively limited role in the current DR portfolio. This is due to the influence of the electricity crisis in 2000 and the return to California Public Utilities Commission-regulated utility demand response programs[5]. In addition, the demand response participation in other ancillary services markets is currently limited in the Western Interconnection by Western Electricity Coordinating Council rules. CAISO intends to address these issues through its demand response initiatives with the proxy demand resource product and as part of a multi-year ancillary services redesign initiative[6].

In California, unlike Australia, energy users supply needs are now primarily served by vertically integrated utilities. While some consumers (mostly large industrial or commercial users) are still served by competitive providers this is only done subject to grandfathering that remains in place after California retreated from liberalized electricity sales after its energy crisis. In addition, only retail energy suppliers (primarily vertically integrated utilities) are allowed to offer demand response directly to the ISO markets. This may change in the near future however as a market development effort is currently underway to more directly include DR into the market (see referenced DR roadmap below).

The California ISO did not have any DR deployments during summer 2012, but the ISO did issue several Flex Alerts in August 2012. Flex Alert is a CAISO program that encourages California consumers to voluntarily conserve electricity and shift demand to off-peak hours when the ISO issues an alert.[7]

In June of 2013, CAISO issued for comment a draft demand response and energy efficiency roadmap[8]. At the highest level the roadmap recognized the need to better integrate DR and EE into the fabric of how the wholesale market addresses balancing supply and demand. While limited in specific implementation

[4] Source: ISO/RTO Council, *North American Demand Response Program Comparison*, 2011.

[5] California Independent System Operator Order 719 Demand Response Barriers Study, Freeman, Sullivan & Co. and Energy and Environmental Economics, Inc. April 28, 2009.

[6] Source: ISO/RTO Council, *ISO/RTO Metrics Report*, 2010, p.60

[7] Assessment of Demand Response & Advanced Metering FERC Staff Report, December 2012.

[8] http://www.caiso.com/Documents/Draft-ISODemandResponseandEnergyEfficiencyRoadmap.pdf

details, this roadmap sets the stage for new paths for DR to participate directly in ISO operated markets in the near future.

2.2 Electric Reliability Council of Texas

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 6.7 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.[9] Customers served by cooperatives and municipal-owned utilities do not have competitive choice.

ERCOT is unique in the U.S. power grid as it remains electrically isolated from the rest of the eastern and western interconnected systems (including Canada & Mexico) with only very limited DC ties to outside networks. This unique single state physical network configuration also results in much more limited federal oversight of ERCOT. As such, unlike other RTOs and ISOs in the U.S. that are pure wholesale oriented entities, ERCOT is almost exclusively regulated by a state policy that coordinates both wholesale and retail market rules. In this environment, its wholesale markets and systems are designed more closely in tandem with state regulated retail electricity market policies. ERCOT's role extends beyond that of other RTOs to include some aspects of retail market facilitation.

Among the key features that result from this unique physical and regulatory construct is ERCOT's role in facilitating competition at not only the wholesale market level, but also at the retail level. ERCOT serves as the primary facilitator of Texas' highly liberalized retail market for electricity. This includes serving as the agency responsible for managing and processing switch requests to move consumers among competing providers. It is also the meter data management agent for those customers and their providers.

Beyond its unique retail facilitation role, among the U.S. RTOs & ISOs, ERCOT's markets construct and technical role most closely matches with that of the AEMO. In a key similarity with the Australian market, ERCOT also operates an "energy only" market with the highest price regimes in the U.S. Beginning in 2014, ERCOT spot prices will be allowed to rise as high as $9000/MWh during extreme scarcity. Most other RTOs have caps on prices at around $1000/MWh. The clear intent of these price mechanisms is to better signal the value at scarcity to both electricity supply and demand.

[9] http://ercot.com/about/

In the last four years, ERCOT has begun to allow third party aggregation for demand response in limited forms. Such DR is given access through stand-alone demand response emergency programs described in the table below. The public utility commission of Texas currently has an open docket examining as part of its resource adequacy investigation if such access should be made broader to include third party aggregation in the energy market.

Table 3 below presents the demand response products offered by ERCOT.

Table 3 – ERCOT Demand Response Products[10]

Name	Service Type	Minimum Eligible Resource Size	Aggregation Allowed	Primary Driver
Emergency Response Service	Capacity	1 MW	Yes	Reliability
Non-Controllable Load Resources providing Responsive Reserve Service -- Under Frequency Relay Type	Reserve	100 kW	No	Reliability
Controllable Load Resources providing Responsive Reserve Service	Reserve	100 kW	No	Reliability
Load Resources providing Non-Spinning Reserve Service	Reserve	100 kW	No	Reliability
Controllable Load Resources providing Regulation Service	Regulation	100 kW	No	Reliability

In addition to the products listed above, ERCOT is running a pilot program to test Emergency Response Service for weather sensitive loads. The pilot started on June 1, 2013 and will run for the summer period.

2.3 ISO New England

ISO New England is a regional transmission organization (RTO) with three primary responsibilities:

[10] ISO/RTO Council, *North American Demand Response Program Comparison*, 2011. Updated to reflect change from Emergency Interruptible Load Service to Emergency Response Service as per phone interview with Carl Raish on June 10, 2013.

- Minute-to-minute reliable operation of New England's electric power system, providing centrally dispatched direction for the generation and flow of electricity across the region's interstate high-voltage transmission lines.
- Development, oversight, and fair administration of New England's wholesale electricity marketplace, through which electric power has been bought, sold, and traded since 1999.
- Management of comprehensive planning processes for the electric power system and wholesale markets.[11]

Like some other ISO/RTOs, ISO-NE uses a capacity market in addition to energy and ancillary services markets to deliver on its regulatory mandates. The capacity market mechanism for resource adequacy has been one of the primary draws of demand response to the ISO-NE markets. Many reasons exist for why demand response is drawn to participate in a capacity market, but one key factor is relatively low bid-price caps ($1000) in the ISO-NE region in the energy market limiting the benefits to DR of actively offering hourly energy on a regular basis.

ISO-NE's region is largely liberalized at the retail energy supply level, but ISO does manage any retail data or otherwise directly facilitate retail competition. Such competition has not, in and of itself, provided meaningful incentives for demand response. In this environment, ISO-NE has actively pursued market designs intended to integrate demand response directly in the wholesale market through aggregation and baseline measurement and verification (M&V) methods for settlement.

ISO-NE's demand response products are presented in Table 4 below.

Table 4 – ISO-NE Demand Response Products[12]

Name	Service Type	Minimum Eligible Resource Size	Aggregation Allowed	Primary Driver
Real Time Demand Response Resource	Capacity	100 kW	Yes	Reliability
FCM: On-Peak Demand Resources	Capacity	100 kW	Yes	Reliability
FCM: Seasonal Peak Demand Resources	Capacity	100 kW	Yes	Reliability
Real Time Emergency Generation Resource	Capacity	100 kW	Yes	Reliability

[11] 2010 ISO/RTO Metrics Report, ISO/RTO Council.

[12] ISO/RTO Council, *North American Demand Response Program Comparison*, 2011. Updated to reflect expired programs as per phone interview with Henry Yoshimura on June 24, 2013.

Dispatchable Asset Related Demand	Reserve	1 MW	Yes	Economic

ISO-NE did not report calling on demand response resources from June to August 2012, although the ISO called upon Real-Time Price Response Loads several times in late May.[13] (Note: the Real-Time Price Response product is no longer offered.)

2.4 Midwest ISO

Participating in Midwest ISO are 34 transmission owners with approximately 93,600 miles of transmission lines and generation owners with 145,570 MW of electrical generation. In December 2001, MISO began providing reliability coordination services to transmission-owning members of MISO and their customers, as well as operations planning, generation interconnection, maintenance coordination, long-term regional planning, market monitoring, and dispute resolution services. In 2002, MISO began providing regional transmission services, and in 2005 MISO began operating a market-based, congestion management system while included a day-ahead and real-time energy market and a financial transmission rights market. In 2009, MISO began operating a market for ancillary services.[14]

The wholesale grid region managed by MISO is largely not liberalized for retail energy supply. As such, most demand response activity is delivered to the MISO through vertically integrated utility sponsored mechanisms rather than direct participation by end users in MISO markets.

Demand response products currently offered by MISO are presented in Table 5 below.

Table 5 – MISO Demand Response Products[15]

Name	Service Type	Minimum Eligible Resource Size	Aggregation Allowed	Primary Driver
Demand Response Resource Type I (Energy)	Energy	1 MW	Yes	Economic
Demand Response Resource Type II (Energy)	Energy	1 MW	No	Economic

[13] Assessment of Demand Response & Advanced Metering FERC Staff Report, December 2012.

[14] 2010 ISO/RTO Metrics Report, ISO/RTO Council.

[15] ISO/RTO Council, *North American Demand Response Program Comparison*, 2011.

Emergency Demand Response	Energy	100 kW	Yes	Reliability
Demand Response Resource Type-I (Reserve)	Reserve	1 MW	Yes	Economic
Demand Response Resource Type-II (Reserve)	Reserve	1 MW	No	Economic
Demand Response Resource Type-II (Regulation)	Regulation	1 MW	No	Economic
Load Modifying Resource	Capacity	100 kW	Yes	Reliability

The Midwest primarily met the 2012 summer heat wave loads through non-demand resources. The Midwest ISO declared an emergency event on July 17, 2012 (which gave the Midwest ISO the option to utilize emergency demand response resources), but wind generation unexpectedly increased and through voluntary conservation efforts the ISO did not have to turn to emergency demand response resources.[16]

2.5 New York ISO

The NYISO runs a day-ahead and a real-time market for electricity. In addition, the NYISO handles the scheduling of direct transactions between buyers and sellers (i.e., bilateral transactions). Roughly 98% of energy is scheduled in the day-ahead market, while the remaining 2% is accounted for in the real-time market. About half of the energy settled in the day-ahead market is scheduled through bilateral contracts.[17]

The NYISO administers a capacity market as well as competitive markets for key ancillary services such as reserves and regulation. Reserves and regulation are typically provided by generators; however the NYISO has opened these markets to include loads (demand-side providers).[18] The vast majority of demand response participation in the NYISO region is through its capacity market. The reasons are likely to be very similar to those in ISO-NE.

Table 6 presents the demand response products provided by NYISO.

[16] Assessment of Demand Response & Advanced Metering FERC Staff Report, December 2012.

[17] http://www.nyiso.com/public/about_nyiso/understanding_the_markets/energy_market/index.jsp

[18] http://www.nyiso.com/public/about_nyiso/understanding_the_markets/ancillary_services/index.jsp

Table 6 – NYISO Demand Response Products[19]

Name	Service Type	Minimum Eligible Resource Size	Aggregation Allowed	Primary Driver
Day-Ahead Demand Response Program	Energy	1 MW	Yes	Economic
Emergency Demand Response Program	Energy	100 kW (per Zone)	Yes	Reliability
Installed Capacity Special Case Resources (Energy Component)	Energy	100 kW (per Zone)	Yes	Reliability
Demand Side Ancillary Services Program	Reserve	1 MW	No	Economic
Demand Side Ancillary Services Program	Reserve	1 MW	No	Economic
Demand Side Ancillary Services Program	Regulation	1 MW	No	Economic
Installed Capacity Special Case Resources (Capacity Component)	Capacity	100 kW (per Zone)	Yes	Reliability

New York ISO called upon demand response resources in June and July 2012. NYISO called upon reliability demand response resources several times during June 20-22. In July, NYISO utilized reliability demand response resources on July 18, and a mix of economic and reliability demand response resources on July 17. NYISO did not report any large demand response deployments during August.[20]

2.6 PJM Interconnection

Currently, PJM administers a day-ahead energy market, real-time energy market, capacity market, financial transmission right congestion hedging market, day-ahead scheduling reserve market, synchronized reserve market and regulation market. PJM ensures sufficient black start service to supply electricity for system restoration, and also administers demand response programs that help increase operational efficiency and improve resource diversity.[21]

[19] ISO/RTO Council, *North American Demand Response Program Comparison*, 2011.

[20] Assessment of Demand Response & Advanced Metering FERC Staff Report, December 2012.

[21] 2010 ISO/RTO Metrics Report, ISO/RTO Council.

PJM is often considered the most successful market in the U.S. at attracting demand response participation. The most significant draw in PJM for DR is the three year forward contracting for resource capacity that occurs each year. This market, like ISO-NE and NYISO, simplifies the process for demand response resources to be paid for responding during peak conditions. Since reforming its capacity market in 2006 to include the three year forward procurement, PJM has seen demand response grow to more than 10% of its installed reserve margin.

PJM's market access for DR into ancillary services has also been generally well received if less well publicized. Particularly for spinning/synchronized reserves DR has played a significant part seeing large portions of the hour to hour reserves now provided by DR instead of generation.

Growth of DR in PJM's energy markets has been more muted. This is likely to be a result of relatively low bid-price caps ($1000) and the existence of the lucrative capacity market that effectively takes the place of scarcity rent seeking by DR in the energy markets.

Most of the advances PJM has made integrating DR into the wholesale market would not be possible without the implementation of sufficiently understandable baseline M&V methods.

Table 7 – PJM Demand Response Products[22]

Name	Service Type	Minimum Eligible Resource Size	Aggregation Allowed	Primary Driver
Economic Load Response (Energy)	Energy	100 kW	Yes	Economic
Economic Load Response	Reserve	100 kW	Yes	Reliability
Economic Load Response (Regulation)	Regulation	100 kW	Yes	Reliability
Emergency Load Response - Energy Only	Energy	100 kW	Yes	Economic
Full Emergency Load Response	Capacity	100 kW	Yes	Reliability
Full Emergency Load Response	Energy	100 kW	Yes	Reliability

[22] ISO/RTO Council, *North American Demand Response Program Comparison*, 2011.

PJM reported several large deployments of demand response resources in June and July 2012. It estimated 17,148 MWh in reductions from its economic demand response program over the month of June, and PJM issued hot weather alerts for June 20-21 instructing generators and transmission owners to defer unnecessary maintenance on plants and power lines. In July, PJM reported large demand response deployments from July 2 – 8 and July 16 – 18. PJM deployed economic demand response resources from July 2 – 8; however no emergency demand response was dispatched over this one-week period. PJM again utilized economic demand response resources on July 16, and a mix of economic and emergency demand response from July 17-18.[23]

[23] Assessment of Demand Response & Advanced Metering FERC Staff Report, December 2012.

3. General Overview of Baseline Methodologies

In this section we present a general overview of the terms and concepts surrounding baseline development to provide the overall context of demand response performance evaluation methodologies. Note the primary focus of our research is the Baseline Type-I.

The following sub-sections are excerpts from *Measurement and Verification for Demand Response Prepared for the National Forum on the National Action Plan on Demand Response: Measurement and Verification Working Group* (2013).

Overview

The electricity industry has been moving towards development and adoption of a common set of terminology, definitions, analysis methods and protocols for DR products and services in recent years. The North American Energy Standards Board (NAESB) has developed Business Practice Standards for demand response measurement and verification for wholesale and retail markets. The wholesale and retail standards were developed to be nearly the same, with some additional elements specific to retail business practices. A primary focus of the NAESB business practice standards is on M&V methods used for market operations and settlement, but the terminology applies also to other M&V applications.

The Federal Energy Regulatory Commission (FERC), which regulates wholesale markets only, has adopted the Phase 1 version of the NAESB standards for M&V in wholesale markets, and has issued a Notice of Proposed Rulemaking (NOPR) to adopt the Phase 2 version. The Phase 2 standards, ratified by NAESB membership, expand and clarify criteria described in Phase 1 Business Practice Standards.

Goals of the NAESB Business Practice Standards

The goals of the NAESB M&V standards are:

- Transparency: Facilitate market transparency by developing accessible and understandable M&V requirements for Demand Response products.
- Accountability: promote accurate performance measurement of DR resources by system operator(s), in dispatch, operations, management and market settlements.
- Consistency: Develop uniform and consistent methods and procedures applicable across all wholesale markets.

Performance Evaluation Methodologies

Performance evaluation methodology refers to the approach taken to estimate the demand reduction value of the product/service provided by a demand response resource. Five performance evaluation methodologies have been defined in the NAESB Business Practice Standards:

- **Maximum Base Load**: A performance evaluation methodology based solely on a Demand Resource's ability to maintain its electricity usage at or below a specified level during a Demand Response Event.
- **Meter Before / Meter After**: A performance evaluation methodology where electricity Demand over a prescribed period of time prior to Deployment is compared to similar readings during the Sustained Response Period.
- **Baseline Type-I**: A Baseline performance evaluation methodology based on a Demand Resource's historical interval meter data which may also include other variables such as weather and calendar data.
- **Baseline Type-II**: A Baseline performance evaluation methodology that uses statistical sampling to estimate the electricity usage of an Aggregated Demand Resource where interval metering is not available on the entire population.
- **Metering Generator Output**: A performance evaluation methodology in which the Demand Reduction Value is based on the output of a generator located behind the Demand Resource's revenue meter.

