

DEMAND RESPONSE MECHANISM AND ANCILLARY SERVICES UNBUNDLING - HIGH LEVEL MARKET DESIGN

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1 Executive Summary

This report presents the high level design of a demand response mechanism (DRM) and ancillary services unbundling (ASU) arrangements to be implemented in the National Electricity Market (NEM).

AEMO has been tasked by the Standing Council on Energy and Resources (SCER) to develop and implement the DRM and ASU in consultation with industry. This document, which reflects what has been agreed to date, is intended to provide a high level reference point for that work and form the basis for the detailed market design to be developed by October 2013.

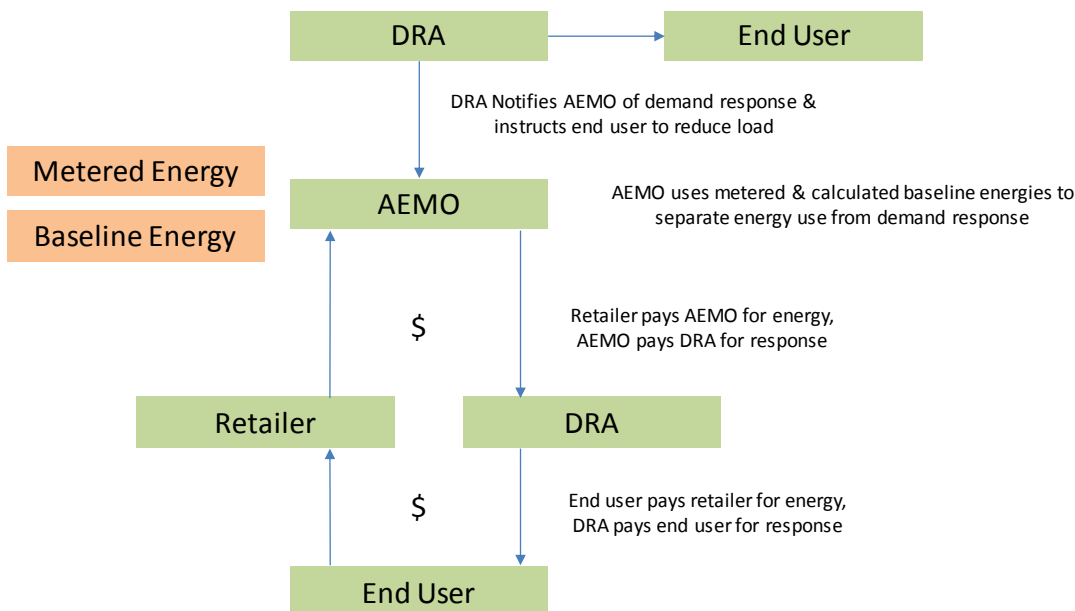
The DRM and ASU are two of the recommendations from the Australian Energy Market Commission’s (AEMC) Power of Choice review.¹ The package of recommended reforms is intended to provide households, businesses and industry with more opportunities to make informed choices about the way they use electricity and manage expenditure. The AEMC has found that under the current arrangements consumers are limited in their ability to respond to changes in the wholesale electricity spot price. While they are able to physically reduce their consumption under specific contractual arrangements such as interruptible tariffs, spot pass-through and scheduled loads, these involve a degree of risk and transaction costs that for most commercial and industrial users cannot be efficiently managed.

The DRM will initially be available to industrial and commercial end users of electricity with a contestable energy supply contract, annual consumption of the order of 100 MWh or above and revenue-grade, remotely-read interval metering. An end user will participate indirectly through a registered Demand Response Aggregator (DRA) or directly by registering itself as a DRA.

A DRA will be a new category of registered participant in the NEM. Any existing market participants (retailers or generators for example) will be able to register as a DRA. In addition, new specialist aggregators will also be able to register. The Australian Energy Regulator is considering whether there should be restrictions on network service providers.

Figure 1 presents the workings of the DRM for a demand response interval.

Figure 1 Demand Response Mechanism



In summary:

- A DRA notifies AEMO of an imminent or commenced load reduction forming what is termed a Demand Response Interval.

¹ Power of Choice Review – Giving Consumers Options in the way they use Electricity. Final Report. AEMC 30 November 2012.

- After the event, AEMO calculates a baseline consumption for this interval, reflecting what demand is expected to have been had there been no demand response. The baseline is based both on historic data and data from the day the demand reduction occurred.
- In settlement, the calculated “baseline” consumption is compared with actual energy used to unbundle the amount of demand response from the energy usage had the response not occurred. Outside of the demand response interval settlement will operate as it does today, but during the demand response interval:
 - DRAs will be paid (at the NEM spot price) for the difference between baseline consumption and actual consumption. For symmetry, DRA will be charged if actual consumption exceeds baseline consumption.
 - End users would be paid by the DRA for their response based on their commercial arrangements with the DRA.
 - Retailers will be charged for energy consumption (at the NEM spot price) based on the baseline consumption.
 - End users would be charged by their retailer (at their retail rate) based on the baseline consumption.

Demand response will be non-scheduled at the commencement of the DRM, although the possibility exists to evolve to an AEMO scheduled response in the future. It is proposed that AEMO’s annual report on DRM performance could be the mechanism that identifies evolution and amendments to the DRM.

The introduction of DRM will require changes to metering arrangements so as to support the baseline calculations and settlement; provide for information exchange and notifications of changes in equipment or responsible entities. It is proposed that the DRM arrangements will only employ meters with a National Metering Identifier (NMI). This would exclude customers and meters that are not visible or registered in the NEM systems (i.e. sub-meters).

DRAs will be required to “classify” the loads providing the demand response by providing AEMO with the NMI for those loads. For the purposes of DRM reporting, DR loads will be categorised by the type of load (e.g. mining, manufacturing, transport and storage) and the mechanism by which DRM is provided (e.g. electricity generation, plant shutdown, demand shifting etc.).

DRAs will be subject to the NEM’s prudential requirements which act to minimise the exposure of the market to payment default. These controls consist of a quarterly assessment of credit limits and a daily assessment of financial position. Normally, a DRA will be a creditor to the NEM. Prudential requirements for retailers will be assessed using baseline energy during demand response intervals.

The Ancillary Services Unbundling changes will enable third parties to register and sell Frequency Control Ancillary Service (FCAS) using aggregated loads independently of the retailer. This means that at the commencement of the DRM, the DRAs will be able to offer demand response as FCAS if it satisfies the NEM’s technical requirements. The existing technical and procedure requirements will apply to the DRAs. Any load offered by a DRA as ancillary service cannot simultaneously be offered as DRM load for a demand response interval and the DRM process has no involvement in the settlement of that DRA or load in providing FCAS.

