Consultation Paper on Demand Side Bidding

MARCH 2021

This Report is prepared by the
Philippine Electricity Market Corporation and
the WESM Technical Committee

Contents

1.0 PURPOSE OF THE DOCUMENT

This consultation paper together with the accompanying survey aims to

1.1. Provide information and background on Demand-side Bidding (DSB); and
1.2. Gather information on the interest and preparedness of market participants on DSB

2.0 INTRODUCTION

2.1 Background

Demand-side bidding refers to the active participation of customers in the determination of real-time electricity prices through submission of bids to buy electricity at corresponding maximum prices[1]. In most electricity markets, customers are usually passive trading participants where they buy electricity at the price of the last generator necessary to serve the demand.

Compared to supply that can respond to market results and is able to actively participate in the determination of prices in electricity markets through the submission of offers, demand for electricity is mostly an inflexible variable[2]. Since use of electricity is a necessity in the modern world, most loads are not geared towards flexibility; hence, demand systems are not designed to have the ability to respond to market pricing signals.

2.2 Benefits of Demand-Side Bidding

According to a paper by the U.S. Department of Energy (DOE)[3], benefits from demand response, which includes demand-side bidding, may be grouped into four (4). These are:

1. Participant financial benefits
   This refers to the individual cost savings of loads that participate in demand response programs. By declaring the maximum price that the load is willing to purchase electricity, the load will not be scheduled to consume during times when the electricity prices are too high and would avoid the high electricity costs.

2. Market-wide financial benefits
   This refers to the lower wholesale spot market prices paid by all trading participants as a result of lower utilization of more expensive power plants that would have been dispatched to serve the load of the demand response participants.

[1] Dela Vina, J., Demand-Side Bidding Implementation Assessment, PEMC, December 2016
[2] Dela Vina, Demand-Side Bidding, 2.
[3] Benefits of Demand Response in Electricity Markets and Recommendations for Achieving Them. Department of Energy of the United States of America. 2006. http://energy.gov/sites/prod/files/oeprod/DocumentsandMedia/DOE_Benefits_of_Demand_Response_in_Electricity_Markets_and_Recommendations_for_Achieving_Them_Report_to_Congress.pdf

3. Reliability benefits
   This refers to the load-side adjustments that could be provided by demand response participants during contingency events, which lowers the possibility of involuntary load curtailment.

4. Market performance benefits.
   This refers to the ability of demand response to mitigate the ability of suppliers to exercise market power by providing an opposing market force that limits the prices in the wholesale spot market.

Among the abovementioned benefits, market-wide financial benefits and market performance benefits directly apply to demand-side bidding. The market-wide benefit may be illustrated as provided in Figure 1. In the figure, Loads D to F were scheduled to curtail since the wholesale price is higher than their maximum price and have avoided the higher electricity costs. However, due to their curtailment, the wholesale price was set at a lower rate (P2) relative to the rate (P1) without the curtailment of those demand-side bidding participants. As a result, Loads A to C would only be paying at the lower wholesale price and would benefit from the actions of the demand-side bidding participants even if they themselves did not curtail any demand. The green-shaded area in Figure 1 represents the total benefit of the market due to the actions of the demand-side bidding participants.

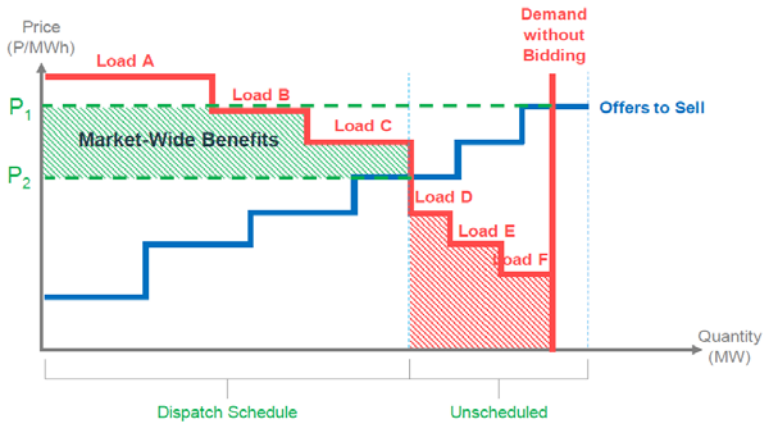

Figure 1 Market-Wide Benefits of Demand-Side Bidding[4]

Figure 2 provides an example of the market performance benefits of demand-side bidding. In the figure, the generators submitted higher offers to sell (solid blue to shaded blue). In both cases (i.e., with demand-side bidding and without demand-side bidding), the higher generation offers would result in higher wholesale prices. It may be observed, however, that the increase in price is less significant when there is demand-side bidding (P3 to P4) compared with when there is no demand-side bidding (P1 to P2). This illustrates how demand-side bidding may temper the impact of supply-side movements on the wholesale prices.