These five performance evaluation methodologies are shown with the four service types defined for demand response in the table below. The check marks indicate whether a performance evaluation methodology is applicable to specific product type.

Table 8 – NAESB Service Types and Applicable Performance Evaluation Methodologies (Table 3-1)

Performance Evaluation Methodology	Valid for Service Type			
	Energy	Capacity	Reserves	Regulation
Baseline Type I - Interval Metering	X	X	X	
Baseline Type II - Non-interval Metering	X	X	X	
Maximum Base Load	X	X	X	
Meter Before/Meter After	X	X	X	X
Metering Generator Output	X	X	X	X

Energy Performance Evaluation Methodologies

The NAESB performance evaluation methodologies serve as a way to characterize the type of measurement used to estimate the reduction of a demand response resource. This report focuses on Baseline Type I and Type II to estimate energy response because they are the most common performance evaluation methodologies in use; these methods are typically used to estimate the amount of energy provided by a demand response resource during an event or schedule. Some demand response programs also use the Baseline Type I or Type II methodology to calculate the capacity provided during a demand response event, as described later in this section in *Capacity Performance Evaluation Methodologies*. Baseline Types I and II are frequently referred to as the Customer Baseline Load, or CBL.

The other three performance evaluation methodologies that are in use may be combined with a Baseline Type I or Type II. Metering Generator Output may be used in combination with a Baseline method for a generator that is used outside of DR events as well as to respond to these events. Products and services that require historical data beyond the data used in a Baseline Type I or Type II may incorporate a Maximum Base Load calculation. Service types that require information closer to the real-time conditions of the demand response resource may use Meter Before/Meter After). As Table 3-1 indicates, most of the performance evaluation methodologies are applicable to all products and services. The design of the demand response program and the environment in which that program operates often provide the context for the performance evaluation methodology that will best align with the objectives of the program.

For Baseline Type I and Type II, the baseline calculation method can take many forms. The calculation method is specified by a combination of the baseline window, the exclusion rules, the calculation type, and the baseline adjustments and adjustment window. The combination of the baseline window and exclusion rule is intended to select days and hours that are similar to what the event day or period would have been absent the event. In many cases, the adjustments can make the baseline calculation less sensitive to the selection rules.

Examples of criteria for Baseline Type I are provided below.

Baseline Window:

A period of time preceding and optionally following a Demand Response Event over which electricity usage data is collected for the purpose of establishing a Baseline. Examples of baseline windows include:

- the last 10 non-holiday weekdays;
- the 10 most recent program-eligible non-event days;
- the 10 most recent program-eligible days beginning 2 days before the event;
- the last 45 calendar days; or

- the previous year.

Exclusion rules:

Rules for excluding data from the Baseline Window. Common exclusion rules include:

- Excluding days with DR events.
- Excluding days with outages, or force majeure events.
- Excluding days with extreme weather.
- Excluding days with the highest or lowest loads.

Calculation Type:

The method of developing the Baseline value using the data from the baseline window. Examples of calculation types include:

- Average value: for each hour of the day, calculate the average of the load at that hour over the included days.
- Regression: calculate load by regressing the load from the included days on weather and other variables, usually with separate regression coefficients by hour of the day.
- Maximum value: take the maximum of the loads in the included period.
- Rolling average: the updated unadjusted baseline for an operating day is equal to 0.9 times the prior unadjusted baseline plus 0.1 times the most recent included day.

Baseline Adjustments:

An additional calculation applied after the basic Calculation Type, to align the baseline with observed conditions of the event day. Factors used for adjustment rules may be based on, but are not limited to; Temperature; Humidity; Calendar data; Sunrise/Sunset time and/or; Event day operating conditions.

Examples of baseline adjustments include:

- Additive: add a fixed amount to the provisional baseline load in each hour, such that the adjusted baseline will equal the observed load at a time shortly before the start of the event period.
- Scalar: multiply the provisional baseline load at each hour by a fixed amount or scalar, such that the adjusted baseline will equal the observed load on average during a window of time shortly before the start of the event period.

Adjustment Window:

The period of time for which the adjusted baseline matches the observed load. The NAESB guidance is that the adjustment window shall begin no more than four hours prior to deployment. Examples of adjustment windows include:

- The hour before the event (hour -1).
- The 2 hours before the event (hours -1 to -2).
- The two hours that end two hours before the event (hours -3 to -4).

4. U.S. ISO Baseline Implementation

The Phase 1 literature review focused on publicly available business and technical process manuals published by each of the ISOs. In addition to the manuals, several reports compiling statistics were available from federal agencies such as the Department of Energy (DOE) and the Federal Energy Regulatory Commission (FERC) and other sources such as the Independent System Operator/Regional Transmission Operator Council (ISO/RTO Council). From these documents and our interviews with the ISOs, we compiled the baseline and adjustment methodologies for each of the ISOs, which are presented in this section. The process by which ISOs initially selected their baselines, key challenges, administrative requirements, and gaming considerations are also presented.

4.1 Baseline Methodologies

Baseline methodologies, the type of adjustment, and the corresponding demand response product type for each ISO are presented in Table 9. The baselines presented in this table focus primarily on baselines implemented in energy and capacity markets (but some are applicable in other markets such as the CAISO 10-in-10 baseline which is also implemented in California's reserve market). These baseline methodologies are the focus of this report. Additional non-baseline performance evaluation methodologies – behind the meter generation, maximum base load, and meter before/meter after – are discussed in Section 4.1.5. Excerpts of the technical and business practice manuals containing the detailed descriptions of each ISO's baselines and performance evaluation methodologies are included in the interview responses in Appendix B - Interviews.

Table 9 – Baselines and Adjustments by ISO and Product Type

ISO	Demand Response Product/Service Type				Baseline	Adjustment
	Energy	Capacity	Reserve	Regulation		
CAISO	X		X		CAISO-10-in-10	Scalar
ERCOT		X			ERCOT-Regression	Scalar
ERCOT		X			ERCOT-Mid 8-of-10	Scalar
ERCOT		X			ERCOT-Matching Day Pair	Scalar
ISO-NE		X			ISO-NE 90/10	Additive
MISO	X	X			MISO-10-in-10	Option of None, Weather-sensitive, or Multiplicative
NYISO	X	X			NYISO 5-of-10	Option of Weather-sensitive or Multiplicative
PJM	X	X			PJM 4-of-5	Option of Weather-sensitive or Additive

There are four general types of baselines: the "X of Y" baselines, the weighted average (or current and preceding day), regression, and matching day-pair.

4.1.1 "X of Y" Baselines

The most common type of baseline is the "X of Y" baselines. Five of the six ISOs we researched have an "X of Y" baseline available (ISO-NE does not have an "X of Y" baseline). Weekday "X of Y" baselines are listed in Table 10 and weekend "X of Y" baselines are listed in Table 11.

Table 10 – Weekday "X of Y" Baselines Used by US ISOs

ISO	Baseline Name	Average of	Out of
CAISO, MISO	10-in-10	10 most recent weekdays	10 most recent weekdays
ERCOT	Mid 8-of-10	10 most recent weekdays, dropping highest and lowest kWh days	10 most recent weekdays
NYISO	5-of-10	5 highest kWh days	10 most recent weekdays
PJM	4-of-5	4 highest kWh days	5 most recent weekdays

Table 11 – Weekend "X of Y" Baselines Used by US ISOs

ISO	Baseline Name	Average of	Out of
CAISO, MISO	10-in-10	4 most recent weekend days	4 most recent weekend days
ERCOT	Mid 8-of-10	10 most recent weekend days, dropping highest and lowest kWh days	10 most recent weekend days
NYISO	5-of-10	2 highest kWh weekend days	3 most recent weekend days
PJM	4-of-5	2 highest kWh weekend days	3 most recent weekend days

4.1.1.1 CAISO and MISO 10-in-10

The CAISO Standard Baseline is one of the "highest X out of Y most recent days" type, except that there are no excluded days (that is, X = Y):

- For weekday events, the baseline consists of the hourly loads averaged over the ten most recent days preceding the event, excluding holidays, weekend days, and event days.
- For weekend or holiday events, the baseline consists of the average hourly loads of the four most recent weekend or holiday days, excluding event days.

The loads in each event hour are averaged over the selected comparison days to form the baseline.

MISO also has implemented this baseline methodology.

4.1.1.2 ERCOT Middle 8-of-10

The ERCOT Middle 8-of-10 is similar to the other "X of Y" baselines except that the selection criterion for comparison days is to drop the highest and lowest kWh days out of the most recent ten. The hourly loads are then averaged over the remaining eight days for form the baseline. The weekday baseline is calculated from the ten most recent weekdays, and the weekend day baseline is calculated from the ten most recent weekend days.

4.1.1.3 NYISO 5-of-10

The NYISO Standard Baseline is another of the "highest X out of Y most recent days" type, with a selection criterion of the five highest kWh days out of the preceding ten non-holiday days (for weekday events), or the two highest out of the preceding three (for weekend or holiday events).

4.1.1.4 PJM 4-of-5

The PJM Economic Baseline consists of hourly loads averaged across the "highest X out of Y" most recent days, where X and Y are numbers that depend on day type:

- For weekday events, the baseline consists of the average hourly loads of the four highest kWh days out of the five most recent weekdays preceding the event, excluding holidays, weekend days, and event days.
- For weekend or holiday events, the baseline consists of the average hourly loads of the two highest kWh days out of the three most recent weekend or holiday days, excluding event days.

The loads in each event hour are averaged over the selected comparison days to form the baseline.

In 2011, PJM sponsored an analysis of the performance of a number of baseline methodologies and adjustment mechanisms. The results of the study found the current PJM 4-of-5 methodology with additive adjustment was consistently among the most accurate baselines. Other baselines demonstrated slightly better accuracy (10 of 10 and ISO-NE); PJM found the incremental benefits could not justify the incremental costs.[24]

4.1.2 Weighted Average

4.1.2.1 ISO New England 90/10

This baseline differs from the preceding ones, in that it consists of a weighted average of the preceding day's baseline and the current day's actual metered load. The baseline is updated on every non-event weekday. It is not calculated on weekends or holidays. On (weekday) event days, the baseline is defined as the previous day's baseline.

For a new asset with no previously computed baseline, the baseline is the simple average hourly load calculated for each hour of the day from the five most recent preceding business days with complete meter data. Since the asset isn't permitted to participate in a DR program during this initial five-day window, event days are not excluded for these calculations. (For purposes of a performance analysis, all of the accounts are "new" at the start of the file, or on the date they first enter the dataset, whichever comes later.)

[24] *Measurement and Verification for Demand Response Prepared for the National Forum on the National Action Plan on Demand Response: Measurement and Verification Working Group* (2013).

For an existing asset (i.e., one with at least five days of usable load data), the current-day baseline is obtained as follows:

- If the current day is an event day, the asset's baseline for the day is equal to the baseline from the previous day.
- If the current day is not an event day, then the asset's baseline is updated according to the following algorithm [Current day baseline = 0.9*previous day baseline + 0.1*current day metered load] for each hour of the current day.

4.1.3 Regression

4.1.3.1 ERCOT Regression

The ERCOT Regression Baseline is calculated using a regression model consisting of a daily energy equation, which has the customer's total daily kWh as the dependent variable, and 24 hourly energy fraction equations, in each of which is the dependent variable is the fraction of the daily load occurring in each hour of the day. The explanatory variables in the model include calendar variables (e.g., day of the week, holiday indicators, season), weather variables (dry-bulb temperature and various functions thereof), and daylight variables (e.g., daylight saving time, times of sunrise and sunset).

4.1.4 Comparable Day

4.1.4.1 ERCOT Matching Day Pair

The ERCOT matching day-pair baseline compares loads on the "business-as-usual" hours of the event day itself up to one hour before the start of event plus the entire 24 hours of the preceding day to like day-pairs in the preceding year, using the sum of squared differences to assess similarity and determine the final comparison day(s). The ERCOT baseline has the additional step of choosing multiple comparable days and then averaging over them to get the final baseline.

4.1.5 Other Performance Evaluation Methodologies

The baselines presented in the sections are primarily baselines implemented in energy and capacity markets and are the focus of this research. However, there are additional performance evaluation (non-baseline) methodologies implemented by US ISOs. These methodologies include the maximum base load, meter before/meter after, and behind the meter generation. These methods differ from the customer baselines above given they employ a pre-determined value (maximum base load), are calculated with a simple comparison of load right before the DR event to load during the response period (meter before/meter after), or are direct measurements of generator output (behind the meter generation). Table 12 lists these evaluation methods by ISO and their corresponding demand response product types. Note that the meter before/meter after evaluation methodology is more commonly used in the reserve and regulation markets than the baselines discussed above, and the behind the meter generation and maximum

base load are implemented in the energy and capacity markets to incorporate demand resources with generation and as alternatives to the Type-I baselines, respectively.

Table 12 – Other Performance Evaluation Methodologies by ISO and Product Type

ISO	Demand Response Product/Service Type				Evaluation Method Name	Performance Evaluation
	Energy	Capacity	Reserve	Regulation		
ISO-NE		X			ISO-NE-BMG	Behind-the-Meter Generation
MISO	X	X			MISO-BMG	Behind-the-Meter Generation
NYISO	X	X			NYISO-BMG	Behind-the-Meter Generation
PJM	X	X			PJM-BMG	Behind-the-Meter Generation
ERCOT		X			ERCOT-Alternate	Maximum Base Load
ISO-NE			X		ISO-NE-MBL	Maximum Base Load
MISO	X	X			MISO-Firm-Service-Level	Maximum Base Load
NYISO		X			NYISO-MBL	Maximum Base Load
PJM		X			PJM-MBL	Maximum Base Load
CAISO			X		CAISO-MBMA	Meter Before / Meter After
ERCOT			X		ERCOT-Reserves	Meter Before / Meter After
ERCOT				X	ERCOT-Regulation	Meter Before / Meter After
MISO	X	X	X		MISO-MBMA-Single-Read	Meter Before / Meter After
MISO				X	MISO-MBMA-Interval-Reads	Meter Before / Meter After
NYISO			X	X	NYISO-MBMA	Meter Before / Meter After
PJM	X		X	X	PJM-MBMA	Meter Before / Meter After

4.2 Baseline Adjustments

Many of the baseline methodologies include a day-of adjustment. This section describes the adjustments in more detail for each ISO.

4.2.1 CAISO

The CAISO baseline calculation includes a symmetric multiplicative adjustment, unless otherwise requested by the DRP and approved by the CAISO. The multiplier will be calculated by averaging the 4 hours prior to the event excluding the hour immediately prior to the event start and defined as a ratio of the average load for these three hours relative to the same 3 hour average of the CBL calculation data set. The same multiplier will be applied to each hour of the event, and will be capped at both a 20% increase and a 20% decrease.[25]

4.2.2 ERCOT

ERCOT applies an event day symmetric scalar adjustment to the baseline loads for any of the three default types, although the control group methodology for the ERS weather sensitive pilot does not include an adjustment.

4.2.3 ISO-NE

For each day ISO-NE calculates the Real-Time demand reduction amount of a Real-Time Demand Response Asset or Real-Time Emergency Generation Asset. The ISO will calculate an adjustment factor equal to the average difference (MW) between the asset's actual metered demand and its Demand Response Baseline in the intervals during the two-hour period beginning 2.5 hours prior to the start of the first interruption interval in the Operating Day. The adjustment factor will be added to the Demand Response Baseline in every interval of the day, which may increase or decrease the Demand Response Baseline. However, the resulting adjusted Demand Response Baseline in any interval shall not be less than zero and shall not exceed the asset's Maximum Load.[26]

ISO-NE previously used an asymmetric adjustment. In 2011, ISO-NE sponsored an analysis of the accuracy of their baseline[27]. One of the conclusions from that study was that asymmetric adjustments cause biased estimates of load reduction, so the adjustment was changed from asymmetric to symmetric.