2 Introduction

The Australian Energy Market Commission's (AEMC) Power of Choice final report sets out a substantial reform package of the National Electricity Market (NEM).² The package is intended to provide households, businesses and industry with more opportunities to make informed choices about the way they use electricity and manage expenditure.

The AEMC recommendations are designed to increase the responsiveness of demand to market conditions in two ways:

- Enabling consumers to see and be rewarded for taking up options for demand side response.
- Enabling the market to support consumer choice through better incentives to capture the value of demand side participation options and through decreasing transaction costs and information barriers.

The two recommendations relating to the wholesale market changes are:

- Demand response mechanism (DRM) - a DRM that pays an end user for reducing demand via the wholesale electricity market. Under the mechanism, end users are able to be rewarded for demand response that would be provided through a demand response aggregator. A calculated baseline consumption profile is compared with actual energy used to unbundle the amount of demand response from the energy usage had the response not occurred. In the typical case of an end user supplied by a retailer, the end user would pay its retailer based on the baseline consumption profile but would receive income from the demand response aggregator based on its assessed level of response.
- Ancillary Services Unbundling (ASU) – to unbundle the sale and supply of energy to allow a third party to register and sell Frequency Control Ancillary Service (FCAS) using aggregated loads independently of the retailer. The scope of the ASU is to allow third parties to register and sell FCAS using aggregated loads independently of the retailers. The existing technical and procedure requirements will apply to third parties.

The AEMC recommended that AEMO is tasked with drafting the rule change proposal for the DRM and ASU changes and that AEMO establish an industry reference group to provide expert guidance in developing the rule change proposal.

The AEMC also published draft specifications for the framework of the rule change proposal, requiring AEMO to submit the rule change proposal by December 2013 so that the framework would be in operation by early 2015. The Standing Council on Energy and Resources (SCER) accepted the AEMC recommendations and subsequently requested AEMO to undertake the work recommended by the AEMC.

Between February and June 2013, AEMO established a project to undertake the work and established a working group and a number of sub-working groups to advise AEMO on a set of initial business requirements covering the major aspects of DRM and ASU – dispatch and notification, metering, registration, reporting and settlements. The next phase of the project is to develop detailed designs and rule changes based on the business requirements for each aspect of DRM and ASU.

This paper provides high level overview of the market design of the proposed DRM.

- Section 3 provides the context of this work, covering the situation today, drivers for change, broader context and the process adopted by AEMO for the project.
- Section 4 describes the end-to-end processes being proposed for DRM.
- Section 5 describes participation in DRM, including registration, categories of DRM assets in the DRM, obligations and responsibilities, and proposed fee arrangements.

² Power of Choice Review – Giving Consumers Options in the way they use Electricity. Final Report. AEMC 30 November 2012.

- Sections 6 and 7 describe the technical and physical requirements being proposed for DRM assets, and the interactions between demand response, ancillary services and operation of the national electricity grid.
- Sections 8 and 9 describe how baseline consumption is determined and how revenue metering processes are affected by the mechanism.
- Section 10 describes proposed settlement and prudential aspects of the mechanism, including retail data adjustments, wholesale settlement processes, and billing.
- Section 11 describes proposed market data and information arrangements.
- Section 12 describes governance arrangements in the NEM for operation, enforcement and changing the proposed DRM.

3 The Context of This Work

This section provides the context of this work, covering the situation today, drivers for change and the broader context for the mechanism.

3.1 The Situation Today

In the NEM, wholesale trading in electricity is conducted as a spot market where supply and demand is instantly matched in real-time through a centrally coordinated process operated by AEMO. All electricity supplied through NEM transmission and distribution networks is purchased from the spot market by market customers who make payments to AEMO for the electricity provided.

AEMO has a number of obligations that relate to the sale of electricity to market customers, including participant registration, determination of the half-hourly spot price of electricity, collection and management of energy data, billing and settlement.

Consumers of electricity have the choice of registering with AEMO and purchasing their electricity directly, or contracting with retailers who purchase the electricity from the spot market and then on-sell to the consumer. Retailers must also register with AEMO as market customers and hold a license to retail with the Australian Energy Regulator (AER).

All market customers are required to install energy revenue metering to record their electricity consumption. Each meter has a unique identifier called a National Metering Identifier (NMI), which will form the basis for allocating demand response levels under the proposed mechanism.

AEMO separately registers, accredits and audits a range of metering services from metering providers and meter data providers. These services include measuring the volume of electricity supplied, validating the data from meters and forwarding the information to AEMO for use in calculating and preparing accounts for financial settlement.

Demand side participation in the market refers to the situation where consumers reduce their consumption of electricity in response to a change in market conditions, such as high spot prices. The demand side can currently participate in a variety of ways:

- As scheduled loads, by bidding them into the central dispatch process operated by AEMO. Consumers (through their market customer) elect to withdraw from the market when the spot price reaches a particular threshold, and resume trading when the price falls to the level of the bid again.
- By manually or automatically switching load in or out of service without reference to AEMO (non-scheduled load). Various strategies can be used, such as shifting load from peak to off-peak periods, responding to 5-minute price volatility, or through agreements with network service providers.
- By using local non-scheduled generation to offset the net demand of a consumer in the same way as non-scheduled load.

- By providing market ancillary services, where load can be tripped off in response to low frequency events. The market customer provides ancillary service bids to AEMO, who then issues instructions to the customer to enable local load shedding equipment that measures frequency. Both scheduled and non-scheduled load can provide frequency control ancillary services.
- By providing non-market ancillary services such as network loading control through agreements with network service providers.

Currently, only pumped-storage hydro schemes are registered as scheduled loads and some aluminium smelters are registered to provide FCAS.

AEMO estimates³ there was 207 MW of non-scheduled demand side participation across all NEM regions in 2011 with an even chance of 303 MW being available in summer 2012-13, and projected medium growth of between 3.2% per annum in New South Wales and 5.4% per annum in Victoria and South Australia. The growth of demand response is mostly attributed to smaller loads, with large industrial load response expected to remain static. DRM is expected to facilitate part of this growth in demand response.

3.2 The Drivers of Change

The AEMC has found that under the current arrangements consumers are limited in their ability to respond to changes in the wholesale electricity spot price. While they are able to physically reduce their consumption under specific contractual arrangements such as interruptible tariffs, spot pass-through and scheduled loads, these involve a degree of risk and transaction costs that for most commercial and industrial users cannot be efficiently managed. For various reasons, these arrangements have only been partially effective in exploiting opportunities for demand response to spot prices.