[4] Dela Vina, Demand-Side Bidding, 2.

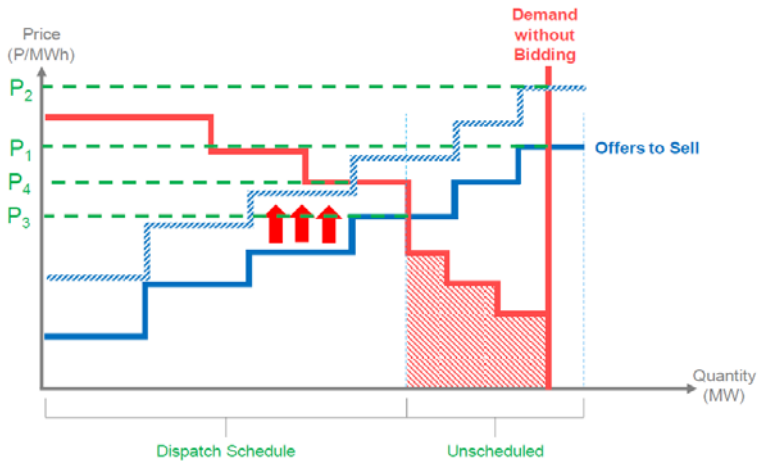

Figure 2 Market Performance Benefits of Demand-Side Bidding[5]

2.3 Demand-side Bidding Participants

Customers registered in the WESM are classified based on the following customer types:

1. Directly-Connected Customer
2. Electric Cooperative
3. Private Distribution Utility
4. Wholesale Aggregator
5. Retail Electricity Supplier
6. Contestable Customers.

Based on the assessment done by PEMC in 2016, directly-connected customers (DCC) have the most potential benefit when they participate in demand-side bidding. DCC refer to end-users that purchase their electricity requirements directly from the transmission system. Since DCCs are directly connected to the transmission system, they are wholesale market participants and may directly participate in the spot market by registering as direct WESM members. As the end-user of the electricity bought from the WESM, DCCs also generally have direct control over their demand requirements and may have the ability to respond to market signals given sufficient lead time.

Aside from DCCs, contestable customers may also benefit when they participate in demand-side bidding in the WESM. Contestable customers (CC) are defined in the Retail Rules as electricity end-users that are certified by the ERC as having met the demand threshold for contestability. To date, the threshold for voluntary contestability is 500kW[6]. Currently, many of the contestable customers are indirect members in the WESM. In order for the CCs to participate in demand-side bidding, they may need to register as WESM direct members or course their participation through their respective retail electricity suppliers.

For the rest of the customer types (i.e., distribution utilities, wholesale aggregators, retail electricity suppliers), additional guidelines may need to be developed for their participation in demand-side bidding since compliance to curtailment schedules would have to be performed by their customers.

[5] Dela Vina, Demand-Side Bidding, 2.

[6] Resolution No. 12 Series of 2020, Energy Regulatory Commission (ERC), December 2020.

Since their customers are the ones foregoing economic activities, it should be ensured that customers that curtailed would receive the benefits of their curtailment.

3.0 DEMAND-SIDE BIDDING IN THE WESM

Current Features of the WESM

The WESM Rules already provides for the participation of scheduled loads in the market through the submission of demand bids. The WESM Rules also have incorporated demand-side bidding in the pricing and scheduling process, and market projections. Moreover, general provisions for the dispatch and settlement processes cover scheduled loads.

Table 4 provides a discussion on the provisions under the WESM Rules and different Market Manuals related to the process of demand-side bidding. List of relevant provisions used on the discussion are provided in Annex A of this document.

Table 4 Provisions on the WESM Rules and Market Manuals

Market Process	Market Rules/ Guidelines
Registration	As provided in WESM Rules Clause 2.3.2, an entity that engages in the activity of purchasing electricity supplied through the transmission system or a distribution System to a connection point would simply register in the WESM as a "customer". In terms of technical requirements, the WESM Manual on Registration, Suspension, and De-registration Criteria and Procedures[7] ("Registration Manual") requires trading participants to have remote terminal unit (RTU) devices that are capable of being monitored by the System Operator, revenue metering facilities or installations compliant with the WESM Rules and Metering Manual, and communication links with the Market Operator and the System Operator.
Submission of Bids	To be considered in the pricing and scheduling processes of the WESM, each customer may submit a standing demand bid in respect of its registered scheduled load facilities for each trading day of the week in accordance with the timetable[8]. In addition to submitting standing demand bids, customers may also submit revised demand bids for any trading interval in any trading day of the current week-ahead market horizon in accordance with the timetable[9].
Pricing and Scheduling	In the determination of prices and schedules, the Market Operator utilizes the market dispatch optimization model (MDOM). The optimization model considers loads based on dispatch bids; demand bids by scheduled loads would be used in determining the prices and schedules for each market run.