4.2.4 MISO

The MISO baseline calculation includes the option of two day-of adjustments. The Demand Response Resource (DRR) delivering the energy product has an option at registration to select either a symmetric

[25] CAISO Business Practice Manual for Metering, Version 6, May 7, 2012

[26] From ISO-NE Market Rule 1:

[27] *Analysis and Assessment of Baseline Accuracy*, KEMA, August 4, 2011.

multiplicative adjustment or a weather sensitive adjustment. The Symmetric Multiplicative Adjustment (SMA) adjusts each baseline hourly value (MW) during the event up or down by the ration of (a) the sum of hourly demands for the three hours beginning four hours prior to the event and (b) the sum of those same three hourly baseline demands. This adjustment is limited to a change in any individual baseline hour of plus or minus 20 percent. The Weather Sensitive Adjustment adjusts each baseline hourly value (MW) up or down by a weather adjustment factor. The weather adjustment factor is determined by a mathematical relationship derived through a regression analysis that considers the DRR load and historical hourly consumption.[28]

4.2.5 NYISO

NYISO emergency and day-ahead CBL methods include an elective weather sensitive CBL method that is essentially a multiplicative adjustment of the basic CBL method.

4.2.6 PJM

PJM's standard CBL utilizes a symmetric additive adjustment, and there is also a weather sensitive adjustment.

4.3 Initial Baseline Development

The reasons for initially selecting the baseline calculations varied depending on the timing of ISO's implementation of demand response. The ISOs who implemented DR into the early market design (ISO-NE, PJM, and ERCOT) mentioned that there was no precedent set by others from which to draw experience and lessons learned, whereas MISO and CAISO were able to look to PJM and ISO-NE's experiences by the time they were implementing DR. Most ISOs mentioned the ultimate selection was based on feedback of the stakeholders during the implementation process. Additional specific reasons for selecting their baseline methodologies are as follows:

- ERCOT used the regression model from the start of their program, and then developed the middle 8-of-10 and day-pair matching method. ERCOT developed these other methods as a result of feedback from participants that the regression method was difficult for the service providers to replicate. ERCOT staff had previous experience with the day-pair matching method at another utility.

[28] MISO's *Demand Response Business Practices Manual BPM-026*, April 2013.

- MISO specifically mentioned that they were following the guidelines put forth by the NAESB, which was a well-informed process at the time.
- ISO-NE stated that accuracy was the primary driver for their baseline selection, and a secondary consideration was related to administrative issues, specifically data storage. Given the ISO-NE is a weighted average, it requires less data and is a simpler calculation than if it was a true rolling average.
- PJM selected their baselines based on three criteria[29]:
    1. The empirical performance of the baselines with respect to accuracy, bias, and variability,
    2. Administrative burden and the simplicity of implementation, and
    3. To minimize gaming or free-ridership.

4.4 Key Challenges

The primary challenges faced at the time the baselines were initially selected included lack of precedence set (for those ISOs who implemented DR before others) and getting final agreement from all of the stakeholders during the vetting process.

Current challenges ISOs face now that their baselines have been established vary by ISO:

- In California, the third party demand response providers are having issues obtaining the interval meter data from the load serving entities. CAISO initially envisioned receiving interval meter data on a regular basis, but really only receive data once an event has occurred.
- At ERCOT, participants have some difficulty replicating the regression methodology, so additional baseline methods were developed. ERCOT evaluates each baseline methodology for each participant every four months (the duration of a contract) which can be computationally intensive for ERCOT staff. In addition, there are large volumes of data to store in order to support the various methodologies.
- ISO-NE is faced with the issue of how to correct for interval meter data errors and the influence data errors have on the calculation of the 90/10 rolling average baseline. If the interval meter data are not initially accurate, then the ISO has to go back and re-calculate the baseline from the time of the inaccuracy, which can be onerous.
- NYISO is challenged by the data verification process.
- PJM has had difficulty determining a baseline for customers with highly variable load.

As a result of some of the current challenges, ISO-NE and PJM are actively evaluating certain elements of their methodologies. ISO-NE is analysing the issue of inaccurate meter data and is looking to determine a

[29] PJM recently conducted a study of baseline performance that was used to vet and establish an appropriate baseline methodology. *PJM Empirical Analysis of Demand Response Baseline Methods*, KEMA April 20, 2011

tolerance for the errors. PJM is working on developing a baseline methodology for highly variable load customers. Other evaluation activities include:

- MISO is planning to modify their methodology related to regulating reserves such as a meter before/meter after method.
- NYISO is conducting a study of baseline performance similar in nature to the PJM 2011 evaluation[30].
- ERCOT is conducting a pilot program during the U.S. summer months of 2013 for weather sensitive participants.

4.5 Administration of the Baselines

ISO-NE and CAISO each have just one baseline methodology for participants to use, so the process of determining the baseline for a particular resource is straightforward. For those ISOs with multiple baselines, the selection process varies somewhat. During the registration process, ERCOT evaluates all of the baselines for a participant and authorizes the best-performing baselines for that participant. The participant then chooses from the authorized baselines (please note: this can be limited to one methodology, if that is the case for that participant). ERCOT repeats this process for each contract period which is every four months. PJM has a similar process evaluating the baselines at the time of registration. However, PJM only evaluates the baselines on an annual basis. The PJM method for evaluating the baseline performance[31] is:

- All Economic registrations, except Economic Regulation Only registrations, should go through the CBL certification process to ensure that the CBL used to predict the customer load and therefore determine the quantity of each hourly load reduction is reasonably accurate and non-biased. All registrations should use a CBL with a relative root mean square error ("RRMSE") no greater than 20% unless otherwise approved by PJM. Registrations with a RRMSE greater than 20% based on hourly load data provided in the registration process are considered variable load customers.
- CBL certification is performed by the Curtailment Service Provider (CSP) prior to registration submission. CSP should always calculate an RRMSE for the standard CBL defined in the tariff. An alternative CBL may be requested if the alternative CBL is more accurate than the standard CBL and has an RRMSE less than or equal to 20%.

[30] *PJM Empirical Analysis of Demand Response Baseline Methods*, KEMA April 20, 2011

[31] *PJM Manual 11: Energy & Ancillary Services Market Operations*, Revision 59, April 1, 2013

- Relative Root Mean Squared ERROR (RRMSE) calculation is performed as follows unless otherwise approved by PJM:
  - To perform the RRMSE calculation, daily CBL calculations are first performed for the CBL method using hours ending 14 through hours ending 19 unless otherwise approved by PJM as the simulated event hours for each of the 60 non-event days according to the CBL method rules.
  - Actual Hourly errors are calculated by subtracting the CBL hourly load from the actual hourly load for each of the simulated event hours of the non-event day.
  - The Mean Squared Error (MSE) is calculated by summing the squared actual hourly errors and dividing by the number of simulated event hours.
  - The Average Actual Hourly Load is the average of the actual hourly load for each of the simulated event hours.
  - The Relative Root Mean Squared Error (RRMSE) is calculated by taking the square root of the MSE then dividing that quantity by the average of the actual load.

There are actions a participant can take if it does not agree with a baseline assignment from the ISO. Some ISOs have an option for the participant to develop their own methodology which must be approved by the ISO (MISO and PJM). Several of the ISOs mentioned they have a formal dispute resolution process (not specific to demand response) if there are unresolved issues. ERCOT reported that with their frequent evaluations of the baselines for each of the participants during the registration process, disputes rarely, if ever, occur.

If a customer has no historical data to establish a baseline, various approaches are taken:

- ISO-NE collects interval meter data for 10 days and establishes a baseline based on the 90/10 baseline methodology.
- PJM may use a similar customer's load as a proxy or may assign a conservative maximum base load value until enough meter data is available to test the other baselines.
- ERCOT uses an alternate "drop to" baseline.
- For the NYISO capacity market baseline (ACL), resources may enrol with a Provisional ACL that is subject to verification after their participation in the season in which they were enrolled with a Provisional ACL baseline.

The interview respondents generally reported that the ISOs have frequent interaction with demand response providers and/or participants. The frequency and intensity of the interaction varies depending on where the ISO is in their program cycle. That is, during program registration the ISOs are busy working with participants to register and authorize baselines (particularly, where more than one is offered such as PJM and ERCOT). Most ISOs reported having contact with participants or providers either daily or weekly. The nature of the interaction is generally to assist with understanding of the baseline calculation and meter data issues.

Once a DR event has occurred, the load reduction amount is calculated using the submitted interval meter data. In most cases, validated interval meter data is submitted by the demand response service provider after the event has occurred to the ISO, the ISO performs validation of the data, and the ISO calculates the baseline and load reduction. ERCOT receives the interval meter data from the transmission and distribution service provider. ISO-NE receives the data continuously from the DR providers and calculates the baselines every weekday, not just after an event has occurred.

When an ISO determines there may be erroneous or questionable data, it is general practice for the ISO to initiate a query about the data to the DR provider. In PJM's case, they forward the data for review by the Electric Distribution Company (EDC) and Load Serving Entity (LSE) who have 10 days to review the accuracy of the data. ERCOT will defer to a "drop by" baseline if data fails validation routines. NYISO may contact the distribution utility to obtain the revenue billing meter data for comparison. ISO-NE, CAISO, MISO have formal billing dispute resolution processes if load data issues are not resolved. ISO-NE may ultimately refer a participant to FERC which has enforcement capability.

Baseline methodologies generally incorporate exclusion rules. For example, a weekday calculation would not include recent weekend days, holidays, or event days. Other instances where data may potentially be excluded include emergency periods or if there were tests for a resource (ERCOT). Both ERCOT and PJM stated that they would likely exclude data if there were atypical levels of load such as periods of time when construction was taking place. PJM also mentioned that they occasionally see atypical values attributed to lightning, and would exclude those values as well.

CAISO, MISO, and PJM currently use software provided by ALSTOM (formerly Utility Integration Solutions) for their demand response system administration. ERCOT was also aware of this software, but does not use it.

None of the ISOs reported a particular trigger for conducting baseline performance reviews with the exception that ISO-NE stated they do conduct gaming reviews and certain behaviours may trigger a review specific to gaming. ERCOT and PJM both conduct baseline reviews for every participant upon the registration (and re-registration) process, which serves as their regular reviews for participants and how a particular baseline is performing for that participant.

For ISOs that have more than one baseline methodology, there are circumstances during which a participant may change their baseline methodology. ERCOT will review a participant's baseline during the contract period if the participant did not have enough data at the time of registration. PJM will review a participant's baseline if load significantly changes. ISOs reported that participants rarely change baselines. ERCOT finds that participants may change baselines according to what time of year it is, and that it is not uncommon for one baseline to perform well for a participant during one time of year, then switching to another authorized baseline for a different time of year.

None of the ISOs reported any reporting requirements that were specific to demand response baselines. ISO-NE reports on demand response in general, and their market monitor publishes a regular report. ERCOT publishes a DR event and contract report. Some of the ISOs have FERC filing requirements and/or answer occasional regulatory data requests.

4.6 Gaming

All ISOs considered gaming – or strategic behaviour – to be of concern, with the exception of one ISO who said participation is so low they do not consider it to be an issue at this time. The general feedback was that the concern is about paying a participant for something that they would do anyway without the program. An example of this is the situation when a participant includes a time period in their baseline when load was abnormally low (e.g., a planned outage). One ISO stated that they keep very informed about gaming issues in the industry by reading industry press and maintaining a close peer network.

Most ISOs have not observed gaming behaviour, with one exception. Participants at the ISO that has observed gaming behaviour were able to lock in high baselines and then participated in events as the season turned cooler and loads decreased. Behind the meter generation has also been an issue for this ISO. The timing of event notifications and the effects on participant load have been observed as well, but one ISO stated that these issues are harder to catch. One ISO commented that participants are very sophisticated, and it is possible for them to bid certain hours with almost certainty they will get picked up, then actively shift their load. Several of the ISOs reported that they did not believe the participants could respond in time to materially affect their baselines.

The ISOs that have experience with strategic behaviour by their participants have resorted to either changing the market rules, changing the baselines, or both.

4.7 Other Feedback

We asked the ISOs we interviewed for any additional comments or feedback regarding the development, implementation, and administration of demand response customer baselines. Several of the responses included the necessity of weighing the baseline performance with the simplicity of administration noting that administrative issues are not trivial. Two ISOs mentioned scalability is critical as they envision participation will increase over time. One ISO mentioned having DR expertise in the meter data group would have been helpful, as their DR expertise was mostly in the policy group who worked on developing the demand response products prior to implementation.

5. Key Findings

The level of baseline complexity is one of the key drivers of demand response adoption and activity rates. That is, the more complex the baseline method, the less likely the demand response mechanism will attract resources to register and participate. Administrative burden to the ISO to implement the baseline methodology (or methodologies) should be taken into consideration during the baseline selection process. Concerns about gaming or strategic behaviour are valid and have been observed in some instances, but these concerns must be weighed against raising unnecessary barriers to entry. Most US ISOs have preferred to start with simpler baseline methods, and some have performed evaluations of baselines as they have gained experience with their demand response mechanism.

These key findings are expanded upon below:

The most common baseline methodology is also the most simple, the "X of Y" methodology. Demand response participants find these methods the easiest to understand and the most transparent. These baselines do not require large volumes of historical data, so the ISO is not burdened with large, costly databases. These are relatively straightforward baselines to implement for participants who do not have historical interval meter data. Recent studies of baseline performance found that these baselines with a day-of-event adjustment perform relatively well and have a lower administrative burden than a more complex methodology such as a regression-based method.

In addition to accuracy, the administration of the baseline method should be taken into consideration when selecting a baseline method (or methods). Implementing only one baseline method is the simplest option in terms of administering the program (i.e., initial participant registration and baseline selection, focusing only on one methodology when interacting with participants), but it might not be optimal for the demand response product depending on the potential participant mix and if a variety of baselines is needed to accommodate a variety of types of loads. If more than one baseline is offered, an evaluation of the baseline performance at the time of registration (certification or authorization) appears to ward off potential participant disputes and regularly ensures the participant is using the best performing baseline. However, the baseline certification or authorization process is resource-intensive. Additionally, the scalability of baseline procedures should be considered.

Gaming is an ongoing concern of the ISOs and has been observed in a few instances. However, gaming has generally not been a widespread issue which is indicative of successful baseline and adjustment mechanisms in that regard. The gaming behaviour that was observed by one ISO prompted a change to a few specific rules within their baseline methodology. ISOs must weigh gaming concerns against raising the barriers to entry.

AEMO should proceed slowly implementing the DR market in increments. AEMO should select a baseline threshold that is sufficiently large to align with other market requirements while initially limiting participation, while establishing a reasonable timetable to address mass market DR program offerings.

AEMO should analyse a large sample of likely AEMO participants to establish appropriate baselines. The baselines tested should cover a range of estimation methods (averaging and matching), a range of timeframes (from same/previous day to previous year), a range of data selection rules (proximity to event, similarity of load, similarity of weather, highest or middle "X of Y"), address weather-sensitive loads, and cover a range of complexities. We suggest the PJM 4-of-5, CAISO 10-in-10, ISO-NE 90/10 weighted average, PJM Emergency Comparable Day (both weather sensitive and non-weather sensitive), and the middle 4-of-6, and another baseline methodology suggested by AEMO, if desired. The results will be used by AEMO to select a baseline that is sufficiently rigorous while minimizing administrative burden.

A. Appendix A - Bibliography

The literature review focused on publicly available business and technical process manuals published by each of the ISOs. In addition to the manuals, several reports compiling statistics were available from federal agencies such as the Department of Energy (DOE) and the Federal Energy Regulatory Commission (FERC) and other sources such as the Independent System Operator/Regional Transmission Operator Council (ISO/RTO Council). A complete list of sources is provided in Table 13.

Table 13 – List of Documents and Sources

Organization	Documents/Sources
CAISO	Business Practice Manual for Metering, Version 6, May 7, 2012 Demand Response & Proxy Demand Resource – Frequently Asked Questions, June 24, 2011
ERCOT	Emergency Response Service: Technical Requirements & Scope of Work, May 31, 2013 Emergency Response Service Default Baseline Methodologies, April 1, 2013 Item 8: Pilot Project; Emergency Response Service for Weather Sensitive Loads, Dumas, March 19, 2013
ISO-NE	Section III Market Rule 1 Appendix E Demand Response ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources, Revision 4, June 1, 2012 ISO New England Load Response Program Manual, Revision 12, October 1, 2007 Analysis and Assessment of Baseline Accuracy, KEMA, August 2011.
MISO	Business Practices Manual Demand Response, Manual No. 026, April 1, 2013
NYISO	NYISO Emergency Demand Response Program Manual, Manual 7, December 2010 NYISO Day-Ahead Demand Response Program Manual, Manual 5, July 2003
PJM	PJM Manual 11: Energy & Ancillary Services Market Operations, Revision 59, April 1, 2013 PJM Empirical Analysis of Demand Response Baseline Methods, KEMA April 20, 2011
ISO/RTO Council	http://www.isorto.org/site/c.jhKQIZPBImE/b.2604461/k.6151/Documents_and_Issues.htm North American Wholesale Electricity Demand Response Program Comparison, 2011
DOE/FERC	Measurement and Verification for Demand Response, DNV KEMA Goldberg and Agnew, 2013. FERC Staff Report, 2011 Assessment of Demand Response and Advanced Metering, November 2011.