The AEMC anticipated that the DRM would mainly assist large electricity users that prefer to have an energy retailer manage spot price risk when consuming, but wish to offer demand response directly or through a specialist intermediary such as an aggregator. The first two initiatives form part of this project.

The AEMC also anticipated that the ASU changes would allow third parties to participate in FCAS without the requirement to register as a market customer (i.e. retailer).

3.3 Broader Context

Since late 2007, the AEMC have undertaken investigations into demand side response in the NEM at the request of NEM participating jurisdictions. The work program consisted of three stages:

- Stage 1 (completed in May 2008) – considered and developed recommendations on demand side participation (DSP) in the context of the AEMC's then current work program, specifically the:
 - Congestion Management Review
 - Reliability Panel's Comprehensive Reliability Review, and
 - National Transmission Planner and related projects.
- Stage 2 (completed in December 2009) – reviewed the National Electricity Rules (NER) more broadly, identifying barriers to efficient integration of demand-side in the NEM and focused on the following aspects of the NEM:
 - economic regulation of networks
 - network planning
 - network access and connection arrangements

³ AEMO. 2012 National Electricity Forecasting Report. Appendix D – Demand-Side Participation. 29 June 2012.

- wholesale markets and financial contracts, and
- using DSP for reliability purposes.

Although the AEMC concluded the NER do not impede the use of DSP, it recommended aspects of the NER that could be improved and identified issues for Stage 3 of the DSP review relating implications of developments such as smart grids and technologies.

- Stage 3 Power of Choice (completed November 2012) – set out a reform package to enable consumers to see and be rewarded for taking up demand side options, and enable the market to support consumer choice through better incentives to capture the value of demand side participation options and through decreasing transaction costs and information barriers. The key recommendations targeted three broad groups:
 - Residential and smaller business – reforms covering access to consumption data, new options for electricity pricing, consumer switching, new metering and data services technology, and consumer protections.
 - Industrial and commercial users – introduces the DRM and more opportunities for selling on-site generation.
 - Market participants – builds frameworks for making demand side part of the network planning and investing process, and for determining distribution network tariffs.

The bulk of these reforms are outside the scope of DRM exercise.

4 DRM Process Overview

The section describes the end-to-end processes being proposed for DRM and shown in Figure 2.

The key processes in DRM are:

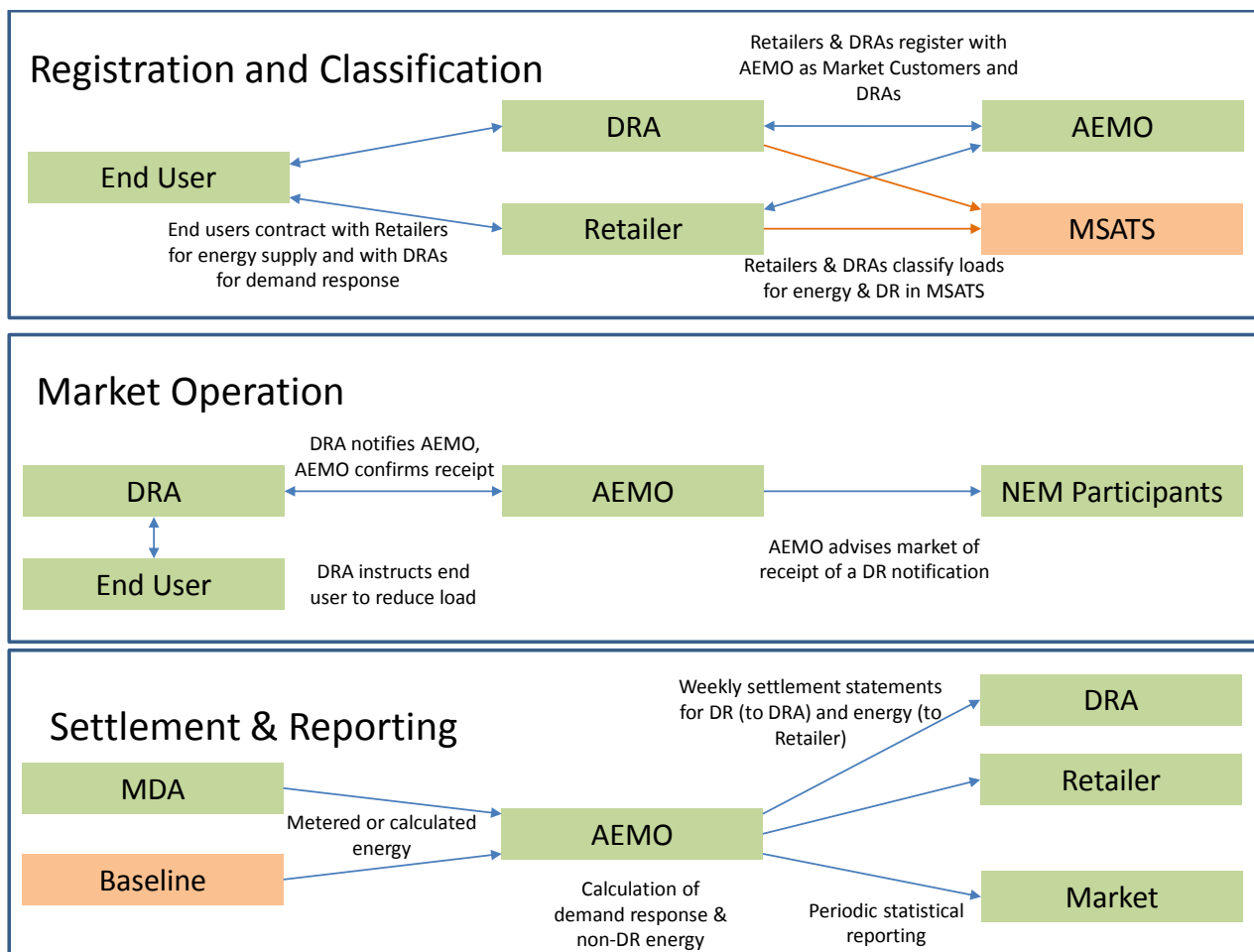
- Registration and classification (section 5) – prospective participants in DRM must first register with AEMO in the new category of registered participant to be called Demand Response Aggregators (DRA), and then classify NMIs as demand response loads and ancillary services loads.

Existing retailers registered with AEMO as Market Customers would also be able to register as DRAs. End users will separately contract with retailers for their energy supply and with DRAs for demand response.