[7] Section 2.5.3.2 of Issue 5.3, November 2020

[8] Section 3.5.6.1, WESM Rules, November 2020

[9] Section 3.5.11.1, WESM Rules, November 2020

Market Process	Market Rules/ Guidelines
	In terms of constraints, Clause 3.6.1.4 of the WESM Rules mentions constraints representing limits on demand bid quantities.
Market Projections	As provided in Clause 3.7 of the WESM Rules, the Market Operator is required to prepare and publish week-ahead and day-ahead projections of the market. Clause 3.7.4.1 of the WESM Rules enumerate the different considerations when preparing a market projection. The considerations include network data, reserve requirements, forecast demand, generation offer, loading levels, and reserve offers but do not include demand bids. Clause 3.7.5.1 of the WESM Rules, however, requires the publication of projected aggregate dispatch of scheduled load at each market network node.
Dispatch	Under Clause 3.8.5 of the WESM Rules, trading participants who are dispatched are required to use reasonable endeavors to achieve a linear ramp over the trading interval.
Settlement	Provisions under WESM Rules Clause 3.13 Settlement Quantities and Amounts treats trading participants similarly regardless of the category (i.e., generation company, customer) or classification (i.e., scheduled, non-scheduled, must dispatch, priority dispatch) of their facilities.

4.0 DEMAND-SIDE MECHANISMS IN OTHER ELECTRICITY MARKETS

Provided as additional references are articles related to demand-side mechanisms in other countries such as:

- Australia
- United States
- United Kingdom

These articles also cover demand-side participation when applicable. See Annex B.

ANNEX A: DEMAND-SIDE BIDDING PROVISIONS IN THE WESM RULES AND MARKET MANUALS

1. WESM RULES, November 2020

2.3.2 Customer

2.3.2.1 A person or an entity that engages in the activity of purchasing electricity supplied through the transmission system or a distribution System to a connection point may register with the Market Operator as a Customer.

2.3.2.2 To register as a Customer, a person or an entity shall satisfy the membership criteria specified in clause 2.3.3.4.

2.3.2.3 A Customer shall comply with the scheduling and dispatch procedures described in chapter 3.

2.3.2.4 A Customer shall register each of its connection points with the Market Operator. For each Contestable Customer, all connection points shall be registered under the same Contestable Customer.

3.5.4 Load Forecasting

All load forecasts at each market trading node in the market network model shall be specified in units of megawatt (MW) and will apply to the end of the relevant dispatch interval unless otherwise stated.

3.5.4.1 Each Customer may submit a forecast in respect of each dispatch interval for each of its registered load facilities for each trading day of week in accordance with the timetable. The forecast submitted by the Customer shall be used by the Market Operator in the preparation of Net Load Forecast.

If the Customer fails to submit a forecast of his load facilities in accordance with the timetable, the forecast prepared by the Market Operator at the scheduling point where the Customer is located shall be used.

3.5.4.2 Each net load forecast shall be prepared in such a way as to represent the net load to be met by generation from scheduled generating units, must dispatch generating units, priority dispatch generating units, non-scheduled generating units, batter energy storage systems and pumped-storage units including losses occurring outside the system represented by the market network model, but excluding any scheduled load.

xx

3.5.6 Customer Demand Bids

3.5.6.1 Each Customer may submit a standing demand bid in respect of each trading interval for each of its registered scheduled load facilities for each trading day of the week in accordance with the timetable.

3.5.6.2 Each demand bid submitted under clause 3.5.6.1 shall:

a) Correspond to load which has been certified as dispatchable, in accordance with the Grid Code and Distribution Code; and
b) Include the information specified in Appendix A1.3 in the WESM Rules.

3.5.6.3 Each Customer shall, in consultation with the System operator, submit check data for each of its registered scheduled load facilities to be used by the Market Operator in accordance with clause 3.5.12, to assist in determining the validity of any demand bid which it may submit.

Annex A1.3: Demand Bids

a) Shall have up to 10 bid blocks per take-off point;
b) Shall have a minimum block size of one (1) MW;
c) Shall have monotonically decreasing prices;
d) Shall start from a zero offtake;
e) May have bid prices that are negative; and
f) Shall include a validity period of bids.