B. Appendix B - Interviews

For Phase 1, DNV KEMA conducted a literature review and interviewed managers or directors of six ISOs on their development and administration of demand response customer baseline methodologies. The ISOs included were California Independent System Operator (CAISO), Electric Reliability Council of Texas (ERCOT), Midwest Independent System Operator (MISO), Independent System Operator of New England (ISO-NE), PJM Interconnection (PJM), and the New York Independent System Operator (NYISO). The names and titles of the ISO personnel interviewed are listed in the table below.

Table 14 – Interview Respondents

ISO	Name and E-mail of Respondent	Title of Respondent
CAISO	Jill Powers jpowers@caliso.com	Smart Grid Solutions Manager
ERCOT	Carl Raish Carl.raish@ercot.com	Principal, Load Profiling
ISO-NE	Henry Yoshimura hyoshimura@iso-ne.com	Director, Demand Resource Strategy
MISO	Michael Robinson mrobinson@midwestiso.org	Sr. Manager, Market Development
NYISO	Donna Pratt dpratt@nyiso.com	Manager, Demand Resource Products
PJM	Pete Langbein langbp@pjm.com	Manager, Demand Side Response Operations

The purpose of the interviews was to gather information not necessarily found in the technical manuals about how the baselines were selected and the ISOs experience and feedback about the process of baseline selection and administration. The interview guide of questions was initially developed by DNV KEMA and additional questions posed by AEMO staff were incorporated.

The final content of the interviews is listed below:

- Questions about current baseline methodologies:
  - What is/are the baseline method(s) offered by the ISO?
  - Are there day-of baseline adjustments included in the baseline method, and if yes, what are they?
  - Is the baseline calculated prospectively or retro-actively?
  - Why did the ISO select the baseline method(s)?
  - What were the challenges when selecting method?
  - What are the challenges now that the baseline is implemented?

- Questions about possible changes to the methodologies in the future:
  - Are there any plans to make modifications to the baseline methods in the future?
  - Is the ISO currently evaluating the methodologies?

- Questions about the baselines as they relate to specific participants:
  - What is the process of selecting baseline for a participant?
  - Is there a process to resolve disputes related to DR baselines?
  - What if a participant has no historical data to establish a baseline?
  - How often does the ISO interact with participants?
  - What is the nature of the interaction with participants?

- Questions about data and administration:
  - What is the process for a participant to submit meter data?
  - What entities receive load data?
  - Is there a process for dealing with objectionable data?
  - Are there circumstances when it is acceptable to exclude meter data from baseline development?
  - Does the ISO use commercially available software for baseline administration?

- Questions about baseline performance:
  - Are there any particular triggers for conducting a baseline review?
  - Is there a process by which performance audits would be conducted?
  - Can/do participants changes baselines, and if so, why and how often?
  - Are there any public reporting requirements specific to DR baselines?

- Questions about gaming:
  - Does the ISO have any concerns about gaming?
  - Has the ISO observed any gaming behaviour by participants?
  - Is the ISO aware of issues regarding the timing of notifications that would alter participants' usage during the baseline period?

The interviews were conducted over the phone, and were about an hour in length (with one exception where the respondent preferred to provide written responses). The remainder of this section presents the results of the interviews. Note answers to questions related to gaming have been kept confidential. Respondents provided answers to the gaming questions that have been incorporated into the results, but responses are not attributed to a specific ISO.

Australian Energy Market Operator (AEMO)
Demand Response Mechanism Customer Baseline Development
North American ISO Interview

Interviewer	Lorin Molander
Completion Date	June 12, 2013

Respondent Information

Contact Name	Jill Powers
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Company Name	California ISO

Contact Log

Date/Time	Notes/Results/Actions
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Interview Guide

Introduction

Good (morning/afternoon). My name is _____ and I am calling from DNV KEMA on behalf of the Australian Energy Market Operator, Australia's Independent System Operator. We are conducting interviews of North American ISO staff that have knowledge of demand response customer baseline development, methodology and administration. The data collected during this interview will be used to provide guidance to the Australian Energy Market Operator of the concepts needed for the development of a baseline consumption methodology as they implement a Demand Response Mechanism.

Topic	No.	Question
Intro	1	[Record name, organization, and contact information of respondent on cover sheet.]
Intro	2	Please briefly describe your role and function within your organization. Works within the Smart Grid Technology and Strategy area, which is in the IT group, emphasis on DR and removing the technical barriers for participation.

<table>
<tr><th>Topic</th><th>No.</th><th>Question</th></tr>
<tr><td>Current</td><td>3</td><td>
What are CAISO's current baseline approaches? Do the baseline approaches differ by type of DR program offered by CAISO? If so, please include which programs use each baseline methodology.

Table from ISO/RTO council website (2011 version)
<table>
<tr><td>PDR</td><td>Proxy Demand Resource Product</td><td>CAISO-10-in-10, CAISO-Alternative</td><td>Details about 10-in10 below;
CAISO Alternative – Alternative calcs may be proposed and will be reviewed for appropriateness by the CAISO</td></tr>
<tr><td>PDR</td><td>Proxy Demand Resource Product</td><td>CAISO-MBMA (Capacity Check) &
CAISO-10-in-10 (Energy Payment)</td><td>Meter Before/Meter After based on 5 minute interval</td></tr>
</table>

From the CAISO Business Practice Manual for Metering, Version 6, May 7, 2012:

The Proxy Demand Response (PDR) provides the capability to permit an aggregator of retail customers to bid DR on behalf of retail customers directly into the ISO's market. A PDR may participate in the Day-Ahead, Real-time, and Non-Spinning Reserve markets.

Performance of the PDR is generally determined through a pre-determined baseline calculation using the last 10 non-event days with a look back window of 45 days and a bidirectional morning adjustment capped at 20%.

Weekdays and weekend/Holidays are supported. The selection of the CBL days is performed by iterating backward through the acceptable days prior to the event day. Once the target number of days is reached, selection ends. If the target number of days is not reached, but the minimum number of days is reached, the CBL is calculated on the selected days. If the minimum number of days is not reached, the highest usage prior event days within the CBL window will be used to the reach the minimum number of days. The highest usage event days are defined as the highest totalized load for the resource during event hours. Targets are 10 days for weekdays, 4 for weekend/holidays; minimums are 5 days for weekdays, 4 for weekend/holidays. There is no elimination of abnormally high or abnormally low usage days. The CBL shall be calculated as a simple hourly average of the selected days' meter data (hourly data). The CBL calculation includes a symmetric multiplicative adjustment.
</td></tr>
</table>

Topic	No.	Question
Current	4	Do any or all of the baselines include an adjustment (e.g., additive, multiplicative)? From the CAISO Business Practice Manual for Metering, Version 6, May 7, 2012: The CBL calculation includes a symmetric multiplicative adjustment, morning adjustment, unless otherwise requested by the DRP and approved by the CAISO. The multiplier will be calculated by averaging the 4 hours prior to the event excluding the hour immediately prior to the event start and defined as a ratio of the average load for these three hours relative to the same 3 hour average of the CBL calculation data set. The same multiplier will be applied to each hour of the event, and will be capped at both a 20% increase and a 20% decrease. For PDR awarded for ancillary services and/or RT Imbalance Energy, a PDR energy measurement adjustment for real time is made to simulate a real-time energy curve. 5 minute data is required for these offerings. The adjustment is PDREnergy = 1/12 * PDRbaseline – sum of loads (for each 5m in hour).
Current	5	Are the baselines calculated prospectively or retroactively? What historical or forward-looking period of time is used to determine the appropriate baseline? Performance of the PDR is generally determined through a pre-determined baseline calculation using the last 10 non-event days with a look back window of 45 days.
Current	6	What were the reasons for selecting this/these baselines? Our baseline was selected based on feedback from stakeholders and consultants. There is more information from the development process from the policy angle, and there may be comments regarding the development of PDR online in the policy documents. We looked to what PJM had already been doing, so there was some precedence about using this type of baseline.
Current	7	What are the challenges you faced when selecting this/these baseline(s)? During the development of the PDR policy, there were comments made by stakeholders that needed to be addressed.

Topic	No.	Question
Current	8	What are the challenges with these baselines now that they are implemented? The 3rd party DRPs in California are challenged with getting access to load data through the LSE. When first implementing the PDR, we anticipated a steady stream of interval data being delivered to our system (like a generator) but this has not been the case. We really get data once an event has occurred, then the data is for the last 45 days in order to calculate the baseline and load reduction (performance quantity). We have needed to re-visit the business process manuals to make adjustments in the language about the requirements for the meter data submittal. Also, we needed to address test scenarios such as if an event occurred in two separate market days (that is, event started in hour ending 24 of one day, and ending in hour 4 of the following day). CAISO treats these two days separately, and no day-of adjustments to the baseline for the first four hours of a day.
Current	9	Are you in the process of evaluating - or do you have any plans to evaluate - your current baseline methodology? CAISO does not have enough experience with the PDR product at this point to start evaluating the methodology. Once we have more participation, we would be able to do that, but we do not have any current plans to do so. We have explored the idea of a statistical sampling methodology and have opened that up for discussion in our processes to develop the RDR (Reliability Demand Response Resource).
Future	10	Are there any plans for making modifications to the current baseline approaches? See #9 above.
Participants	11	Please describe the process for choosing a baseline for a participant. Are there specific criteria that determine a customer's eligibility for a particular baseline? At this time, we have one baseline methodology for PDR participants, so that is the only choice.

Topic	No.	Question
Participants	12	What if the customer does not agree with the ISO's baseline assignment? What is the process to resolve disputes? At this time we have one baseline methodology so if a participant does not agree to this baseline, they do not participate. Consequently, we do not have any disputes about the baseline methodology. We may have disputes regarding the results or the meter data, and those disputes would be resolved through our normal dispute resolution process.
Participants	13	How is a baseline determined for a customer with no historical data? The baseline calculation will run with available meter data. If the conditions of the 10 and 10 day methodology are met with the available meter data (may not necessarily be the full 45 days) then there can be an accurate baseline calculated. See BPM for more details on the conditions that need to be met.
Participants	14	How often do you or other staff at CAISO interact with DR participants or service providers? The staff at CAISO interact with DR service providers, referred to as Demand Response Participants (DRP), and do not have interaction with individual "DR participating loads/customers". There was considerable contact with DRPs that were participating in the PDR program, but there were only a few of those actively participating.

Topic	No.	Question
Participants	15	Please describe interactions with DR participants or service providers. When and why do you have contact? We have a PDR coordinator available in the meter data analysis group. This coordinator is available on a daily basis for PDR participants. The meter data analysis group is responsible for processing generation and load data every day. The PDR coordinator has minimal contact with individual participating loads working only with demand service providers, called Demand Response Providers DRPs. As part of the settlement process, Scheduling Coordinators for DRPs review the settlement results of a DRP's participating proxy demand resource and have the through the established settlement process which includes the ability to contact the CAISO with questions/issues with settlement or to potentially dispute a DRP's resulting settlement. . These interactions are usually more about the data than other issues (including the baseline itself). Also, prior to a participant going active, there may be some interaction regarding how the program works and how the baseline is calculated. Again, we only have one baseline, so this interaction is minimal as well.
Data/Admin	16	Once a load reduction event has occurred, what is the process for submitting and processing the raw meter data? That is, please describe the steps and procedures in place for obtaining the raw meter data from the end use consumer, applying data validation procedures, calculating the baseline for the event (if applicable), and calculating the load reduction during the event. We receive revenue grade (settlement quality) meter data from the DRP, not raw meter data. CAISO calculates the baseline and the performance measurement (load reduction); meter data is provided to the ISO aggregated to the resource level.
Data/Admin	17	Who or what entities receive the load data used for determining the baseline and the load reduction amount? What roles and responsibilities does each entity have for processing and storing the data? The Scheduling Coordinator representing the DRP is responsible for submitting the revenue quality (VEE'd) meter data. The DRP may be the LSE or a 3rd party. Once the data is submitted, CAISO stores the meter data for some period of time, requirements established to meet Settlement requirements. CAISO processes the data to calculate the baseline and performance measurement.

Topic	No.	Question
Data/Admin	18	Is there a process for dealing with objectionable data? Please describe. We generally work with participants to confirm data, but haven't had issues with objectionable data. If there were objections to something, it would be resolved though our normal dispute resolution process. We do have the authority to require the participants to conduct self-audits (this is required for all Scheduling Coordinator submitted meter data, but applies to PDR as well).
Data/Admin	19	Are there circumstances when it is acceptable to exclude meter data from baseline development? What are those circumstances? I am unfamiliar with any circumstances when we would exclude data.
Data/Admin.	20	Do you or provide – or are you aware of – an "off the shelf" software product that specifically calculates the baseline consumption for an event? If so, what vendors provide these products? Yes, UISOL (acquired by Alstom). CAISO implemented PDR using their base system DR BIZNET, with customization to meet integration needs. This product was implemented at PJM.
Baseline Perf.	21	Does CAISO have any automatic systems or processes in place that triggers a baseline review for a DR participant? We only have one baseline to choose from, so N/A.
Baseline Perf.	22	Does CAISO conduct audits of baseline performance for individual DR participants? If yes, how often? No, we do not conduct audits of the baseline performance at this time.
Baseline Perf.	23	In what circumstances can a participant's baseline methodology be changed? We only have one baseline to choose from, so N/A.

Topic	No.	Question
Baseline Perf.	24	On average, how often does the methodology for the baseline change for a participant? We only have one baseline to choose from, so N/A.
Baseline Perf.	25	Does CAISO have any public reporting requirements regarding baseline performance and/or demand response mechanism performance? There are no reporting requirements specifically for baselines, but we do a yearly FERC filing regarding demand response.
Gaming	26	We have a few questions regarding the issue of gaming. Responses to these questions will be aggregated and summarized for our report to AEMO. Your responses will not be attributed to your particular ISO. Does CAISO have any concerns about gaming by demand response participants? If so, please describe those concerns. CONFIDENTIAL
Gaming	27	Has CAISO observed gaming by demand response participants? CONFIDENTIAL
Gaming	28	Are you aware of issues regarding the timing of notifications and the response by participants that would alter usage during the baseline period? CONFIDENTIAL

Topic	No.	Question
Other	29	In general, do you have any other comments or feedback regarding the development, implementation, and administration of demand response customer baselines? Once the program was implemented we needed to incorporate after-market operation processes and synchronize our processes with the data submittal requirements. We had no baseline expertise in that organization (meter data analysis), and that would have been helpful. The Policy group had the experience with implementation. It is beneficial to have knowledge within the group that performs the daily functions. However DR is implemented, the systems and processes need to be scalable. Post implementation, yet without a significant amount of participation, there has been requests for PDR to provide different baseline methodologies including for the allowance of individual PDR's to use a statistical sampling of participating loads to determine the performance measurement, This required providing the functionality in the system to accept "performance data" instead of calculating a baseline and subsequent performance measurement. The system was enhanced to provide the ability for the DRP to submit a performance or generation measurement through the system. The nature of this program has been low and sporadic participation. We are now taking another look at what we originally implemented and looking at streamlining processes.
Other	30	Your feedback and answers to these questions are extremely beneficial to AEMO as they develop a demand response customer baseline methodology. With the exception of the gaming questions, do we have your permission to report your responses and attribute them to your organization? Yes, but please send the write-up and I will review and approve. Thank you very much for your time and feedback.

Australian Energy Market Operator (AEMO)
Demand Response Mechanism Customer Baseline Development
North American ISO Interview

Interviewer	Lorin Molander
Completion Date	June 10, 2013

Respondent Information

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Contact Log

Date/Time	Notes/Results/Actions
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Interview Guide

Introduction

Good (morning/afternoon). My name is _____ and I am calling from DNV KEMA on behalf of the Australian Energy Market Operator, Australia's Independent System Operator. We are conducting interviews of North American ISO staff that have knowledge of demand response customer baseline development, methodology and administration. The data collected during this interview will be used to provide guidance to the Australian Energy Market Operator of the concepts needed for the development of a baseline consumption methodology as they implement a Demand Response Mechanism.