NMIs that have been classified under the DRM will have two financially responsible market participants (FRMP) for the one NMI: the retailer will be responsible for the energy supplied to market loads and the DRA will be responsible for the energy from demand response loads. Under the current arrangements, there is a strict principle of one FRMP per NMI which will change under DRM.

- Market Operation (sections 6 and 7) – DRAs notify AEMO of demand response action and instruct their end user to reduce load. AEMO will also send general advice to the market of demand response action.
- Settlement and Reporting (sections 8 to 11) – during periods of demand response, baseline consumption profiles for demand response loads will be calculated and, with revenue metering from Meter Data Agents (MDA), used to determine the energy to bill retailers and demand response to pay DRAs. End users will also settle with their retailer and DRA. AEMO will establish a separate process for regular performance reporting to the market.

Figure 2 – Overview of Key Demand Response Mechanism Processes



5 DRM Participation

This section describes participation in the DRM, including registration, categories of DRM assets in the DRM, obligations and responsibilities and proposed fee arrangements.

The NEM is designed to be a wholesale market and this is the same for the DRM. There are separate processes for registration of entities and classification of the assets and this will be the same for the DRM. The participation model for DRM borrows concepts from the existing Customer and Small Generator Aggregator categories of participant.

5.1 Registration

Under the proposed DRM participation model:

- Demand response (DR) under the DRM can only be provided to the spot market by someone who is registered to do this. Demand response outside the DRM can continue to be provided as it is now.
- There will be a new category of Market Participant to be known as a Demand Response Aggregator (DRA), who will be financially responsible for income received from the spot market from demand response.
 - It is expected DRAs in the NEM will be either existing retailers, who wish to unbundle energy provision and demand response services, users with a contestable energy supply contract, or specialist aggregators who will offer to purchase demand response from a number of end users and sell it to the NEM through the DRM.

- AEMO will be responsible for registering participants as DRA under the DRM and new participants must register with AEMO to be able to participate. As with registered Market Customers, to be eligible for registration an applicant must demonstrate an ability to comply with the NER and satisfy AEMO it intends to “classify” loads under the DRM within a reasonable period of time. This classification process is described below. In practice, an applicant will be asked to confirm they have business processes in place to comply and provide a plan showing their intentions regarding DR loads.
- The end user will have no formal role under the DRM rules and will form relationships with the DRA to provide the demand response. An end user also has the option of registering as a DRA and directly providing demand response to the NEM.
- DRAs will pay a once-off registration fee and an ongoing energy-based fee⁴. DRAs will only be required to pay fees when demand response is being provided.
- The process for ceasing to be registered will be the same as for other Market Participants – that is, by notification to AEMO subject to meeting outstanding financial obligations to AEMO.

5.2 Classifying Loads

Once registered, it is proposed that DRAs would classify demand response loads using existing Market, Settlements and Transfer Solution (MSATS) infrastructure to identify market loads that will participate in the DRM.

- Each DRA will “classify” one or more demand response loads (each load identified by its NMI), which must also be classified as a market load by a Market Customer (such as a Retailer).
- Loads classified under the DRM will not be able to be classified as scheduled loads for the initial implementation (see discussion in section 7.3).⁵

For the purposes of DRM reporting, DRM assets will also be classified by the type of load and mechanism by which DRM is provided. A subset of the 17 broad industry divisions of the Australian and New Zealand Standard Industrial Classification scheme is proposed:

- A – Agriculture, forestry, fishing and hunting
- B – Mining
- C – Manufacturing
- D – Electricity, gas and water supply
- I – Transport and storage
- J – Communication services

Additionally, loads would be classified by the method by which response is delivered. This scheme is yet to be fully described but could include electricity generation, plant shutdown, heating ventilation and air conditioning and demand shifting.

AEMO will build or modify systems to allow loads to be classified in this way.

5.3 Obligations and Responsibilities

Once the DRA has registered and classified its loads, it is able to participate in the DRM. DRAs will be financially responsible⁶ for revenue from connection points delivering demand response to the market.

⁴ The current fee determination expires in 2016. The fee structure is subject to formal consultation by AEMO and may change.

⁵ Scheduled demand response, were it available, would be dispatched by AEMO rather than notified by a DRA.

A DRA will signal that DR is being provided by notifying AEMO. A notification may be at any time before or during a half-hour trading interval, to be called a demand response interval (DRI).

DRA may have obligations to provide DR if it has provided notification of DR to AEMO. This may be in the form of a good-faith provision in the NER. The settlement design would also result in a DRA being required to pay for energy consumption above baseline during a DRI. DRAs will also be subject to normal prudential obligations under the NEM, including credit limits, noting DRAs will normally be creditors to the NEM.

For each DRI, AEMO will trigger processes to calculate a baseline consumption profile (see section 8) for each NMI, make adjustments to retailer and DRA allocated energy, and settle the market under the DRM.

6 Provision of Demand Response under DRM

This section describes the technical and physical requirements being proposed for DRM assets.

DRAs would be able to provide demand response by instructing a group of their loads to reduce consumption and by notifying AEMO that demand response is occurring. DRAs will be able to aggregate customers and their loads from a range of connection points. Each notification would identify the NMIs providing DR, and the trading intervals affected by the DR. There will be no restriction on the number of NMIs in a single notification, although it may be necessary that the NMIs in a single notification will be from a single NEM region⁷.

Initially, DRM will be available to industrial and commercial, but not residential, loads with annual consumption of the order of 100 MWh per year.⁸

All DR provided under the DRM will initially be provided by non-scheduled loads. The DRM will include a review to determine whether scheduled DR loads are required in the future. However, DRAs providing FCAS to the NEM will be scheduled, provided the loads meet technical requirements specified in AEMO's market ancillary services specification. These issues are discussed more fully in section 7.2 and section 7.3.

Demand response loads would be contestable and similar processes used for transferring market loads (using MSATS) would apply to demand response loads. There will be additional data to be provided for DR loads to allow annual reporting of the performance of the DRM (see section 11).

Proposed demand response loads in the DRM must be sufficiently predictable so that baseline methodology will be sufficiently accurate. As discussed in section 8, the baseline will be calculated for each NMI and this may place a practical minimum on the size of loads that will participate in DRM. Section 9 describes the technical requirements for DR load metrology.

Because there will be no provision for scheduled DR loads initially, there will be no additional technical requirements for DR loads such as remote monitoring or communications requirements. DR notifications from a DRA to AEMO will be electronic and each DRA will receive confirmation from AEMO that it has received a DR notification. AEMO will also publish aggregated summary information to the market concerning DR notifications.

7 Provision of Demand Response under DRM and Operations

This section describes the interactions between demand response and operation of the NEM under the DRM.