3.5.9 Revision of Standing Offers/Bids

3.5.9.1 A standing generation offer, a standing reserve offer, a standing nomination of loading levels, a standing projected output, or a standing demand bid for any trading interval in any day of the week may be revised by the relevant Generation Company or Customer in accordance with the timetable.

3.5.9.2 A standing generation offer, a standing reserve offer, a standing nomination of loading levels, a standing projected output, or a standing demand bid which is revised under Clause 3.5.9.1:

a) Shall take effect the next time a week ahead projection is initiated, in accordance with the timetable; and
b) Shall only affect the offers employed in market dispatch optimization model runs used to determine projections, dispatch, or pricing for periods not already covered by week-ahead

projections which have already been published, or whose preparation has already been initiated at the time when the revised offer or bid is accepted.

3.5.12 Confirmation of Receipt of Valid Offers, Bids, Nomination of Loading Levels, and Projected Outputs

3.5.12.1 To be valid, generation offers, reserve offers, nomination of loading levels, projected outputs or demand bids shall be submitted by the relevant Trading Participant:

a) in accordance with Clause 3.5.1;
b) in accordance with the timetable; and
c) consistent with the check data submitted by the Trading Participant under Clauses 3.5.5.3, 3.5.5.7, 3.5.6.3, and 3.5.7.4 as appropriate.

3.5.12.2 The Market Operator shall send to each Trading Participant from whom it has received a valid generation offer, valid nomination of loading level, valid reserve offer, valid demand bid or valid projected output, an electronic confirmation of receipt and acceptance of that generation offer, nomination of loading level, reserve offer, demand bid or projected output in accordance with the timetable prescribed in the relevant Market Manuals.

3.5.12.3 If a Trading Participant does not receive confirmation of receipt under Clause 3.5.12.2, from the Market Operator, the Trading Participant shall contact the Market Operator to determine whether or not the generation offer, nomination of loading level, reserve offer, demand bid, or projected output was received.

3.5.12.4 If the generation offer, reserve offer, demand bid, or projected output is invalid, the Market Operator shall promptly inform the Trading Participant to resubmit a corrected generation offer, reserve offer, demand bid or projected output in accordance with Clause 3.5.11.

3.6 Market Dispatch Optimization Model

3.6.1.3 The objective of the market dispatch optimization model shall be to maximize the value of dispatched load based on dispatch bids, minus:

(a) The cost of dispatched generation based on dispatched offers;

(b) The cost of dispatched reserves based on reserves contracted for or when applicable reserve offers; and

(c) The cost of constraint violation

3.6.1.4 In formulating the market dispatch optimization model, the Market Operator and System Operator shall ensure that the dispatch for each trading interval is made subject to:

a) Constraints representing limits on generation offers, demand bids, nomination of loading levels, projected outputs, and, when applicable, reserve offers as specified by Trading Participants in accordance with Clause 3.5, except to the extent that as they may be relaxed in accordance with Clause 3.5.13;

xx

3.6.1.5 The market dispatch optimization model shall be designed so that, subject to the approximations and adjustments provided for by Clause 3.6.4:

xx

c) It will produce energy prices for each market trading node, and when applicable reserve price for each reserve region, so that the recommended dispatch targets for each individual Trading Participant would be optimal for that participant at those prices, given their offers and demand bids and after accounting for other constraints which may affect that Trading Participant, and

xx

3.7.4 Preparation of Market Projections

3.7.4.1 Each market projection shall take into account:

(a) The network service provider data prepared in accordance with clause 3.5.2;

(b) Reserve requirements, the anticipated market network model configuration, constraints and system security requirements for each reserve region, as advised by the System operator in accordance with clause 3.5.3;

(c) The forecast demand information prepared in accordance with clause 3.5.4;

(d) The market offer information submitted by each relevant Trading Participant in accordance with clause 3.5.5;

(e) The nomination of loading levels for each non-scheduled generating unit and the projected output for each must dispatch generating unit and priority dispatch generating units submitted under Clause 3.5.5; and

(f) When applicable, the reserve offer information submitted by each relevant Trading Participant in accordance with clause3.5.7 and 3.5.8.

3.7.5 Published Information

3.7.5.1 Based on the information referred to in Clause 3.7.4, each *market projection published* by the *Market Operator* in accordance with the *timetable* specified in the relevant *Market Manuals* shall contain the following information for each *dispatch interval* or one (1) hour interval, as applicable, in the period covered by the *market projection*:

xx

(d) Projected aggregate dispatch of *scheduled generating units, must dispatch generating units, priority dispatch generating units, non-scheduled generating units,* and *scheduled load* at each *scheduling point;*

Xx

3.8.5 Dispatch Conformance Standards

3.8.5.1 The Market Operator, in consultation with the System Operator and Trading Participants, shall develop dispatch conformance standards to be set forth in the relevant Market Manual which shall be consistent with the Grid Code and Distribution Code.