<table>
<tr><th>Topic</th><th>No.</th><th>Question</th></tr>
<tr><td>Intro</td><td>1</td><td>[Record name, organization, and contact information of respondent on cover sheet.]</td></tr>
<tr><td>Intro</td><td>2</td><td>Please briefly describe your role and function within your organization.

Works in the demand integration organization, supports ERS and other demand response program administration.</td></tr>
<tr><td>Current</td><td>3</td><td>What are ERCOT's current baseline approaches? Do the baseline approaches differ by type of DR program offered by ERCOT? If so, please include which programs use each baseline methodology.

Table from ISO/RTO council website (2011 version)
<table>
<tr><td>EILS*</td><td>Emergency Interruptible Load Service</td><td>ERCOT-Regression / ERCOT-Mid 8 of 10 / ERCOT-Matching Day Pair / ERCOT-Alternate / ERCOT-NIDR Agg</td><td>Details below</td></tr>
<tr><td>Load Resource (RRS-UFR)</td><td>Non-Controllable Load Resources providing Responsive Reserve Service -- Under Frequency Relay Type</td><td>ERCOT-Reserves</td><td>Meter Before/Meter After method</td></tr>
</table>
</td></tr>
</table>

Topic	No.	Question

Load Resource (RRS-CLR)	Controllable Load Resources providing Responsive Reserve Service	ERCOT-Reserves	Meter Before/Meter After method
Load Resource (NSRS)	Load Resources providing Non-Spinning Reserve Service	ERCOT-Reserves	Meter Before/Meter After method
CLR (Reg)	Controllable Load Resources providing Regulation Service	ERCOT-Regulation	Meter Before/Meter After method

From the ERCOT Emergency Response Service Technical Requirements and Scope of Work, contract term through May 31, 2013:

Baseline methodologies fall into two categories – default or alternate.

There are three default baseline types:

1. Regression model with weather-, calendar-, and daylight/darkness-related variables for model inputs;
2. "middle 8-of-10 preceding like days";
3. Matching day pair model based on identifying the sets of two days over the preceding 12 months in which the ERS Load's actual interval-metered usage most closely matches its actual load data for day before and the day of the ERS deployment event. This methodology selects the 10 closest-matched day pairs and averages them together by interval to create an unadjusted baseline.

ERCOT applies an event-day adjustment to the baseline load estimates for any of the three default types. The event day adjustment is a scalar adjustment based on the ERS Load's actual load for the hours preceding the declaration of an EEA. The adjustment may be up or down.

Alternate Baseline:

If a sufficiently accurate default baseline cannot be established due to the characteristics of the sites within an ERS Load, ERCOT will assign the ERS an alternate. ERCOT may also assign an ERS Load to the alternate baseline if it

Topic	No.	Question
		determines the ERS Load's availability and performance can be more accurately evaluated or more simply administered if assigned to the alternate baseline. The availability factor for an ERS Load assigned to the alternate baseline is calculated based on its average hourly load during the committed time period minus the declared maximum base load. MW capacity offers for such ERS Loads should be based on this calculation. <u>From Interview:</u> EILS is now called ERS, this occurred because ERCOT now includes generators so the program is not just interruptible load. Also, a pilot program started on June 1, 2013 to test ERS for weather sensitive loads. In this test, a control group methodology has been incorporated for the baseline calculations.
Current	4	Do any or all of the baselines include an adjustment (e.g., additive, multiplicative)? ERCOT applies an event-day adjustment to the baseline load estimates for any of the three default types. The event day adjustment is a scalar adjustment based on the ERS Load's actual load for the hours preceding the declaration of an EEA. The adjustment may be up or down. The control group methodology for the ERS weather sensitive pilot does not include an adjustment.

Topic	No.	Question
Current	5	Are the baselines calculated prospectively or retroactively? What historical or forward-looking period of time is used to determine the appropriate baseline? From documentation: Depending on the default baseline type, analysis of at least 12 months of historical interval meter data may be necessary for ERCOT to determine whether an ERS Load can be modelled accurately under a default baseline. From interview: The answer to this question is really a bit of both prospectively and retroactively. During the initial resource identification phase for ERS, ERCOT performs a baseline analysis for the participant. ERCOT tests all of the baseline methodologies and evaluates the effectiveness of each baseline. These tests are performed on 2-hour hypothetical events in history, for as long back as 3 years. They compare the baseline to actual loads and rank the methods based on goodness of fit statistics. The best ranking baselines will be authorized by ERCOT, and then the participant selects the baseline method when they make an offer. ERCOT calculates the actual baseline for an event after an event has occurred. For the regression baseline, data from after the event may be used to develop that event's baseline. The participant should have a minimum of 270 days of historical data for the regression method, and about 6 months for the 8 of 10 and day pair matching method. If they don't have that much historical data available, the baseline will be the alternate baseline. It is different with the control group method which is only applicable to residential. No history is needed for these participants, only interval meter data needs to be available starting the day of registration.

Topic	No.	Question
Current	6	What were the reasons for selecting this/these baselines? From the start, we used a regression model method, and developed the others later. We had feedback that the regression method was difficult for the service providers to shadow, so we added the 8 of 10 and the day pair matching. Day pair matching was another method used previously by ERCOT staff at another utility and so we had experience with that method.
Current	7	What are the challenges you faced when selecting this/these baseline(s)? As mentioned, the feedback from service providers was that the regression baseline can be hard to follow. Also, evaluating all of the baselines is computationally intensive for ERCOT during the resource initiation phase. As we get more and more participants, more and more computations are made at the resource initiation/baseline evaluation phase. Extracting and analysing that much data is challenging.
Current	8	What are the challenges with these baselines now that they are implemented? Same as #7 above. The participants are reluctant to accept the regression baseline, but sometimes it is the only baseline ERCOT authorizes for that participant.
Current	9	Are you in the process of evaluating - or do you have any plans to evaluate - your current baseline methodology? ERCOT evaluates the performance of the current baselines on each participant as they sign up as a resource. ERCOT has a wish list to evaluate some other baselines, but it is not necessarily the plan.

Topic	No.	Question
Future	10	Are there any plans for making modifications to the current baseline approaches? Not really at this time, although ERCOT has initiated the ERS for weather sensitive customers pilot program that is running this summer.
Participants	11	Please describe the process for choosing a baseline for a participant. Are there specific criteria that determine a customer's eligibility for a particular baseline? When a participant signs up and initiates the registration process, ERCOT evaluates all of the baselines for that participant, produces a report of the evaluation, and authorizes the best-performing baselines for that participant. The participant ultimately selects the baseline of their choice from the authorized baselines. There are usually several to choose from, but occasionally there is only one method to choose from.
Participants	12	What if the customer does not agree with the ISO's baseline assignment? What is the process to resolve disputes? We have not really had any disputes. We do offer an optional baseline re-assignment during the contract period if the participant did not have enough data to evaluate all of the baselines prior to becoming a participant.

Topic	No.	Question
Participants	13	How is a baseline determined for a customer with no historical data? If a participant does not have any historical data, they fall under the alternate baseline method which is a “drop to” amount. For the weather sensitive pilot, we do not require historical load data given there is a control group method. Contract periods are four months long, and participants may have their baseline re-evaluated/re-assigned if they have enough data during the contract period.
Participants	14	How often do you or other staff at ERCOT interact with DR participants or service providers? ERCOT interacts very often with service providers. Either daily or every other day.
Participants	15	Please describe interactions with DR participants or service providers. When and why do you have contact? During the resource identification phase, ERCOT provides a lot of feedback about the resource. During the course of the contract, there is a lot of testing, deployment instructions, and results of testing. There may be substitutions for a resource in place which is having issues, and those may submit alternates or substitutions. We also deal with participant reinstatements, which involve testing as well. At the end of a contract ERCOT provides performance reports. ERCOT also interacts by computing payment amounts as well as charges computed for the LSE (which sometimes gets us involved with DR non-participant interaction, too).

Topic	No.	Question
Data/Admin	16	Once a load reduction event has occurred, what is the process for submitting and processing the raw meter data? That is, please describe the steps and procedures in place for obtaining the raw meter data from the end use consumer, applying data validation procedures, calculating the baseline for the event (if applicable), and calculating the load reduction during the event. ERCOT receives all meter data from the T&D Service Provider, who is responsible for meter reading used for the daily settlement process. We use this source of data. ERCOT may also receive data directly from the service provider if the participant is a customer of a muni or co-op (Non opt in entity, NOIE). The service provider must install and collect interval meter data for these customers, or agree with the muni to install the meter. If it comes from the service provider, ERCOT requires a professional engineer to sign off on the data being provided. If the data is coming from the NOIE, ERCOT accepts it since it is coming from the NOIE's billing system. It is considered validated once ERCOT receives the data. If ERCOT has both monthly billing data as well as the interval meter data, ERCOT will do a check to make sure they are consistent. ERCOT calculates the baseline for the event and the load reduction.
Data/Admin	17	Who or what entities receive the load data used for determining the baseline and the load reduction amount? What roles and responsibilities does each entity have for processing and storing the data? See #16 above for the steps. ERCOT receives the load data, and calculates the baseline and load reduction. The DR group within ERCOT who uses the data for these calculations are responsible for receiving it, storing it, and using it for analysis. ERCOT's settlement group is probably the system's official owner.

Topic	No.	Question
Data/Admin	18	Is there a process for dealing with objectionable data? Please describe. There are two cases – data failing and where data doesn't exist. Sometimes you get meters from the wrong customers. These all have adverse impacts on the resource. If data fails validation, we treat it as a "drop by" baseline.
Data/Admin	19	Are there circumstances when it is acceptable to exclude meter data from baseline development? What are those circumstances? Yes, ERCOT excludes data for emergency periods, and if there were tests for a resource. We allow a 10-hour recovery period which is also excluded. Occasionally we would exclude a period of time where usage is abnormal such as when construction was taking place.
Data/Admin.	20	Do you or provide – or are you aware of – an "off the shelf" software product that specifically calculates the baseline consumption for an event? If so, what vendors provide these products? We are aware of a product called Utility Integration Solutions. ERCOT does not use this product.
Baseline Perf.	21	Does ERCOT have any automatic systems or processes in place that triggers a baseline review for a DR participant? We have a regular process of evaluation baselines at the time of registration or re-registration of a new 4-month contract. We look at the performance of all baselines at that time.

Topic	No.	Question
Baseline Perf.	22	Does ERCOT conduct audits of baseline performance for individual DR participants? If yes, how often? Same as #21. These audits happen for each new contract period which is every four months.
Baseline Perf.	23	In what circumstances can a participant's baseline methodology be changed? If a participant does not have enough data at the time of registration (new contract), then the participant has an option for baseline reassignment during the contract period once enough data has been collected to evaluate the baselines. A participant renews their contract every four months at which time the baselines are re-evaluated for that participant.
Baseline Perf.	24	On average, how often does the methodology for the baseline change for a participant? Fairly frequently. When ERCOT runs the baseline evaluation for a participant we run it for the same months as the upcoming contract period. It is not uncommon for the 'usual' baselines to be different depending on which four month period.
Baseline Perf.	25	Does ERCOT have any public reporting requirements regarding baseline performance and/or demand response mechanism performance? Not necessarily regarding baseline performance, but ERCOT does do event and contract reporting. We also have an availability requirement which gets reported on and becomes publicly available.

Topic	No.	Question
Gaming	26	We have a few questions regarding the issue of gaming. Responses to these questions will be aggregated and summarized for our report to AEMO. Your responses will not be attributed to your particular ISO. Does ERCOT have any concerns about gaming by demand response participants? If so, please describe those concerns. CONFIDENTIAL
Gaming	27	Has ERCOT observed gaming by demand response participants? CONFIDENTIAL
Gaming	28	Are you aware of issues regarding the timing of notifications and the response by participants that would alter usage during the baseline period? CONFIDENTIAL
Other	29	In general, do you have any other comments or feedback regarding the development, implementation, and administration of demand response customer baselines? I think we've covered it.

Topic	No.	Question
Other	30	Your feedback and answers to these questions are extremely beneficial to AEMO as they develop a demand response customer baseline methodology. With the exception of the gaming questions, do we have your permission to report your responses and attribute them to your organization? Yes. Thank you very much for your time and feedback.

Australian Energy Market Operator (AEMO)
Demand Response Mechanism Customer Baseline Development
North American ISO Interview

Interviewer	Lorin Molander
Completion Date	June 24, 2013

Respondent Information

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Company Name	ISO New England

Contact Log

Date/Time	Notes/Results/Actions
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Interview Guide

Introduction

Good (morning/afternoon). My name is _____ and I am calling from DNV KEMA on behalf of the Australian Energy Market Operator, Australia's Independent System Operator. We are conducting interviews of North American ISO staff that have knowledge of demand response customer baseline development, methodology and administration. The data collected during this interview will be used to provide guidance to the Australian Energy Market Operator of the concepts needed for the development of a baseline consumption methodology as they implement a Demand Response Mechanism.

Topic	No.	Question
Intro	1	[Record name, organization, and contact information of respondent on cover sheet.]
Intro	2	Please briefly describe your role and function within your organization. Director, demand resource strategy. Leads development efforts.
Current	3	What are ISO-NE's current baseline approaches? Do the baseline approaches differ by type of DR program offered by ISO-NE? If so, please include which programs use each baseline methodology. From ISO-NE Market Rule 1: A DR baseline is calculated for any real-time demand response asset or real-time generation asset that requires a baseline on a daily basis using 5-minute meter data. Baseline Type I – a baseline performance evaluation methodology based on a DR's historical interval meter data which may also include other variables such as weather and calendar data (required for real-time demand response, and real-time emergency generation resources). Baseline Type II – A baseline performance evaluation methodology that uses statistical sampling to estimate the electricity usage of an aggregated demand resource where interval metering is not available on the entire population. Metering Generator Output – a performance evaluation methodology, used when a generation asset is located behind the DR's revenue meter, in which the DR value is based on the output of the generation asset. Establishing the initial DR baseline. The DR baseline for a new real-time DR

Topic	No.	Question
		asset or real-time emergency shall be the simple average of meter data for the asset for each 5-minute interval from the initial ten non DR holiday weekdays. The initial ten non-Demand Response holiday weekdays of meter data used to establish the DR baseline shall consist of the first ten consecutive non-DR holiday weekdays with a complete set of interval meter data. A market participant may not submit DR reduction offers until the month following the initial establishment of a DR baseline for an asset. Establishing the DR baseline for the next day. If, for a Real-time Demand Response Asset or Real-Time Emergency Generation Asset that has established an initial Demand Response Baseline: (a) the present day is not a Demand Response Holiday, Saturday or Sunday, and; the asset has not been dispatched or audited in the present day pursuant to Section III.13, and; the Demand Reduction Offer associated with the asset is not eligible in any hour of the present day for payments pursuant to Section III.E.9, or; (b) the present day is not a Demand Response Holiday, Saturday or Sunday and more than seven of the prior 10 non-Demand Response Holiday weekdays have established a Demand Response Baseline determined pursuant to Section III.8.2; then: the asset's Demand Response Baseline in each five-minute interval, for the next day is calculated as the sum of 0.9 times the asset's Demand Response Baseline established for the present day in the same five-minute interval and 0.1 times the asset's meter data in the same five-minute interval from the present day.
Current	4	Do any or all of the baselines include an adjustment (e.g., additive, multiplicative)? From ISO-NE Market Rule 1: 8.4.1 Baseline Adjustment for Real-Time Demand Reductions From Real-Time Demand Response Assets Without Generation or From Real-Time Emergency Generation Assets Without Additional Generation For each day the ISO calculates the Real-Time demand reduction amount of a Real-Time Demand Response Asset or Real-Time Emergency Generation Asset, the ISO will calculate an adjustment factor equal to the average difference (MW) between the asset's actual metered demand and its Demand Response Baseline in the intervals during the two-hour period beginning 2.5 hours prior to the start of the first interruption interval in the Operating Day. The adjustment factor will be added to the Demand Response Baseline in every interval of the day, which may increase or decrease the Demand Response Baseline.