⁶ Using NER terminology, the DRA will be a Financially Responsible Market Participant.

⁷ The requirement that notifications cover one NEM region is yet to be confirmed but may be required to meet reporting requirements. In addition, a future implementation of schedule DR loads would be regional.

⁸ This is roughly equivalent to a flat load of 11 kW all year, or an average of roughly 30 kW for a site operating for 12 hours a day on weekdays.

7.1 Provision of Demand Response

Demand response is already provided in the NEM by some customers in response to high prices. The response can either be in anticipation of a forecast in pre-dispatch, or in reaction to a published high price published in the central dispatch process. AEMO has seen evidence of both of these occurring.

Demand response under the DRM is expected to occur in the same way, with some important differences:

- The DRA will notify AEMO that it has or will reduce demand over a period of time at specific locations defined by the NMIs for those locations.
- The amount of demand response will be determined using baseline consumption profiles (see section 8) and metered energy (see section 9).
- Demand response will be valued at the spot price and settled with the DRA with associated settlement adjustments for the retailer (see section 10).

7.2 Notification

DRAs will be required to provide notification to AEMO that demand response will occur or is occurring in a trading interval (i.e. that is before the end of the trading interval). DRAs will not be permitted to provide retrospective notification of demand response.

This means a DRA would be permitted to respond to a price spike in the last five-minute dispatch interval of a trading interval, and be entitled to receive spot market revenue for that response. An outcome of this is that it will not be possible to provide advance notice to the rest of the market of DRM occurring within a trading interval.

Each notification includes a timeframe for the response and a list of NMIs associated with the demands that are being reduced.

Although not part of the initial implementation, scheduled DR loads would not be required to submit notifications. Instead, a dispatch instruction issued by AEMO to a scheduled DR load would be treated as a notification.

7.3 Central Dispatch of DRM for Energy

The initial design of the DRM will only allow for non-scheduled participation in the energy market. Although the current market design allows for scheduled loads, this is not mandatory and in practice the only scheduled loads currently in the NEM are associated with pumped storage hydroelectric schemes.

Note this is inconsistent with the treatment of generating units in the NEM, which generally must be classified as scheduled if the rating of the unit is above 30 MW. Alternative approaches considered in the design included requiring large DR loads to be scheduled or mandating all loads to be scheduled. The proposed design is considered the most effective way to encourage demand side competition.

Current levels of non-scheduled demand response in the NEM do not cause difficulties in managing operation of the electricity grid and do not materially impact on network flows, power system frequency or the operation of the power system within its technical envelope. Advice from industry is that implementation of DRM will not materially increase the levels of demand response for the first few years.

There is a small possibility that over time take up of DR under the DRM could lead to increased uncertainty in market price outcomes. As a result, the assumption that participation under DRM will be small will need to be tested regularly and if necessary mandatory scheduling of DR loads, whether part of the DRM or outside it, must be reconsidered.

7.4 Demand Response as Market Ancillary Services and DRM

DR loads will be able to be offered into the existing frequency control ancillary services (FCAS) market, with some additional requirements:

- FCAS aggregation rules were introduced some time ago and will be available to DRAs who have aggregated DR loads.
- Market Customers (retailers) will not be able to provide FCAS with a load if the load has also been classified by a DRA for demand response.
- Loads generally provide frequency raise service by being able to trip out of service in response to low frequency events. Similarly, DR loads will only be able to provide FCAS contingency raise services.
- A load will not be able to provide FCAS if the load is out of service. The DRA will be responsible for ensuring it does not offer FCAS that cannot be physically delivered.
- A load providing FCAS must meet AEMO's market ancillary service specification, which includes:
 - An automated control system that trips the load out of service when power system frequency falls to a level specified by AEMO.
 - Measuring equipment to record the response of the load to system frequency.
 - Verification of frequency response based on the measurements mentioned above and calculations specified by AEMO.

8 Determination of Baselines and Demand Response

This section describes how baseline consumption profiles are calculated in other markets and presents potential methodologies for the NEM. The precise methodology for baseline will be finalised during the detailed design phase of work.