3.8.5.2 The Market Manual under Clause 3.8.5.1 shall set out the following:

(a) dispatch conformance standards that will apply to generating units and to scheduled load facilities;

(b) procedures for monitoring and notifying Trading Participants of the non-compliance by their generating units with their dispatch schedules; and

(c) Procedures for identifying and checking non-conformance with the dispatch conformance standards taking into consideration any ancillary service schedule, ancillary service responses, or emergency directions issued to dispatched Trading Participants.

xx

3.8.6 Sanctions of Trading Participants

Any Trading Participant that (a) does not comply with the dispatch conformance standards or (b) consistently fails to use its reasonable endeavors to comply with the dispatch instructions issued by the System Operator under Clauses 3.8.3, 6.3 and 6.5, may be liable of a sanction imposed under Clause 7.2.

3.11.1 Market Information

3.11.1.3 Each *trading day*, in accordance with the *timetable*, the *Market Operator* shall *publish*:

(a) The *dispatch schedule* for each *scheduled generating unit, battery energy storage system, pumped-storage unit, must dispatch generating unit, priority dispatch generating unit, non-scheduled generating unit* and *scheduled load* in each *dispatch interval* in the *settlement intervals* for the previous *trading day*; and

xx

2. WESM MANUAL ON REGISTRATION, SUSPENSION AND DE-REGISTRATION CRITERIA AND PROCEDURES ISSUE 5.3, November 2020

2.5.1.2 Customers

a) A person or entity that engages in the activity of purchasing electricity supplied through the transmission system or the distribution system to a connection point may register with the Market Operator as a Customer.
b) The following are qualified to register as Customer –
   - Distribution Utilities, including private distribution utilities, electric cooperatives and local government utilities undertaking distribution of electricity.
   - Retail Electricity Suppliers that have been authorized to engage in retail electricity supply by the ERC, provided, however, that the RES may only register in the WESM upon declaration of retail competition and open access by and shall transact in the WESM and subject to relevant rules, regulations and issuances of the ERC.
   - Bulk Users or End Users that are withdrawing electricity from the transmission system or from the distribution system which are permitted to trade in the WESM pursuant to prevailing rules, regulations and issuances promulgated by the ERC. It is provided, however, that Bulk/End Users connected through a distribution system may only transact in the WESM upon declaration of retail competition and open access by and shall transact in the WESM and subject to relevant rules, regulations and issuances of the ERC. All references to the Bulk or End Users in this Manual are understood to be subject to the foregoing condition. In case of any conflict between this Manual and the provisions of relevant rules, regulations and other issuances of the ERC, the latter shall prevail.

c) A Customer shall register each of its connection points with the Market Operator. For each Contestable Customer, all connection points shall be registered under the same Contestable Customer.

2.5.3. Technical and Commercial Requirements

The persons or entities that met the membership criteria and are qualified to be registered as Trading Participants must also comply with the following requirements before they can be authorized to participate and transact in the WESM.

xx

2.5.3.2. Facilities. The Applicant must have the following facilities –

a) Remote Terminal Unit (RTU) devices compliant with the requirements of the relevant network service provider, and are capable of being monitored by the facilities of the System Operator.
b) Revenue metering facilities or installations compliant with the requirements set forth in Chapter 2 of the WESM Rules and relevant WESM manuals, and which metering installations are duly registered with a WESM-registered Metering Services Provider.

c) Communication links with the Market Operator and the System Operator, which are compliant with specifications set forth by the Market Operator and the System Operator.

xx

3. WESM MANUAL ON DISPATCH PROTOCOL ISSUE 13.2, October 2020

6.0 Bids, Offers and Data Submission and Processing

6.1.2 Qualified *customer*s or those registered by the *Market Operator* as *dispatchable load* may submit standing profiles of *demand bids* in respect of each one (1) hour interval for each of its registered scheduled *load* facilities for each *trading day* of the week in accordance with the *timetable*. Submission of *demand bids* are provided for in *WESM Rules* Clause 3.5.6.

xx

6.1.7 *WESM Rules* Clause 3.5.11.5 requires *Trading Participants* to revise their *bids* or *offers* if they no longer represent a reasonable estimate of either the expected *availability* for the *dispatch interval* of the relevant *generating unit* or *scheduled load* or the *demand bids* or *offers* likely to apply in the *real-time dispatch* optimization for the *dispatch interval*.