Topic	No.	Question
		However, the resulting adjusted Demand Response Baseline in any interval shall not be less than zero and shall not exceed the asset's Maximum Load. 8.4.2 Baseline Adjustment for Real-Time Demand Reductions From Real-Time Demand Response Assets with Generation or From Real-Time Emergency Generation Assets With Additional Generation For each day the ISO calculates the Real-Time demand reduction amount of a Real-Time Demand Response Asset or Real-Time Emergency Generation Asset, the ISO will calculate an adjustment factor equal to the average difference (MW) between the sum of the asset's actual metered demand and the output of all generators, or for Real-Time Emergency Generator Assets all additional generators, located behind the asset's end-use customer meter in the same time intervals and the asset's Demand Response Baseline in the intervals during the two-hour period beginning 2.5 hours prior to the start of the first interruption interval in the Operating Day. The adjustment factor will be added to the Demand Response Baseline in every interval of the day, which may increase or decrease the Demand Response Baseline. However, the resulting adjusted Demand Response Baseline in any interval shall not be less than zero and shall not exceed the asset's Maximum Facility Load. 8.4.3 Baseline Adjustment for Real-Time Demand Reductions Produced By Directly Metered Generation For each day that the ISO calculates the Real-Time demand reduction amount of a Real-Time Demand Response Asset that is comprised of a Distributed Generation asset located behind the end-use customer meter of an individual end-use customer facility, the asset's Demand Response Baseline shall not be subject to the baseline adjustment.
Current	5	Are the baselines calculated prospectively or retroactively? What historical or forward-looking period of time is used to determine the appropriate baseline? It is prospective. Participants know the baseline going into an event.

Topic	No.	Question
Current	6	What were the reasons for selecting this/these baselines? Accuracy was the primary driver. ISO-NE has had the DR program for over a decade, using the same general baseline methodology. Previously we used an asymmetric adjustment, but that created bias, so now we use a symmetric adjustment. A secondary driver was related to administrative issues. Given that it is a weighted average, it simulates a rolling average. We do not have to store each historical day's interval data. The 90/10 calculation simplifies the calculation.
Current	7	What are the challenges you faced when selecting this/these baseline(s)? We implemented these baselines about 10 years ago, and there wasn't much to choose from at that time. We put this method forth, and it's relatively accurate. Our participants' load does not change that much day to day, but does change from season to season. We ran into a data storage issue with a rolling average calculation, so we came up with the 90/10 weighted average.
Current	8	What are the challenges with these baselines now that they are implemented? Some of the DR providers have raised the issue about what to do if there are inaccuracies found in the meter data, but the issues are found after the fact. If the meter data is not correct the first time, then the ISO has to go back and correct the data, then re-calculate the rolling average type of baseline. Depending on when the data errors occur, this can be an onerous task. With this type of methodology, it is really important to get it right the first time. We have also had challenges with gaming.
Current	9	Are you in the process of evaluating - or do you have any plans to evaluate - your current baseline methodology? We are currently analysing the issue of the incorrect data and what the effects are on the baseline. We are looking to determine levels of tolerance for the errors; that is rules for when you would need to go back and make the correction vs. when the error has little or no effect.

Topic	No.	Question
Future	10	Are there any plans for making modifications to the current baseline approaches? No active plans at this time.
Participants	11	Please describe the process for choosing a baseline for a participant. Are there specific criteria that determine a customer's eligibility for a particular baseline? We only have one baseline.
Participants	12	What if the customer does not agree with the ISO's baseline assignment? What is the process to resolve disputes? We only have one option available if a customer participates in the program.
Participants	13	How is a baseline determined for a customer with no historical data? If a customer has no historical load data, a meter is installed, data is collected for 10 days, and a baseline is established.
Participants	14	How often do you or other staff at ISO-NE interact with DR participants or service providers? As an ISO, we interact with providers and participants every day.
Participants	15	Please describe interactions with DR participants or service providers. When and why do you have contact? There are people who are focused on market design, and there are market administrators who deal with the meter data issues. We interact with providers and participants on all levels, i.e., rule interpretation, lifecycle of the program.

Topic	No.	Question
Data/Admin	16	Once a load reduction event has occurred, what is the process for submitting and processing the raw meter data? That is, please describe the steps and procedures in place for obtaining the raw meter data from the end use consumer, applying data validation procedures, calculating the baseline for the event (if applicable), and calculating the load reduction during the event. The 5 minute interval data is submitted to ISO-NE on a continuous basis. It goes through a series of validation checks on the front end by the providers (high values, low values, and zero load values). ISO-NE also applies validation routines (same checks), and flags questionable data. For questionable data, an inquiry is made by the ISO to the service provider. The provider checks the data again and either validates the data or makes corrections.
Data/Admin	17	Who or what entities receive the load data used for determining the baseline and the load reduction amount? What roles and responsibilities does each entity have for processing and storing the data? Both the ISO and the DR providers store the data and calculate the baseline. It is a big system. There are several months of data stored in the system. We have data retention standards for settlement purposes.
Data/Admin	18	Is there a process for dealing with objectionable data? Please describe. Sometimes the ISO receives data that just looks wrong. For example, the time signatures may be off or the peak may be higher than the previously known peak for a particular customer. These data go into a loop of validation. If we still think the data is incorrect, we refer that DR provider to FERC who has enforcement capability (as ISO-NE does not have enforcement capability). We have a formal billing dispute resolution procedure, too, which can be initiated by the participant.

Topic	No.	Question
Data/Admin	19	Are there circumstances when it is acceptable to exclude meter data from baseline development? What are those circumstances? We needed to incorporate a rule requiring a certain proportion of the days in the baseline calculation to be from the immediate period (rather than locking in a baseline and keeping it at that level for a long period of time). This keeps the baseline fresh to reflect the actual baseline in the season. In 2012, we've incorporated a new '7 of last 10' in baseline calculation to address this.
Data/Admin.	20	Do you or provide – or are you aware of – an "off the shelf" software product that specifically calculates the baseline consumption for an event? If so, what vendors provide these products? Not the way ISO-NE calculates the baseline.
Baseline Perf.	21	Does ISO-NE have any automatic systems or processes in place that triggers a baseline review for a DR participant? We do have gaming issue reviews; certain behaviours may trigger a review.
Baseline Perf.	22	Does ISO-NE conduct audits of baseline performance for individual DR participants? If yes, how often? No audits of baseline performance are conducted.
Baseline Perf.	23	In what circumstances can a participant's baseline methodology be changed? N/A. Only one baseline.
Baseline Perf.	24	On average, how often does the methodology for the baseline change for a participant? N/A. Only one baseline.

Topic	No.	Question
Baseline Perf.	25	Does ISO-NE have any public reporting requirements regarding baseline performance and/or demand response mechanism performance? ISO-NE reports on DR in general. The market monitor (an independent entity) publishes a regular (annual) report about DR, in which they may opine on baselines, if baselines are an issue.
Gaming	26	We have a few questions regarding the issue of gaming. Responses to these questions will be aggregated and summarized for our report to AEMO. Your responses will not be attributed to your particular ISO. Does ISO-NE have any concerns about gaming by demand response participants? If so, please describe those concerns. CONFIDENTIAL
Gaming	27	Has ISO-NE observed gaming by demand response participants? CONFIDENTIAL
Gaming	28	Are you aware of issues regarding the timing of notifications and the response by participants that would alter usage during the baseline period? CONFIDENTIAL

Topic	No.	Question
Other	29	In general, do you have any other comments or feedback regarding the development, implementation, and administration of demand response customer baselines? Administrative issues related to baseline methodology are important, as well as accuracy. One should consider these – e.g., Resources, hardware/software. Philosophically speaking about why we have DR baselines: We have developed DR mechanisms given that we are not pricing energy at the real cost of energy. The metering infrastructure is not developed enough at the retail level, which limits the types of time-based energy products. If a customer buys energy at flat prices, there is no incentive to do any DR. DR programs have essentially been developed as a product of American law, and the DR programs require baselines. Baselines would not be required if a utility could price the product with the actual price of energy. For political and economic reasons, we do not do this. There are two ways of basically getting the same thing – one is to develop baselines and pay an incentive, the second is to charge the cost of service in real time.
Other	30	Your feedback and answers to these questions are extremely beneficial to AEMO as they develop a demand response customer baseline methodology. With the exception of the gaming questions, do we have your permission to report your responses and attribute them to your organization? Yes. Thank you very much for your time and feedback.

Australian Energy Market Operator (AEMO)
Demand Response Mechanism Customer Baseline Development
North American ISO Interview

Interviewer	Lorin Molander
Completion Date	June 28, 2013

Respondent Information

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Contact Log

Date/Time	Notes/Results/Actions
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Interview Guide

Introduction

Good (morning/afternoon). My name is _____ and I am calling from DNV KEMA on behalf of the Australian Energy Market Operator, Australia's Independent System Operator. We are conducting interviews of North American ISO staff that have knowledge of demand response customer baseline development, methodology and administration. The data collected during this interview will be used to provide guidance to the Australian Energy Market Operator of the concepts needed for the development of a baseline consumption methodology as they implement a Demand Response Mechanism.

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<tr><td>Intro</td><td>2</td><td>Please briefly describe your role and function within your organization.

Background in economics. I am involved in policy, training, market rules, tariffs, and stakeholder processes.</td></tr>
<tr><td>Current</td><td>3</td><td>What are MISO's current baseline approaches? Do the baseline approaches differ by type of DR program offered by MISO? If so, please include which programs use each baseline methodology.

Table from ISO/RTO council website (2011 version)
<table>
<tr><td>DRR-I</td><td>Demand Response Resource Type I (Energy)</td><td>MISO-10-In-10-Metered, MISO-10-In-10-Sampled,
MISO-Manual-Sampled, MISO-10-Manual-Sampled,
MISO-BMG,
MISO-Firm-Service-Level,
MISO-MBMA-Single-Read</td></tr>
<tr><td>DRR-I</td><td>Demand Response Resource Type-I (Reserve)</td><td>MISO-MBMA-Single-Read</td></tr>
<tr><td>DRR-II</td><td>Demand Response Resource Type II (Energy)</td><td>MISO-10-In-10-Metered, MISO-Manual-Metered,
MISO-BMG,
MISO-Firm-Service-Level,
MISO-MBMA-Single-Read</td></tr>
</table>
</td></tr>
</table>

Topic	No.	Question

DRR-II	Demand Response Resource Type-II (Reserve)	MISO-MBMA-Single-Read
DRR-II	Demand Response Resource Type-II (Regulation)	MISO-MBMA-Interval-Reads
EDR	Emergency Demand Response	MISO-10-In-10-Metered, MISO-10-In-10-Sampled, MISO-Manual-Sampled, MISO-10-Manual-Sampled, MISO-BMG, MISO-Firm-Service-Level, MISO-MBMA-Single-Read
LMR	Load Modifying Resource	MISO-10-In-10-Metered, MISO-10-In-10-Sampled, MISO-Manual-Sampled, MISO-10-Manual-Sampled, MISO-BMG, MISO-Firm-Service-Level, MISO-MBMA-Single-Read

From the Demand Response Business Practices Manual BPM-026, effective April 1, 2013:

ECONOMIC ENERGY AND OPERATING RESERVES

The specific baseline depends on the product being delivered – regulating reserve, contingency reserve, energy, or capacity.

Regulating reserve – the baseline in any 5 minute dispatch interval is the forecasted demand for the Demand Response Resource's host load zone in the dispatch interval. No later than 5 minutes prior to the start of each hour the DRR must submit to MISO a forecast of demands in the 12 5-minute intervals for that hour. No Dispatch Interval Demand Forecast may exceed the Dispatch Interval Demand Forecast cap, which represents the maximum achievable value of the Host Load Zone's gross demand, based on the previous 12 months of historical demand, or some other verifiable calculations if such historical data are unavailable. The Dispatch Interval Demand Forecast cap is initially set when the ARC registers the DRR and must be periodically updated at the request of any market participant but not more frequently than each quarter.

Contingency reserve – this contains spinning reserve and supplemental reserve. The baseline depends on if the resource is DRR-Type I or Type II. (The two types differ primarily with respect to their flexibility in responding to

Topic	No.	Question
		dispatch instructions. A DRR-Type I has only two output states (either on or off), and a DRR-Type II resource can deliver output over a continuous range of values.) For a DR-Type I, the baseline is its metered demand for the 5-minute interval immediately preceding the start of the contingency event. The amount of contingency reserve deployed is then measured by the difference between its consumption baseline value and its metered demand for the 5-mite interval ending 10 minutes after the start of the contingency event. For a DRR Type II providing contingency reserve service must provide telemetered data at 10 second intervals. The consumption baseline is its telemetered average demand in the 10-second interval just prior to the start of the event. The amount of contingency reserve deployed is then measures by the difference between its consumption baseline and its telemetered demand in the 10-second interval occurring exactly 10 minutes after the start of the event. Energy -- For different generic baselines exist for DRRs delivering the energy product – 1) metered generation, 2) calculated baseline, 3) direct load control, and 4) custom baseline. 1. For metered generation, the baseline is the resource's actual metered generation over the hour beginning two hours prior to the hour in which the DRR is initially instructed to reduce load. The deemed demand reduction is the difference between its metered output and its consumption baseline. 2. For the calculated baseline, the baseline is a profile of hourly demand based on an averaged sample of historical data which may be adjusted for factors that reflect specific, on the day conditions such as weather. The default baseline will be – separate hourly demand profiles will be determined for non-holiday weekdays and for weekends/holidays; the weekday hourly profile will be based on the average of the 10 but not less than 5 most recent weekdays that are not holidays or other non-standard event days; the weekend/holiday profiles will be based on the average of the 4 but not less than 2 most recent weekend days or holidays that are not event days; the maximum look-back window will be limited to 45 days; if the 45 day window contains insufficient days to meet the minimum number of days described above, the profiles will be constructed based on the available days within the 45-day window that qualify, supplemented by the largest (MW) matching event day value for that resource within that same window as necessary to obtain the minimum number of values. The MP sponsoring the DRR will have the option (at registration) to accept the unadjusted baseline or to modify it by applying one of the following adjustment mechanisms – symmetric multiplicative and weather sensitive. 3. Direct load control applies to small distributed resources that are not interval metered. The baseline will be statistically estimated from hourly metered demand data. MISO must approve of the specific statistical methodology to be employed before the MP can utilize a DLC consumption baseline.

Topic	No.	Question
		4. Custom baselines may be calculated if none of the three standard baselines above would produce reasonable estimates. MISO must approve of the specific methodology. Capacity – the baseline to determine a DRR's compliance with an instruction to reduce load during an emergency will be the same employed to estimate its delivered energy during normal conditions (see above). EMERGENCY DEMAND RESPONSE The baseline is the actual usage of the facility containing the EDR resource in the hour prior to the start of the event. For resources that are under direct load control, the EDR market participants must provide a description of the DLC system, a description of the load research data used in the measurement and verification analysis, a description of the methodology used to produce the estimate, and a description of all source information for the variables used in the analysis. DR AS A PLANNING RESOURCE The baseline will be the expected value of the DR's average hourly load, rounded to the nearest kWh, for each of the 24 hours in a day. A default baseline will be calculated for each hour in a day as being the simple averages of hourly metered data from the ten business days prior to an emergency event. Alternatives may be proposed at the time of registration. Following an emergency event in with DR was deployed; the MP that registered the DR shall determine the baseline applicable to the hours when the event was active. From the interview: We have to conform to North American Energy Standards Board (NAESB).

<table>
<tr><th>Topic</th><th>No.</th><th>Question</th></tr>
<tr><td>Current</td><td>4</td><td>Do any or all of the baselines include an adjustment (e.g., additive, multiplicative)?

Table from ISO/RTO council website (2011 version)
<table>
<tr><td>MISO-Manual-Metered</td><td>Baseline Type-I</td><td>Customer / Resource Specific</td></tr>
<tr><td>MISO-Manual-Sampled</td><td>Baseline Type-II</td><td>Customer / Resource Specific</td></tr>
<tr><td>MISO-10-In-10-Metered</td><td>Baseline Type-I</td><td>Customer Options:
None
Weather-Sensitive Adjustment
Symmetric-Multiplicitiive Adjustment</td></tr>
<tr><td>MISO-10-In-10-Sampled</td><td>Baseline Type-II</td><td>Customer Options:
None
Weather-Sensitive Adjustment
Symmetric-Multiplicitiive Adjustment</td></tr>
<tr><td>MISO-BMG</td><td>Behind-the-Meter Generation</td><td>N / A</td></tr>
<tr><td>MISO-Firm-Service-Level</td><td>Maximum Base Load</td><td>N / A</td></tr>
<tr><td>MISO-MBMA-Single-Read</td><td>Meter Before / Meter After</td><td>None</td></tr>
<tr><td>MISO-MBMA-Interval-Reads</td><td>Meter Before / Meter After</td><td>None</td></tr>
</table>
From the Demand Response Business Practices Manual BPM-026, effective April 1, 2013:

The DRR delivering the energy product has an option at registration to select either a symmetric multiplicative adjustment or a weather sensitive adjustment. The SMA adjusts each baseline hourly value (MW) during the event up or down by the ration of (a) the sum of hourly demands for the three hours beginning four hours prior to the event and (b) the sum of those same three hourly baseline demands. This adjustment is limited to a change in any individual baseline hour of plus or minus 20 percent.