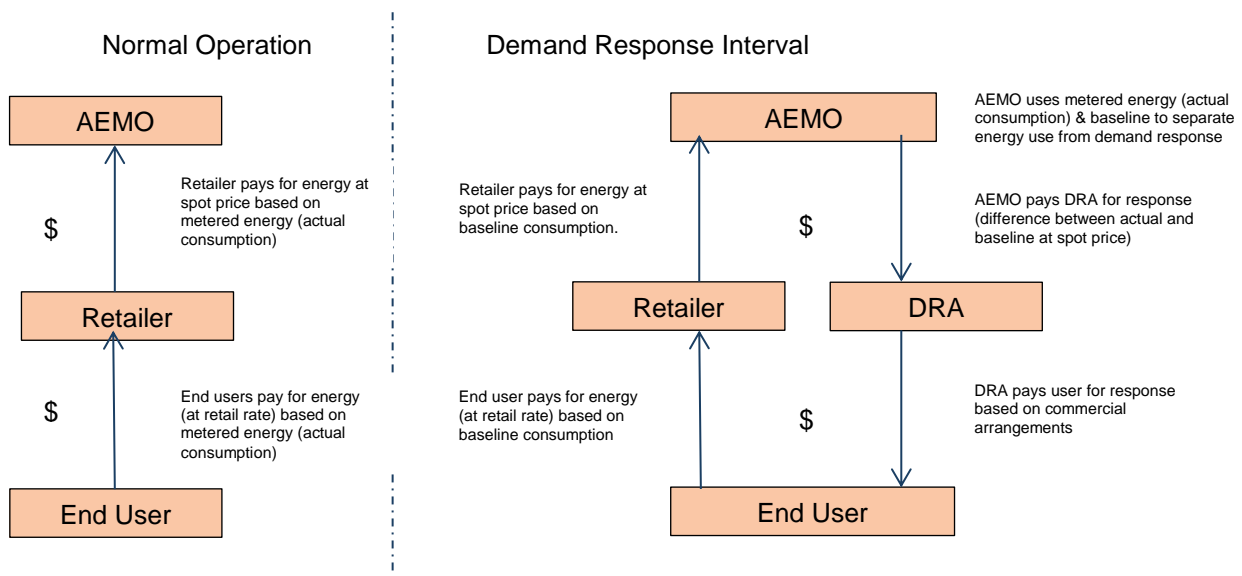
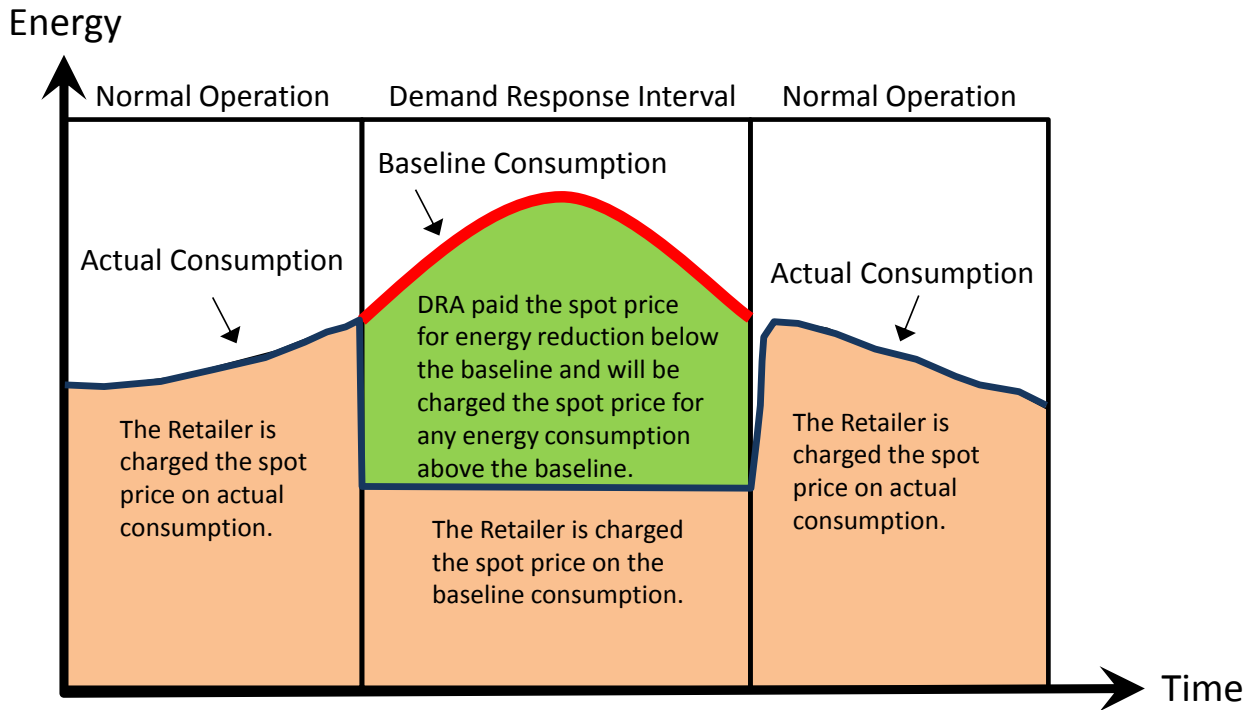
The mechanism will pay a DRA for the demand response delivered to the market at the spot price. The amount of response delivered will be calculated as the difference between the revenue metered consumption of energy and the theoretical consumption had the response not occurred (called the baseline consumption).

During a demand response interval the retailer pays the wholesale market according to the baseline consumption and bills the consumer (at the retail rate) for the same quantity. AEMO pays the DRA (at the NEM spot price) for the calculated demand response (green area) and the consumer receives a payment from the aggregator for the same quantity.⁹ Network usage charges would be based on the actual consumption volume. Note that the baseline consumption is only determined after the event.

This is demonstrated in Figure 3.

⁹ The payment relationship between the demand response aggregator and the consumer is not covered by the design and will be whatever arrangement they commercially agree. It is important to note that as the DRA will be exposed to a charge if the actual demand exceeds the baseline consumption this needs to be considered in the commercial arrangement between DRAs and consumers.

Figure 3 – Relationship between Baseline Consumption and Actual Consumption



The selection of an appropriate baseline methodology is a key success factor for DRM, balancing accuracy, simplicity and integrity. Overseas research indicates that different approaches may be necessary for different types of loads. Most baseline methods use an adjusted “high x of y” approach – for example, a high 5 of 10 approach uses the highest 5 days out of 10 candidate days, with the profile adjusted to match the demand on the day in question. The approach for a high 5 of 10 methodology is illustrated in Figures 4 and 5 below.

The most recent 10 candidate days are identified by removing public holidays, weekends and previous demand response events in the period leading up to an event. The top 5 of those 10 days are then used to establish the baseline. On the day in question, the baseline curve is adjusted to take into account the actual demand being consumed before the demand response action is taken.

PJM, an electricity market in the United States, uses five pre-approved baselines, allowing customers to select a baseline that achieves an acceptable level of accuracy¹⁰. Customers may

¹⁰ Currently a Relative Root Mean Square Error of 20% or less.

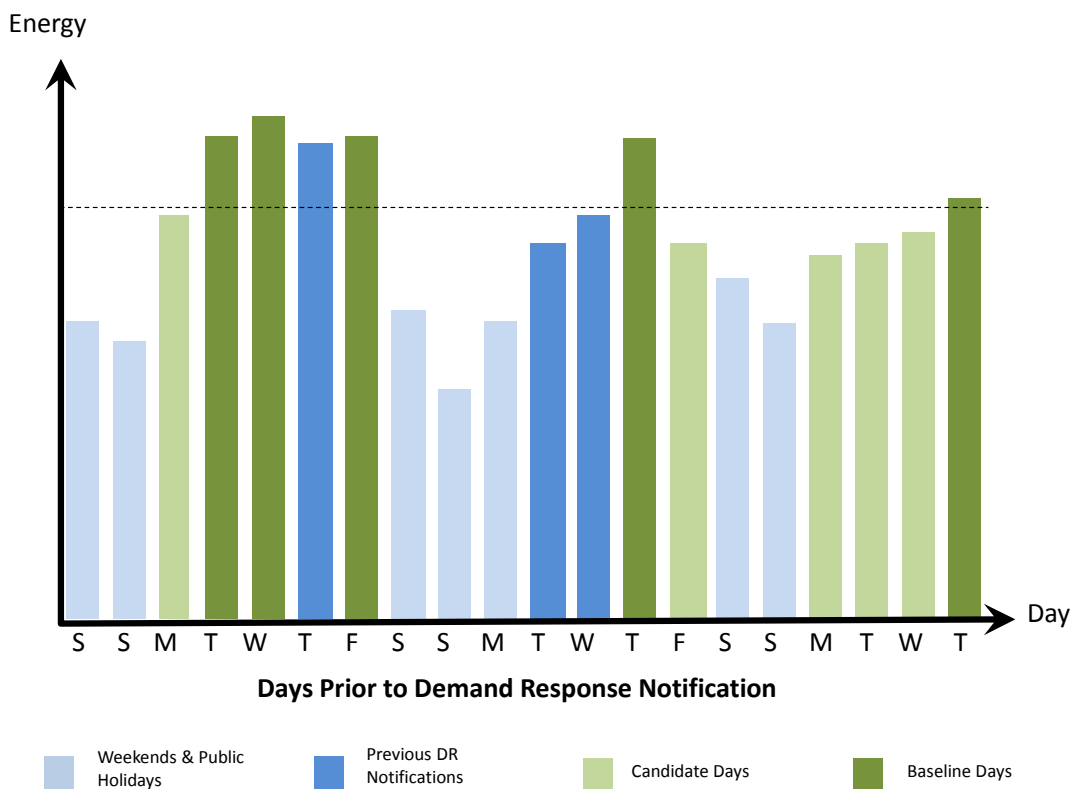
also propose a customised baseline if it meets PJM’s accuracy test. The current PJM pre-approved baselines are:

- 3 day types (Weekdays/Saturday/Sunday). High 4 of 5 with adjustment.
- 3 day types. High 4 of 5 without adjustment.
- 7 day types. High 4 of 5 with adjustment.
- 7 day types. High 4 of 5 without adjustment.
- Maximum Base Load (last resort baseline - flat baseline set at the average of the lowest hourly usages).

Adjustments rely on meter data and can only be calculated one day after the event at best.

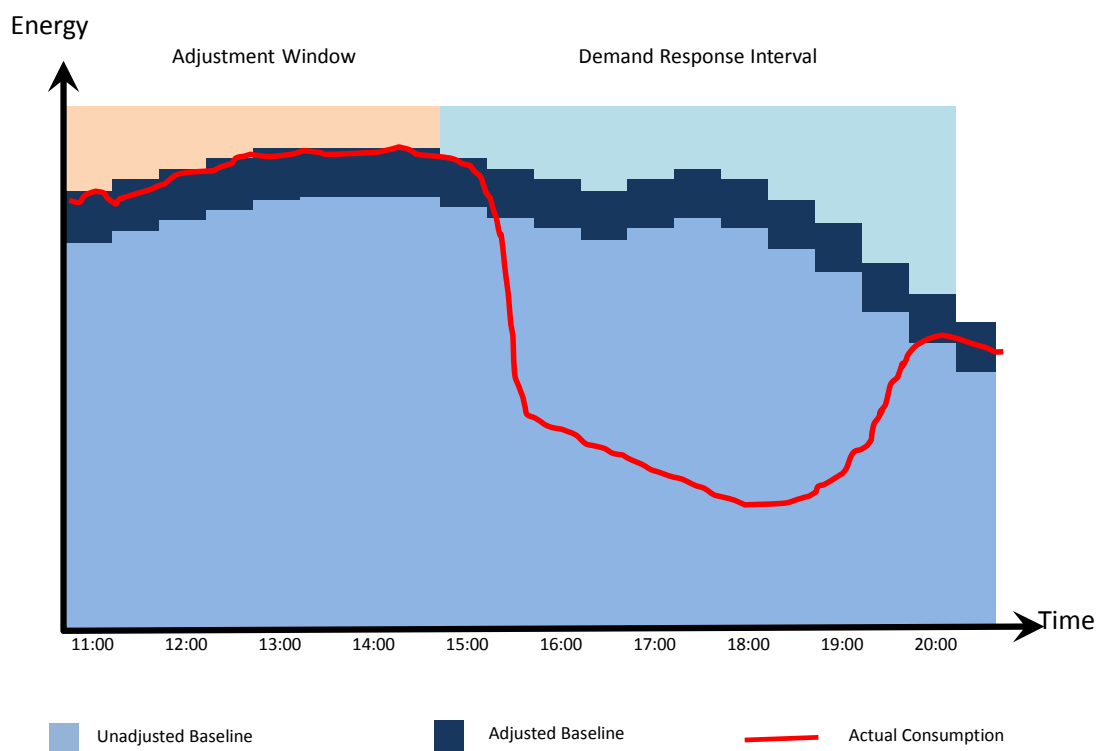
The current recommendation from the industry working group is for AEMO to adopt a similar approach to that used by PJM, using the High 4 of 5 with adjustment as a default methodology, adapted for the NEM’s 30 minute trading intervals. AEMO has engaged KEMA to assist with developing the baseline methodology. The nature of the baseline methodology will be developed in the detailed design and will take account the industry working group recommendations and work undertaken by KEMA.

Figure 4 – Demonstration of the High x of y Baseline Methodology¹¹



¹¹ Adapted from Enernoc presentation “Demand Response in Wholesale Markets”, 1 February 2013

Figure 5 – Demonstration of Baseline Adjustment



Because an explicit baseline is to be calculated for each NMI and because there will be minimum accuracy requirements for each baseline, AEMO anticipates a practical minimum size for NMIs that will initially participate in DRM of 100 MWh per annum.

Under current DRM proposals, AEMO would be responsible for developing the baseline procedures and for developing the baselines themselves. Disputes between a DRA and AEMO concerning baseline consumption profile errors would be managed as for any metering error through the existing settlement dispute process.

9 Metering

This section describes how existing revenue metering processes are affected by the DRM.

9.1 Minimum Technical Requirements

AEMO will be required to establish a procedure setting out metering requirements for demand response purposes, potentially including exemption processes. DRM will require remotely-read interval meters with existing metering accuracy requirements that are dependent on the size of the load.

The AEMC contemplated DRM would apply to industrial and commercial users initially. Accordingly, the initial implementation will exclude residential customers.

9.2 Metering Procedure Changes

The implementation of DRM will require modifications to the existing metering procedures. These changes are expected to include:

- Exclusion of non-revenue grade sub-meters from DRM metering.
- Incorporation of DRM in to metering estimation and substitution process.

- Provision of metering data from Meter Data Providers (MDPs) to DRAs.
- Any special provisions for embedded consumers and exempt distribution networks.
- AEMO's baseline calculation obligations and methodology.
- Notification to AEMO of NMIs participating.
- Processes and best practice around notification of equipment changes and maintaining accuracy of baseline.
- Handling DRA transfers, including a notification and objection process.

9.3 Use of Non Revenue Grade Sub-metering

The current NER in the NEM require that revenue grade metering is used for all metering installations. There is some flexibility in the design of metering installations that allow for “parent” and “child” metering points (where the difference between energy measured by the parent and child metering points represents the energy consumption for a connection point) and virtual meters (where data is calculated using an algorithm approved by AEMO). However, in both cases the metering data must be based on revenue-grade metering.