xx

6.4 Categories of Self-scheduled Nominations, Bids, and Offers

6.4.1 The *self-scheduled nominations, bids*, and *offers* that can be submitted in the *WESM* are as follows:

a. Real-time *market offers* for *scheduled generating units* of *Scheduled Generation Companies*;
b. Operating *reserves offers* for certified *ancillary service providers;*
c. *Demand bids* from *customer Trading Participants*; and
d. Self-scheduled nominations
    i. Schedule of *loading levels* (i.e. *energy* quantities only) for *non-scheduled generating units* of non-scheduled *Generation Companies*; and
    ii. *Projected output* (i.e. *energy* quantities only) of *Generation Companies* with *must dispatch generating units* and *priority dispatch generating units*

6.9 Formats and Contents of Submission

6.9.5 *Trading Participants* shall provide the following information when submitting *demand bids:*

a. Shall have up to 10 *bid* blocks per take-off point;
b. Shall have a minimum block size of one (1) MW;
c. Shall have monotonically decreasing prices;
d. Shall start from a zero off-take;
e. May have *bid* prices that are negative; and
f. Shall include a validity period of *bids.*

8.4 Data Inputs/Information Requirements

8.4.1 Pursuant to *WESM Rules* Clause 3.7.4, the *market projections* shall take into consideration various data inputs. These inputs shall be made available or submitted to the *Market Operator* in accordance with the *WESM timetable* and the procedures set out in this Dispatch Protocol and relevant provisions of the *WESM Rules*.

8.4.2 The data inputs for the *market projections* are as follows:

a. *Generation energy* and *reserve offers*, *self-scheduled nominations,* and *demand bids*
b. *Demand/load forecast* determined in accordance with the *WESM* Load Forecasting Methodology
c. *System snapshot*
d. *Outage* schedules
e. *Reserve* Requirements
f. *Contingency* list
g. Transmission limits
h. *Over-riding constraints*
i. System advisories

9.1 Real-Time Dispatch Scheduling

9.1.1 *WESM Rules* Clause 3.8 sets out the responsibilities of the *Market Operator* in the scheduling of *generation* and *load* in the *WESM*. Among other responsibilities, *WESM Rules* Clause 3.8.1 directs that prior to the commencement of each *dispatch interval,* the *Market Operator* shall use the *market dispatch optimization model* (MDOM) to determine the target *loading level* in MW for each *non-scheduled generating unit, must dispatch generating unit, priority dispatch generating unit, scheduled generating unit* or each *scheduled load* and for each *reserve facility* for the end of the *dispatch interval* using the latest data from the *System Operator* and the *Trading Participants*. The *Market Operator* shall submit to the *System Operator* the *dispatch schedule* containing the *target loading levels* to be achieved at the end of the *dispatch interval.*

4. WESM MANUAL ON MARKET NETWORK MODEL DEVELOPMENT AND MAINTENANCE – CRITERIA AND PROCEDURES ISSUE 4.2, November 2020

6.6 Customer MTN

6.6.1 A customer node is the point where energy is withdrawn by the WESM participant and the direction of the power flow is from the network operated by the Network Service Providers, including the System Operator, to the energy consuming apparatus or equipment (i.e. load) owned by or connected to the customer trading participant.

6.6.2 The information required from the customers during their submission of demand bids or reserve offers in the case of dispatchable loads are listed in Appendix A of the WESM Rules.

ANNEX B: DEMAND-SIDE BIDDING IN OTHER ELECTRICITY MARKETS

This section provides information on the implementation of demand-side mechanisms in other electricity markets. Presented below are three articles on demand-side bidding in other jurisdictions.

The first article is from Clayton Utz which presents the wholesale demand response mechanisms in the National Electricity Market (NEM) of Australia which is managed by the Australian Energy Market Operator (AEMO). The second and third article, both from The Brattle Group, presents demand response market in the US and demand-side bidding in the UK.

1. Wholesale Demand Response Mechanism in Australia[10]

On 12 March 2020, the Australian Energy Market Commission (AEMC) released a second Draft Rule Determination on the proposed wholesale demand response mechanism (Draft Determination). The Draft Determination sets out a series of proposed changes to the National Electricity Rules (NER) which would allow large customers to routinely sell demand response in the wholesale market either on their own account or through specialist aggregators.

Currently the National Electricity Market (NEM) is characterized by active supply-side participation (ie. generation) and passive demand-side participation (ie. consumption). In its Draft Determination, the Australian Energy Market Commission (AEMC) considers that moving to a two-sided market (with active participation on both the demand side and supply side) will assist the NEM in evolving towards the power sector of the future, in which there will be a need for flexible and dispatchable resources (including demand response) to accommodate the increasing penetration of variable generation and network infrastructure needs.