The WSA adjusts each baseline hourly value (MW) up or down by a weather adjustment factor. The weather adjustment factor is determined by a mathematical relationship derived through a regression analysis that considers the DRR load and historical hourly consumption.</td></tr>
</table>

Topic	No.	Question
Current	5	Are the baselines calculated prospectively or retroactively? What historical or forward-looking period of time is used to determine the appropriate baseline? Retroactively. It's a 10-in-10 from a look-back period, after an event happens the participants submit their data.
Current	6	What were the reasons for selecting this/these baselines? The primary reason for selecting these baselines was that we need to follow NAESB protocols as a starting point. It was a well-informed process when we selected these. We looked to PJM and ISO-NE who had experience in the market with similar baselines.
Current	7	What are the challenges you faced when selecting this/these baseline(s)? The challenges were vetting the baseline methodology in the stakeholder process and getting buy-in.
Current	8	What are the challenges with these baselines now that they are implemented? No significant challenges now that they are implemented, although we are sensitive to the possibility of gaming.
Current	9	Are you in the process of evaluating - or do you have any plans to evaluate - your current baseline methodology? We are planning on modifying our methodology related to regulating reserves to comply with a FERC order to determine an alternative to the forecasting portion of the M&V process. An example of an alternative we are considering is the meter before/meter after method.

Topic	No.	Question
Future	10	Are there any plans for making modifications to the current baseline approaches? See #9.
Participants	11	Please describe the process for choosing a baseline for a participant. Are there specific criteria that determine a customer's eligibility for a particular baseline? There are a number of steps to follow, similar to a decision tree: 1) what market is the customer participating in, 2) product selection, i.e., what program will the customer participate, 3) what are the assets (load reduction and/or behind the meter generation. These determine which baseline will be applicable.
Participants	12	What if the customer does not agree with the ISO's baseline assignment? What is the process to resolve disputes? If a participant does not agree, they need to discuss this with ISO and propose a custom baseline methodology. There is a formal dispute resolution process if there are disagreements, as documented in the tariff.
Participants	13	How is a baseline determined for a customer with no historical data? We have not experienced this situation.
Participants	14	How often do you or other staff at MISO interact with DR participants or service providers? My role and my group's role is during the market design phase, and the stakeholder process and policy, so there is little interaction with DR participants. The Customer Relations group, however, likely interacts more often with participants dealing with settlements.

Topic	No.	Question
Participants	15	Please describe interactions with DR participants or service providers. When and why do you have contact? See #14.
Data/Admin	16	Once a load reduction event has occurred, what is the process for submitting and processing the raw meter data? That is, please describe the steps and procedures in place for obtaining the raw meter data from the end use consumer, applying data validation procedures, calculating the baseline for the event (if applicable), and calculating the load reduction during the event. The process is very automated. We use the UISOL software. The providers sign in to the system, submit the meter data, and the software calculates the baseline. The data comes from the DR provider, the MDM agent, or the load serving entity (LSE). There are validation procedures MISO uses to verify the data.
Data/Admin	17	Who or what entities receive the load data used for determining the baseline and the load reduction amount? What roles and responsibilities does each entity have for processing and storing the data? See #16 above.
Data/Admin	18	Is there a process for dealing with objectionable data? Please describe. If MISO determines there is questionable data, we initiate a process to inquire about the data with the service provider (or whomever is submitting the data) to determine if the data values are real. If there are issues not settled through this inquiry, we have a dispute resolution group who would handle the situation.
Data/Admin	19	Are there circumstances when it is acceptable to exclude meter data from baseline development? What are those circumstances? We exclude events days from the baseline calculation.

Topic	No.	Question
Data/Admin.	20	Do you or provide – or are you aware of – an "off the shelf" software product that specifically calculates the baseline consumption for an event? If so, what vendors provide these products? Yes, we use UISOL (now ALSTOM).
Baseline Perf.	21	Does MISO have any automatic systems or processes in place that triggers a baseline review for a DR participant? No.
Baseline Perf.	22	Does MISO conduct audits of baseline performance for individual DR participants? If yes, how often? We have reviewed the baseline performance for participants, but we do not conduct these reviews often. It should be noted that we do not have vigorous amounts of participation in our energy market.
Baseline Perf.	23	In what circumstances can a participant's baseline methodology be changed? A participant may propose an alternate baseline methodology, and prove that it is more accurate for them than the standard MISO baseline.
Baseline Perf.	24	On average, how often does the methodology for the baseline change for a participant? Rarely.
Baseline Perf.	25	Does MISO have any public reporting requirements regarding baseline performance and/or demand response mechanism performance? We do not currently have reporting requirements. Occasionally we will get questions from FERC about DR.

Topic	No.	Question
Gaming	26	We have a few questions regarding the issue of gaming. Responses to these questions will be aggregated and summarized for our report to AEMO. Your responses will not be attributed to your particular ISO. Does MISO have any concerns about gaming by demand response participants? If so, please describe those concerns. CONFIDENTIAL
Gaming	27	Has MISO observed gaming by demand response participants? CONFIDENTIAL
Gaming	28	Are you aware of issues regarding the timing of notifications and the response by participants that would alter usage during the baseline period? CONFIDENTIAL
Other	29	In general, do you have any other comments or feedback regarding the development, implementation, and administration of demand response customer baselines? Currently, we have few participants in the energy DR market. Should our participation grow, we would be challenged by the amount of resources it would take to 'stay on top of it.' Scalability should be kept in mind when developing a new program.
Other	30	Your feedback and answers to these questions are extremely beneficial to AEMO as they develop a demand response customer baseline methodology. With the exception of the gaming questions, do we have your permission to report your responses and attribute them to your organization? Yes. Thank you very much for your time and feedback.

Australian Energy Market Operator (AEMO)
Demand Response Mechanism Customer Baseline Development
North American ISO Interview

Interviewer	Written document completed by NYISO
Completion Date	July 18, 2013

Respondent Information

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Company Name	New York ISO

Contact Log

Date/Time	Notes/Results/Actions
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Interview Guide

Introduction

Good (morning/afternoon). My name is _____ and I am calling from DNV KEMA on behalf of the Australian Energy Market Operator, Australia's Independent System Operator. We are conducting interviews of North American ISO staff that have knowledge of demand response customer baseline development, methodology and administration. The data collected during this interview will be used to provide guidance to the Australian Energy Market Operator of the concepts needed for the development of a baseline consumption methodology as they implement a Demand Response Mechanism.

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Manager of Demand Response Products – responsible for development of market design and market rule changes related to NYISO's demand response programs</td></tr>
<tr><td>Current</td><td>3</td><td>What are NYISO's current baseline approaches? Do the baseline approaches differ by type of DR program offered by NYISO? If so, please include which programs use each baseline methodology.

Table from ISO/RTO council website (2011 version), edited by NYISO
<table>
<tr><td>DADRP</td><td>Day-Ahead Demand Response Program</td><td>NYISO-Base1</td></tr>
<tr><td>DSASP</td><td>Demand Side Ancillary Services Program – Spinning Reserves</td><td>NYISO-MBMA</td></tr>
<tr><td>DSASP</td><td>Demand Side Ancillary Services Program - Non-Synchronous Reserves</td><td>NYISO-MBMA</td></tr>
<tr><td>DSASP</td><td>Demand Side Ancillary Services Program – Regulation Service</td><td>NYISO-MBMA</td></tr>
<tr><td>EDRP</td><td>Emergency Demand Response Program</td><td>NYISO-Base1, NYISO-Base2, NYISO-BMG</td></tr>
</table>
</td></tr>
</table>

Topic	No.	Question

SCR	Installed Capacity Special Case Resources (Energy Component)	NYISO-Base1, NYISO-Base2, NYISO-BMG
SCR	Installed Capacity Special Case Resources (Capacity Component)	NYISO-MBL

EMERGENCY AND DAY AHEAD –

From Manual 7, Emergency Demand Response Program Manual, December 2010. At the time of enrolment, participants may elect either the Average Day CBL or the Adjusted CBL method.

Average Day –

- {NOTE: On July 9, 2013 the NYISO presented an updated description of how the Average Day CBL is calculated. It is much clearer than the existing language included here. It is already posted on the NYISO's website under Manuals Under Review. }

Weekdays:

Step 1: Establish the CBL window:

a) Determine the participant's peak hourly load over the past 30 days or the period covered by the load data file, whichever is lower. This value is the initial seed value for the average event period usage level.
b) Beginning with the weekday that is two days prior to the event: eliminate holidays, event days, days prior to event days. Calculate the average daily event period usage for that day, defined as the simple average of the participant's actual usage over the hours that define the event for which the CBL is being developed. Eliminate low usage days (usage less than 25% of average event period usage). If the day has not been eliminated, update the average event period usage level by including the average daily event period usage for this day. If this is the first day added to the CBL window, replace the average event period usage level (which was the initial seed value) with the average daily event period usage. Add this day to the CBL window.
c) Move back one day and loop back to step b.
d) Final CBL window must contain 10 weekday days.

Step 2: Establish CBL basis:

a) Identify 5 days from the 10-day window to be used to develop the CBL values for each hour of the event by eliminating the 5 days

Topic	No.	Question
		with the lowest average daily event period usage. Step 3: Calculate Average Day CBL values for the event: a) For each hour of the event, the CBL is the average of the usage in that hour in the five days that comprise the CBL basis. Weekend Days: Step 1: Establish the CBL window: a) The CBL window is comprised of the most recent three like (Saturday or Sunday) weekend days. There are no exclusions for Holiday or event days. Step 2: Establish CBL basis: a) Calculate the average daily event period usage value for each of the three days in the CBL window eliminating the day with the lowest average daily event period usage level. Step 3: Calculate Average Day CBL values for the event: b) For each hour of the event, the CBL is the average of the usage in that hour in the two days that comprise the CBL basis. Elective Weather-sensitive CBL: Step 1: Follow the steps above to calculate the Average Day CBL values for each hour of the event period. Step 2: Calculate the event final adjustment factor, which is applied to each of the individual hourly values of the Average Day CBL: a) Establish the adjustment period, the two-hour period beginning with the start of the hour that is four hours prior to the commencement of the event through the end of the hour three hours prior to the event. b) Calculate the Adjustment basis Average CBL c) Apply the Average Day CBL formula as described above to the adjustment period hours as through it were an event period two hours in duration, but using the five days selected for use in the Average CBL basis (i.e., average the ten hours). d) Calculate the average of the two usage values in the step above. Step 2: Calculate the Adjustment basis average usage – simple average of the participant's usage over the two hour adjustment period on the event day. Step 3: Calculate the gross adjustment factor – equal to the Adjustment Basis Average Usage divided by the Adjustment basis Average CBL.

Topic	No.	Question
		Step 4: Determine the final adjustment factor: a) If the gross adjustment factor is greater than 1.00, then the final adjustment factor is the smaller of the gross adjustment factor or 1.2. b) If less than 1.0, the final adjustment factors are greater of the gross factor or .8. c) If the gross is 1.0, then then final is 1.0. Step 5: The event adjusted CBL value for each hour of an event is the product of the final adjustment factor and the Average CBL for that hour.

<table>
<tr><th>Topic</th><th>No.</th><th>Question</th></tr>
<tr><td>Current</td><td>4</td><td>Do any or all of the baselines include an adjustment (e.g., additive, multiplicative)?

The Emergency and Day Ahead CBL method includes an elective weather sensitive CBL method that is essentially a multiplicative adjustment of the basic CBL method.

Table from ISO/RTO council website (2011 version), edited by NYISO
<table>
<tr><td>NYISO-MBL</td><td>Maximum Base Load</td><td>N / A</td></tr>
<tr><td>NYISO-MBMA</td><td>Meter Before / Meter After</td><td>N / A</td></tr>
<tr><td>NYISO-Base1</td><td>Baseline Type-I</td><td>Weather-Sensitive Adjustment (Optional), Symmetrical Proportional Adjustment with a maximum of +/- 20% based on the load levels in the third and fourth hours before the deployment period. Advance Notification occurs at least two hours prior to the deployment period.</td></tr>
<tr><td>NYISO-Base2
(Small Customer Aggregations)</td><td>Baseline Type-II</td><td>Equivalent of the Baseline Adjustment defined for other resources (NYISO-Base 1), as approved on a case by case basis through the NYISO’s stakeholder process</td></tr>
<tr><td>NYISO-BMG</td><td>Behind-The-Meter Generation</td><td>N / A</td></tr>
</table>
</td></tr>
</table>

Topic	No.	Question
Current	5	Are the baselines calculated prospectively or retroactively? What historical or forward-looking period of time is used to determine the appropriate baseline? It depends on the product and market. The Maximum Base Load type baseline of the Special Case Resource (SCR) program uses an average of the highest twenty hourly loads of the top 40 hourly loads of the resource that are coincident with the system peak hours from the prior like season – called the Average Coincident Load (ACL). The ACL becomes the upper limit of the capacity the demand response resource can offer into the capacity market. The ACL is also used for computing response during a deployment. So it is a prospective baseline that uses historical data to determine the amount of capacity that a demand side resource has and it is used to evaluate whether or not the resource delivered its capacity obligation. In addition, capacity resources are eligible for an energy payment during a deployment. For the energy calculation, the baseline may or may not be provided to the resource in advance of a deployment, depending on the aggregator that enrols the resource. The NYISO does not currently calculate the energy baselines for each resource; they are calculated by the aggregator and reported to the NYISO along with the meter data relevant to compute response. The energy baseline (NYISO-Base1) uses historical data from a more recent time period to estimate the hourly load level that may have been consumed if the deployment had not occurred. Historical data is generally from the two weeks prior to the deployment, and may not exceed thirty days before the deployment. The energy baseline applies to demand response resources that receive an energy payment for an emergency deployment and for demand response resources scheduled in the energy market on a day-ahead basis. The NYISO does not currently permit demand response to participate in the real-time energy market, but is developing market rules. The baseline for demand response in the real-time energy market has not yet been defined. Also, a revised energy baseline that addresses degradation resulting from frequent scheduling (the ECBL proposed in the NYISO's Aug. 19, 2011 filing on Order 745) has been proposed for economic demand response in the energy market. Baseline measures used in the real-time market for ancillary services use a Meter Before/Meter After approach due to the nature of dispatch for ancillary services. The six-second interval prior to receiving a non-zero base point signal is the baseline for the duration of the dispatch. When the resource receives a zero base point signal for operating reserves, the baseline is set to zero until the next non-zero base point. For demand response resources providing regulation service, the zero base point must be accompanied by the "off" status of the regulation flag to ensure that the reset of the baseline does not occur when a demand resource is regulating down.

Topic	No.	Question
Current	6	What were the reasons for selecting this/these baselines? Based on the product type, the frequency of scheduling, and stakeholder feedback.
Current	7	What are the challenges you faced when selecting this/these baseline(s)? Maintaining an approach that takes into account the requirements of the product type, reflects the best estimate of the load at the time of the deployment, and does not get distorted by piecemeal changes proposed by stakeholders.
Current	8	What are the challenges with these baselines now that they are implemented? Data verification.
Current	9	Are you in the process of evaluating - or do you have any plans to evaluate - your current baseline methodology? Yes, the NYISO is conducting a study that will be completed by the end of 2013. Presentation on the analysis design: http://www.nyiso.com/public/webdocs/markets_operations/committees/bic_icapwg/meeting_materials/2013-05-22/SCR%20Baseline%20Study%20Update%20PRLWG_ICAPWG%20May222013%2005152013.pdf
Future	10	Are there any plans for making modifications to the current baseline approaches? Possibly, based on the results of the study. As we are just about to begin the analysis phase, it is too early to tell at this time.

Topic	No.	Question
Participants	11	Please describe the process for choosing a baseline for a participant. Are there specific criteria that determine a customer's eligibility for a particular baseline? Unable to provide a response to this question.
Participants	12	What if the customer does not agree with the ISO's baseline assignment? What is the process to resolve disputes? The NYISO baselines are product-specific, not resource-specific.
Participants	13	How is a baseline determined for a customer with no historical data? With very limited exceptions, a resource may not be enrolled in NYISO's demand response programs unless it has an interval meter. For the capacity market baseline (ACL), resources may enrol with a Provisional ACL that is subject to verification after their participation in the season in which they were enrolled with a Provisional ACL baseline. Variance between the Provisional and Verified ACL is subject to a shortfall penalty at the resource level, regardless of whether or not their response to a deployment satisfied their capacity obligation. Capacity response affects a reduction of the possible performance going forward; the shortfall penalty is a result of overstating capability in the season for which they enrolled with a Provisional ACL.
Participants	14	How often do you or other staff at NYISO interact with DR participants or service providers? We interact with the aggregators of demand response resources as often as daily, as questions or issues arise. We have limited interactions with the end use customers that are represented by the aggregators.
Participants	15	Please describe interactions with DR participants or service providers. When and why do you have contact? Primarily through the stakeholder process, but also directly with aggregators when questions and issues arise that require discussion related to the aggregator.