A potential barrier to participation in DRM may occur if revenue grade metering is not available. These situations include:

- Customers connected to exempt networks (such as shopping centres) where the site owner allocates NEM energy costs between tenants.
- Industrial sites with multiple items of plant, some of which may be able to provide demand response.
- Other sites, such as power generators where the house load is not separately metered but can be derived from other information.

Although generally considered desirable, there are a number of issues with a proposal to use sub-meters including compliance, enforceability, accuracy and risk of data manipulation. For these and other reasons, AEMO will not provide for sub-meters for the initial implementation.

10 Settlement and Prudentials

This section describes the proposed settlement and prudential aspects of the DRM, including retail data adjustments, wholesale settlement processes and billing.

Settlement processes will only be affected by DRM during notified demand response intervals. During other intervals, settlements will be unchanged from existing processes.

10.1 Energy Settlements

Settlement of DRM will be based on the half-hourly spot price and half-hourly energy assessed using metered energy and baseline usage information. While not part of the DRM process described here, retailers will continue to settle with their customers based on the baseline usage – that is, as if no DR had been provided – with this settled at the customer's retail rate. Similarly, DRAs would settle with the same customers based on the assessed demand response at the agreed demand response rate.

During a demand response interval, the energy at a NMI will be unbundled and charged as follows:

- The baseline energy will be charged to the retailer¹² for the NMI.
- The demand response energy, which will be the difference between the baseline energy and the metered energy, will be credited to the DRA.

¹² Strictly, the NEM charges the financially responsible Market Participant for the NMI. For loads being considered under the DRM, this is most likely to be retailers.

The energy to be settled for the retailer and the DRA will be adjusted by the transmission and distribution loss factors using existing processes. Potentially, the demand response energy could be positive or negative. Demand response energy can be negative if the revenue metered demand is greater than the baseline. In this case, the DRA will be charged, rather than credited, for the energy difference.

Settlement statements issued to DRAs will include separately identified demand response transactions and summaries of DR transactions.

10.2 Ancillary Services

FCAS provided by DRAs will be settled according to existing processes. The central dispatch process “enables” each service and each 5-minute interval is separately settled.

AEMO’s costs of procuring ancillary services will be recovered according to existing procedures. Loads that have suitable monitoring equipment are assessed using existing “causer pays” principles. Unallocated “residual” FCAS costs for DR loads will be treated as for market customers for recovery of regulation FCAS and as for generators for recovery of contingency FCAS.

DRA will also be treated as generators for recovery of system restart ancillary service but will not be charged for network control ancillary services.

10.3 Prudentials

Prudentials in the NEM is a set of controls that minimise the exposure of the market to payment default. These controls consist of a quarterly assessment of credit limits and a daily assessment of financial position. Normally, a DRA will be a creditor to the NEM.

Prudential requirements for retailers will be assessed using baseline energy during demand response intervals.

DRA will be subjected to standard credit limits and prudential requirements, based on their assessed settlement amounts. DRA will generally be a net creditor to the NEM and would therefore generally not be required to provide credit support.

10.4 Fees

Participant fees (at a rate equivalent to a market customer) will be charged to each DRA based on the amount of energy from DR that is allocated to it. A DRA that does not provide DR during a billing period will not be charged participant fees. Participant fees will be charged to each retailer based on the amount of energy they consume, or based on the baseline consumption profile during DR intervals.

AEMO’s costs to fund compensation it can be required to pay under the rules will not be recovered from DRAs and will be recovered from retailers based on their baseline energy.

11 Data, Information and Reporting Requirements

This section describes proposed market data and information arrangements for the DRM.

Existing systems would be used to allow DRAs to classify DR loads and for DR loads to be transferred between participants. Existing business-to-business processes would also be used to allow DRAs, retailers and other market participants to communicate changes with each other.

As discussed in section 5.2, AEMO will also need to collect data concerning the industry type and DR method for each DR load for reporting and statistical analysis. Additionally, AEMO will collect information on the size of loads that have been aggregated by each DRA.

AEMO will also be required to produce an annual report on aggregated services provided under the DRM for the first five years. This report will include:

- Statistical information on the number of notifications and energy delivered by DR for each region, transmission node, DRA, industry classification and DR method, numbers of NMIs, and price paid for each DR notification.
- Performance of the baseline consumption profile algorithms.
- A summary of ancillary services provided by DR.
- Commentary on power system security implications of DR as well as on the need for scheduled DR loads and forecasting issues in the future.

Appendix A: Definitions

Glossary

TERM	DEFINITION
Aggregation	Assembling groups of small loads to be operated as a block for the provision of demand response or ancillary services.
Baseline consumption profile	A calculated half-hourly profile calculated by AEMO to be a proxy for the demand had demand response not occurred.
Connection point	The agreed point of supply established with a Network Service Provider. The NER definition will be modified as part of DRM rule changes.
Customer	An entity registered with AEMO as a Customer or Market Customer in the NEM.
Demand response	Any mechanism, including local generation, by which net consumption of electricity at a connection point has been reduced in response to a signal, usually price.
Demand Response Aggregator	A entity registered with AEMO to provide demand response services to the market under the demand response mechanism
Demand response interval	A (half-hour) trading interval for which AEMO has been notified that it has provided demand response.
Demand Response Mechanism	The mechanism recommended by the AEMC in its Power of Choice review and developed by AEMO by which demand response is unbundled from energy consumption and settled on the spot market.
End User	The end use consumer of electricity.
Market Customer	An entity registered with AEMO as a Customer and as a Market Participant, and who classifies load as market loads to be settled by AEMO.
Market Participant	An entity registered with AEMO in any category of market participant, including Market Generator and Market Customer.
Notification	A process by which AEMO is advised that demand response has occurred and triggers the demand response mechanism.
Retailer	An entity registered with AEMO as a Market Customer and is approved by the AER or a jurisdictional authority to retail electricity to end use consumers.
Scheduled load	A load classified as such by a Market Participant

Abbreviations

ABBREVIATION	MEANING
BCP	Baseline Consumption Profile
DR	Demand response
DRA	Demand response aggregator
DRI	Demand response interval
DRM	Demand Response Mechanism
DSP	Demand side participation
FCAS	Frequency Control Ancillary Services
MDP	Metering Data Provider
MSATS	Market Settlement and Transfer Solution
NEM	National Electricity Market
NER	National Electricity Rules
NMI	National Metering Identifier
PJM	PJM Interconnection, an electricity independent market and system operating in the eastern United States
SCER	Standing Committee on Energy and Resources