<u>What is wholesale demand response and which customers can participate?</u>

Demand response refers to electricity consumers changing their level of consumption in response to short-term market signals. In the context of the NEM, demand response effectively allows consumers to participate in the wholesale market by offering their demand reductions in as a supply resource.

The AEMC's proposed mechanism would allow large consumers to obtain financial reward, in addition to any cost savings they might have through reduced energy consumption during peak periods

The proposed mechanism is limited to large customers or aggregators. This is because the AEMC's proposed wholesale demand response mechanism is designed to allow meaningful volumes of demand-side participation in dispatch and system operation (at least in the near-term). The mechanism requires loads to be controllable for the purposes of scheduling, and predictable to allow reliable measurement of demand reduction (using baseline methodologies). Large commercial and industrial users' electricity loads are usually more predictable, as those users operate large processes often on fixed timetables and fixed hours.

[10] Taylor F., Thomas N., Sloan R., Giordano J., "Place your bids: make money by reducing electricity consumption", 01 April 2020, https://www.claytonutz.com/knowledge/2020/april/place-your-bids-make-money-by-reducing-electricity-consumption

The mechanism is not suitable for small customers. It would require significantly increased complexity and cost to implement for small customers, in return for unclear benefit.

How will the DRSP role fit into the NEM?

To be eligible to participate, an organization needs to register with Australian Energy Market Operator (AEMO) as a Demand Response Service Provider (DRSP) and obtain AEMO's consent to classify their electricity user loads as wholesale demand response units (WDRUs). Only a DRSP will be able to sell wholesale demand response through the wholesale demand response mechanism. If an electricity retailer wants to provide wholesale demand response through the mechanism, it too would need to register as a DRSP.

In order to qualify for registration as a DRSP, an organization would need AEMO's approval to classify an electricity load as an ancillary service load or as a WDRU. A load can be a qualifying load if it has a single connection point, the load is neither a small customer load nor scheduled load, the DRSP has the consent of the customer, and the appropriate metering is installed. AEMO's registration process will outline the obligations with which a DRSP is required to comply, and will provide AEMO with an opportunity to assess the suitability of loads to participate in the mechanism.

DRSPs would have a number of obligations and incentives consistent with the obligations imposed on scheduled generators. AEMO will develop and release guidelines on the registration requirements for classification of WDRUs and other DRSP-related loads.

How does the wholesale demand response settlement mechanism work?

DRSPs would be treated in a similar way to other scheduled market participants in the NEM. DRSPs would submit dispatch bids to AEMO and receive dispatch instructions to provide wholesale demand response to a specified level. When the DRSP is dispatched based on its bid to reduce consumption, AEMO will pay it for its provided wholesale demand response. In effect, DRSPs will be making dispatch bids to reduce consumption and would have the ability to affect the wholesale price.

DRSPs will generally be subject to the same information provision requirements as existing scheduled generators, unless there is a requirement which is not appropriate to apply to DRSPs.

Baselines for DRSP electricity consumption are an integral part of the wholesale demand response mechanism, because the quantity of demand response which a DRSP is selling is determined as the difference between the DRSP's baseline consumption and its actual levels of consumption. The Draft Determination stipulates that AEMO will develop a guideline which sets out information about the process for AEMO to develop baseline methodologies.

2. Demand Response Markets in the US[11]

A feature of all the markets described for the United States is that they have a day-ahead as well as real-time market. As a general matter, bidding on the demand-side in day-ahead energy markets consists of the ability to submit a downward sloping bid (demand) curve. So, that as the price increases, less power would be purchased day-ahead. A typical scheme for demand-side bidding in a

[11] Earle R., Faruqui A., *"Demand-Side Bidding in Wholesale Electricity Markets"*, The Brattle Group, 27 June 2008

day-ahead energy market would be for buyers (demand) to submit their demand curves by noon the day before the operating day. For each operating hour and delivery location, a different demand curve might be submitted. Sellers would also have to submit their offer curves by that time as well. The bid curve submitted by buyers would typically consist of a sequence of price-quantity pairs that would represent the buyers' willingness to pay a certain amount for the quantity indicated. For instance, if a buyer was willing to pay $100/MWh for 1000 MW, but would only want 800 MW if the price rose to $120/MWh, the buyer would submit the price-quantity pairs: ($120/MWh, 800 MWh) and ($100/MWh, 1000 MW).