Topic	No.	Question
Data/Admin	16	Once a load reduction event has occurred, what is the process for submitting and processing the raw meter data? That is, please describe the steps and procedures in place for obtaining the raw meter data from the end use consumer, applying data validation procedures, calculating the baseline for the event (if applicable), and calculating the load reduction during the event. Aggregators are required to collect the hourly interval meter data. If the aggregators request energy payments for capacity demand response, the aggregators perform the energy baseline calculations. Aggregators prepare the data for import to NYISO's system. Data is required to be reported within 75 days of the load reduction event (these are the emergency events, not economic scheduled demand response). For economic demand response in the energy or ancillary services market, the reporting obligations are the same as other generation supply resources. The reporting timeframe is shorter (55 days), includes a different system, and an opportunity to revise the data.
Data/Admin	17	Who or what entities receive the load data used for determining the baseline and the load reduction amount? What roles and responsibilities does each entity have for processing and storing the data? Not sure what is being asked here. The distribution utility collects data from a revenue meter for billing purposes. That data may or may not be the same data that the aggregator reports to the NYISO because the distribution utility does not allow any other party access to the revenue meter. The NYISO allows the aggregator to install non-revenue meters that meet a +/- 2% of full scale level of accuracy. The aggregator is responsible for keeping the meter data that it reports to the NYISO for at least three years. The NYISO has its own data retention policies as outlined in its tariff.

Topic	No.	Question
Data/Admin	18	Is there a process for dealing with objectionable data? Please describe. The tariff provides aggregators with 75 days after a deployment (event) to prepare and report the data. If the NYISO has questions about any of the data reported, it will occur after that 75-day period when it has received and processed the data. Questions about the data may involve contacting the distribution utility to provide its revenue billing meter data for comparison.
Data/Admin	19	Are there circumstances when it is acceptable to exclude meter data from baseline development? What are those circumstances? Yes, as described in the baseline rules.
Data/Admin.	20	Do you or provide – or are you aware of – an "off the shelf" software product that specifically calculates the baseline consumption for an event? If so, what vendors provide these products? Unable to provide a response to this question.
Baseline Perf.	21	Does NYISO have any automatic systems or processes in place that triggers a baseline review for a DR participant? Unable to provide a response to this question.
Baseline Perf.	22	Does NYISO conduct audits of baseline performance for individual DR participants? If yes, how often? Unable to provide a response to this question.
Baseline Perf.	23	In what circumstances can a participant's baseline methodology be changed? Unable to provide a response to this question.
Baseline Perf.	24	On average, how often does the methodology for the baseline change for a participant? Unable to provide a response to this question.

Topic	No.	Question
Baseline Perf.	25	Does NYISO have any public reporting requirements regarding baseline performance and/or demand response mechanism performance? Unable to provide a response to this question.
Gaming	26	We have a few questions regarding the issue of gaming. Responses to these questions will be aggregated and summarized for our report to AEMO. Your responses will not be attributed to your particular ISO. Does NYISO have any concerns about gaming by demand response participants? If so, please describe those concerns. Unable to provide a response to this question.
Gaming	27	Has NYISO observed gaming by demand response participants? Unable to provide a response to this question.
Gaming	28	Are you aware of issues regarding the timing of notifications and the response by participants that would alter usage during the baseline period? Unable to provide a response to this question.
Other	29	In general, do you have any other comments or feedback regarding the development, implementation, and administration of demand response customer baselines? Unable to provide a response to this question.
Other	30	Your feedback and answers to these questions are extremely beneficial to AEMO as they develop a demand response customer baseline methodology. With the exception of the gaming questions, do we have your permission to report your responses and attribute them to your organization? Thank you very much for your time and feedback.

Australian Energy Market Operator (AEMO)
Demand Response Mechanism Customer Baseline Development
North American ISO Interview

Interviewer	Lorin Molander
Completion Date	June 21, 2013

Respondent Information

Contact Name	Pete Langbein
Contact Title	Manager, Demand Side Response Operations
Phone	
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Company Name	PJM Interconnection

Contact Log

Date/Time	Notes/Results/Actions
1	
2	
3	
4	
5	
6	

Interview Guide

Introduction

Good (morning/afternoon). My name is _____ and I am calling from DNV KEMA on behalf of the Australian Energy Market Operator, Australia's Independent System Operator. We are conducting interviews of North American ISO staff that have knowledge of demand response customer baseline development, methodology and administration. The data collected during this interview will be used to provide guidance to the Australian Energy Market Operator of the concepts needed for the development of a baseline consumption methodology as they implement a Demand Response Mechanism.

Topic	No.	Question
Intro	1	[Record name, organization, and contact information of respondent on cover sheet.]
Intro	2	Please briefly describe your role and function within your organization. Manager of demand response operations group.

<table>
<tr><th>Topic</th><th>No.</th><th>Question</th></tr>
<tr><td>Current</td><td>3</td><td>
What are PJM's current baseline approaches? Do the baseline approaches differ by type of DR program offered by PJM? If so, please include which programs use each baseline methodology.

The 3-Day Type with symmetric additive adjustment represents the standard, tariff defined CBL which is utilized for most Non-Variable economic demand resources.

The alternative CBLs on the list have been created over time to provide options, especially for the Variable Load customers that have an RRMSE above 20%. (PJM Manual 11, 2013)

The alternative CBLs are 3 Day Types, 3 Day Types with Weather Sensitive Adjustment, 7 Day Types, 7 Day Types with SAA, Maximum Base Load, and Metered Generation. (PJM Manual 11, 2013)

Table from ISO/RTO council website (2011 version)
<table>
<tr><td>Economic Load Response (Energy)</td><td>PJM-Base1, PJM-BMG, PJM-Base2, PJM-Alternate</td></tr>
<tr><td>Economic Load Response (Synchronized reserves)</td><td>PJM-MBMA-Reserve</td></tr>
<tr><td>Economic Load Response (Day ahead scheduling reserve)</td><td>PJM-MBMA-Reserve</td></tr>
<tr><td>Economic Load Response (Regulation)</td><td>PJM-MBMA-Reg</td></tr>
<tr><td>Emergency Load Response - Energy Only</td><td>PJM-MBMA-Energy</td></tr>
<tr><td>Full Emergency Load Response (Limited DR - Capacity Component)</td><td>PJM-Base1, PJM-BMG, PJM-Base2, PJM-MBMA-Energy, PJM-MBL, PJM-Alternate</td></tr>
<tr><td>Full Emergency Load Response (Extended Summer DR - Capacity Component)</td><td>PJM-Base1, PJM-BMG, PJM-Base2, PJM-MBMA-Energy, PJM-MBL, PJM-Alternate</td></tr>
<tr><td>Full Emergency Load Response (Annual DR - Capacity Component)</td><td>PJM-Base1, PJM-BMG, PJM-Base2, PJM-MBMA-Energy, PJM-MBL, PJM-Alternate</td></tr>
<tr><td>Full Emergency Load Response (Energy Component)</td><td>PJM-MBMA-Energy</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Topic</th><th>No.</th><th>Question</th></tr>
<tr><td>Current</td><td>4</td><td>Do any or all of the baselines include an adjustment (e.g., additive, multiplicative)?

Yes, as mentioned above, the standard CBL utilizes a symmetric additive adjustment. There is also a weather sensitive adjustment. (PJM Manual 11, 2013)

Table from ISO/RTO council website (2011 version)
<table>
<tr><td>PJM-Base1</td><td>Baseline Type-I</td><td>Weather-Sensitive Adjustment OR Symmetric Additive Adjustment</td></tr>
<tr><td>PJM-Base2</td><td>Baseline Type-II</td><td>Approved on case by case basis or may use published deemed savings study</td></tr>
<tr><td>PJM-MBL</td><td>Maximum Base Load</td><td>N / A</td></tr>
<tr><td>PJM-MBMA-Energy</td><td>Meter Before / Meter After</td><td>None</td></tr>
<tr><td>PJM-MBMA-Reserve</td><td>Meter Before / Meter After</td><td>None</td></tr>
<tr><td>PJM-MBMA-Reg</td><td>Meter Before / Meter After</td><td>None</td></tr>
<tr><td>PJM-BMG</td><td>Behind-the-Meter Generation</td><td>N / A</td></tr>
<tr><td>PJM-Alternate</td><td>Baseline Type-I</td><td>Alternative calculations available as appropriate based on specific load conditions as long as it will significantly improve accuracy compared to standard method & can be effectively administered in the market</td></tr>
</table></td></tr>
</table>

Topic	No.	Question
Current	5	Are the baselines calculated prospectively or retroactively? What historical or forward-looking period of time is used to determine the appropriate baseline? Calculated retroactively. It is a function of when the meter data become available. We have to wait to get the data.
Current	6	What were the reasons for selecting this/these baselines? There are three primary decision making criteria for choosing these baselines: 1) the empirical performance of the baselines with respect to accuracy, bias, and variability, 2) administrative burden/simplicity of implementation, and 3) to minimize gaming or free-ridership.
Current	7	What are the challenges you faced when selecting this/these baseline(s)? Getting people to agree on one baseline method. We considered the implementation of the baselines and the administrative burden it would bear on PJM and the participants when selecting the baselines.
Current	8	What are the challenges with these baselines now that they are implemented? To find accurate baseline for variable load customers.
Current	9	Are you in the process of evaluating - or do you have any plans to evaluate - your current baseline methodology? We are focused on developing baselines for customers with highly variable loads.
Future	10	Are there any plans for making modifications to the current baseline approaches? If we find approaches for customers with highly variable loads, we will make those modifications.

Topic	No.	Question
Participants	11	Please describe the process for choosing a baseline for a participant. Are there specific criteria that determine a customer's eligibility for a particular baseline? Registrations go through a CBL certification process. All registrations should use a CBL with a relative root mean square error ("RRMSE") no greater than 20% unless otherwise approved by PJM. The CSP calculates the RRMSE for the standard CBL defined by the tariff. An alternative may be suggested if the alternative is more accurate than the standard and has an RRMSE less than or equal to 20%. The two parties must agree within 30 days. If they don't agree, then PJM will determine the CBL within the next 20 days. The parties may agree upon an alternative within that 20-day period. (PJM Manual 11, 2013) Also, PJM will modify a time period for the RMSE test to align with when a customer expects to curtail if that is different than what PJM uses as a standard basis. For example, if the customer is a school and there are no plans to reduce load during spring break.
Participants	12	What if the customer does not agree with the ISO's baseline assignment? What is the process to resolve disputes? The participant may develop an alternative baseline approach. This approach must be tested and empirically proven that it meets RMSE test. The proposed approach must also be effectively administered.
Participants	13	How is a baseline determined for a customer with no historical data? If a customer does not have historical load data, PJM may use a similar customer's load as a proxy. The other approach is to assign a conservative maximum base load and use that until there is meter data available. A customer can be assigned the standard CBL on a temporary basis, then test other baselines when data becomes available.

Topic	No.	Question
Participants	14	How often do you or other staff at PJM interact with DR participants or service providers? Interaction is a function of the registration cycles. Interaction can happen as often as a daily basis. Once registrations are completed, then it is usually more of a weekly basis.
Participants	15	Please describe interactions with DR participants or service providers. When and why do you have contact? We help new customers understand baselines and how they work, and how the baselines work in the system. We help through the registration process (no load data, RMSE test, exceptions, etc.). We also deal with customers with highly variable loads.
Data/Admin	16	Once a load reduction event has occurred, what is the process for submitting and processing the raw meter data? That is, please describe the steps and procedures in place for obtaining the raw meter data from the end use consumer, applying data validation procedures, calculating the baseline for the event (if applicable), and calculating the load reduction during the event. Curtailment service providers must forward the appropriate meter data to PJM within 60 days of the reduction, through the appropriate PJM system. If meter data files are not received within 60 days, then no payment for participation is provided. Load data must be provided for all hours of the day and for all days necessary for PJM to calculate the CBL for settlements or to measure compliance. Meter data will be forwarded to the EDC and LSE upon receipt, and these parties have 10 days to review accuracy and provide feedback to PJM. (PJM Manual 11, 2013) We are in the process of reviewing the LSE's role for this and may only have EDC review in the future. For the settlement process, PJM had the LSE check the retail rate information since it was used in settlements. With FERC 745 (LMP full compensation), the LSE no longer needs to look at it.

Topic	No.	Question
Data/Admin	17	Who or what entities receive the load data used for determining the baseline and the load reduction amount? What roles and responsibilities does each entity have for processing and storing the data? The CSP provides PJM the meter data. Most CSPs get the data from the EDC (although some sites have their own metering). The EDC and the LSE can look at the data. The EDC reviews the data for accuracy. The meter data is only needed for settlement for when a customer participates. The CSPs maintain data on their side for support purposes. PJM determines the baseline and the load reduction. Occasionally there will be a brand new CBL that has not yet been programmed into the system, in which case the CSP will calculation the baseline.
Data/Admin	18	Is there a process for dealing with objectionable data? Please describe. Meter data will be forwarded to the EDC and LSE upon receipt, and these parties have 10 days to review accuracy and provide feedback to PJM. Objections by the EDC or LSE to the meter data shall be clearly set forth in the comments related to settlement data. The CSP shall correct and re-submit the settlement data within 2 business days. The objecting EDC or LSE shall have 5 business days to review the re-submitted settlement data or PJM will assume acceptance. All load reduction data are subject to PJM Marketing Monitoring Unit audit. (PJM Manual 11, 2013)
Data/Admin	19	Are there circumstances when it is acceptable to exclude meter data from baseline development? What are those circumstances? As previously mentioned, there are periods of time when load is not standard (e.g., spring break on a school campus). The PJM baseline has a usage threshold built into it to catch days that are atypical. If there are atypical or bad data, above and beyond the regular checks then PJM will review the data (e.g., lightning strikes).

Topic	No.	Question
Data/Admin.	20	Do you or provide – or are you aware of – an "off the shelf" software product that specifically calculates the baseline consumption for an event? If so, what vendors provide these products? PJM uses ALSTOM (formerly UISOL, UISOL was purchased by ALSTOM).
Baseline Perf.	21	Does PJM have any automatic systems or processes in place that triggers a baseline review for a DR participant? To participate, PJM's system requires the RMSE test. Once a customer is participating, there is no automatic process that triggers a review.
Baseline Perf.	22	Does PJM conduct audits of baseline performance for individual DR participants? If yes, how often? Again, the RMSE test must be passed in the first place in order to participate. PJM conducts ad hoc analyses to review activity on ongoing basis.
Baseline Perf.	23	In what circumstances can a participant's baseline methodology be changed? If a customer's operating load changes, then a change to the baseline is considered. There is some language in the tariff regarding changes in load and notification to PJM.
Baseline Perf.	24	On average, how often does the methodology for the baseline change for a participant? Rarely.
Baseline Perf.	25	Does PJM have any public reporting requirements regarding baseline performance and/or demand response mechanism performance? No reporting requirements specifically regarding baselines. We have some reliability reporting to NERC as well as some summary reports to FERC. As an operating practice, however, we do publish a public report of DR activity on a monthly basis.

Topic	No.	Question
Gaming	26	We have a few questions regarding the issue of gaming. Responses to these questions will be aggregated and summarized for our report to AEMO. Your responses will not be attributed to your particular ISO. Does PJM have any concerns about gaming by demand response participants? If so, please describe those concerns. CONFIDENTIAL
Gaming	27	Has PJM observed gaming by demand response participants? CONFIDENTIAL
Gaming	28	Are you aware of issues regarding the timing of notifications and the response by participants that would alter usage during the baseline period? CONFIDENTIAL
Other	29	In general, do you have any other comments or feedback regarding the development, implementation, and administration of demand response customer baselines? Research and consideration of baselines is very important when developing a demand response program. The CBL will never be perfect, but it is highly important, the methodology and administration are not trivial.
Other	30	Your feedback and answers to these questions are extremely beneficial to AEMO as they develop a demand response customer baseline methodology. With the exception of the gaming questions, do we have your permission to report your responses and attribute them to your organization? Please write up the responses for my review prior to using them in a report. Thank you very much for your time and feedback.