The bid curves submitted to the Regional Transmission Organization (RTO) would then be cleared with the offer curves. This would give the buyer a position that would be delivered the next day. In real-time, a net buyer could make an offer to change its position from its day-ahead position by submitting another demand curve. The difference in real-time is, however, that the buyer would need to be able to react in real-time to signals from the RTO. Whereas for day-ahead bidding, the buyer's position is set a day in advance and so would have much more time to take whatever measures were necessary in order to increase or decrease its load. Deviations in consumption from the day-ahead schedule for a buyer are typically settled at the real-time price. Sometimes penalties are applied if the deviations are large.

In contrast to the day-ahead and real-time energy programs, emergency programs are those used by RTOs only in the event of a pre-defined triggering event that is considered to be an emergency. These programs in some ways are very much like traditional load control programs (sometimes "DLC" for direct load control when the utility can directly control the load) in which a utility would call for reductions under certain conditions. In return, participants usually receive a fixed payment whether called or not, and sometimes receive a variable payment if called upon. Though emergency demand response programs are not really demand-side bidding, they are included here for completeness and because their size reflects the potential for demand-side bidding.

Ancillary service programs at RTOs range from those providing 10-minute reserve to those providing regulation. The RTOs vary across which ancillary services are open to demand-side bidding.

Finally, some markets in the U.S. have capacity requirements that are formalized through a centralized market for capacity in the RTO. In some of these jurisdictions, demand response can participate as a resource against generation.

3. Demand-Side Bidding in the UK[12]

From 1990 to 2001, there was effectively a mandatory two settlement system in England and Wales14, with a day-ahead Pool after which the Transmission System Operator (TSO) took control of the system and could adjust the accepted Pool offers and use ancillary service contracts to achieve a balanced system. Demand-side bidding into the Pool was allowed from the end of 1993 onwards but initially (until 1998) only 30 demand-side bidders (DSBs) were allowed to participate. Each DSB had to be able to deliver at least 10 MW of demand reduction in any settlement period and 50 GWh of demand reduction over the course of a year. DSBs had to specify the price at which they were prepared to reduce their demand (the same price curve for all 48 settlement periods in a day) and the level of

[12] Earle R., Faruqui A., "Demand-Side Bidding in Wholesale Electricity Markets", The Brattle Group, 27 June 2008

demand reduction they could deliver in each settlement period. DSBs were not paid for any energy they were scheduled not to consume but they did receive an availability payment when they were available to reduce demand but not scheduled to do so.

From 2001 onwards, the original two settlement system was replaced by a single settlement system. Bilateral trading (over the counter or via power exchanges) continues until an hour before the start of each settlement period when a real-time market (the Balancing Mechanism) opens. In principle, there is nothing to stop the demand-side participating in bilateral trading but no information is available on whether this occurs. However, DSB occurs in the Balancing Mechanism, which was specifically designed from the outset to allow this to occur – DSB have to provide information on their intended level of consumption during the settlement period and the price and extent to which they are prepared to move away from this level. If their offer is accepted, i.e., they are requested to reduce their demand, they are paid their offer price for the energy they do not consume.

Measurement issues are less of a problem than is often the case because of the way that the settlement system functions. This is because demand-side participants are exposed to imbalance charges for any difference between the demand they notify to the settlement administrator when the real time market opens (their final physical notification or “FPN”) and the volume of contracts they have signed to cover that demand. If DSBs have an offer accepted, their FPN is adjusted to reflect the demand they are deemed not to have taken. Consequently, if a DSB were to submit an artificially inflated FPN so as to provide headroom for delivering an offer without taking any action, it would have either to accept exposure to imbalance prices (if its contract volume matched its intended actual demand) or to pay under contract for power it did not need (if its contract volume matched its FPN). Neither of these options is likely to make financial sense. (Note that the settlement system does not directly generate an “uplift payments” since the net imbalance cash flow - the difference between the payments made by participants for being short and the payments made to participants for being long - is smeared back across all parties in proportion to their metered volumes.)

In addition, the demand-side can provide a number of different ancillary services, irrespective of whether or not they chose to participate in the Balancing Mechanism. Note that it is possible for large loads to individually contract with the system operator, provided that they can deliver a demand reduction of at least 3 MW, or to have their demand reduction submitted jointly with that of other loads via an aggregator (there are currently three aggregators active in the market).

While the British regulator has always been supportive of the involvement of the demand-side in the wholesale market, e.g., by designing the real-time market to allow its participation, a key driver of the development of demand-side ancillary services has been the financial incentives to which the system operator is exposed. These are of the “sliding scale” variety whereby the system operator gets to keep a proportion of any reductions in its balancing costs below a target level and has to pay a proportion of any increase in its balancing costs above that target level. The demand-side can bring additional competition to the delivery of ancillary services, particularly fast reserve, which can enhance the ability of the system operator to control its costs. This, in turn, delivers benefits to consumers through lower system costs.