AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Appendix 1. Related Projects

June 2022

Appendix to the Scheduled Lite: Draft High Level Design Consultation Paper

Important notice

Purpose

This is Appendix 1 to Scheduled Lite: Draft High Level Design Consultation Paper, available at https://aemo.com.au/initiatives/trials-and-initiatives/scheduled-lite

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Version control

Version	Release date	Changes
1.0	21/06/2022	Initial consultation version

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A1. Related Projects

This appendix outlines the wide range of projects and initiatives that have informed the proposed design for Scheduled Lite. It is provided to support stakeholders to understand how the initiatives have influenced the draft High Level Design; it is not intended to be a complete description of those individual projects and stakeholders should refer to the source information for those projects.

0 below provides a high-level overview of each related project and the Scheduled Lite design elements for which they are relevant. The rest of the appendix explores the relevance of each of individual initiative/project to Scheduled Lite design in more detail and references to further information.

Table 1 Overview of project/initiatives that have informed the proposed Scheduled Lite design

Key: ✓ Visibility Model ✓ Dispatchability Model

Related[1] Projects	Design elements									
	Participation & Registration	Data types	Data exchange/ telemetry	Bids	Dispatch	Constraints	Operations	Compliance	Incentives	Opt-in arrangement
A1.1 IESS	✓ ✓			✓	✓					
A1.2 Flexible Trading Arrangements	✓ ✓									
A1.3 Semi-scheduled Self-forecast		✓							✓	
A1.4 VPP Demonstrations	✓	✓	✓ ✓	✓	✓	✓	✓ ✓	✓		
A1.5 WDR	✓ ✓		✓	✓	✓		✓	✓		
A1.6 SA Smart Meter Backstop Mechanism		✓	✓ ✓				✓ ✓			
A1.7 DEIP - DOE						✓				
A1.8 AEMO DER Program – Project MATCH	✓									
A1.9 Project EDGE		✓	✓ ✓	✓	✓	✓	✓	✓		
A1.10 Project Symphony	✓		✓	✓	✓	✓	✓		✓	
A1.11 Review of PSDCS			✓ ✓							
A1.12 SCADA Lite			✓							
A1.13 IDX			✓ ✓							
A1.14 NZ -DNx										✓

[1] Noting that the relevant projects listed here are in most cases being informed by innovative industry trials/projects. For example, Project EDGE has been collaborating and interacting with complementary projects e.g. Evolve DER

A1.1 Integrating energy storage systems (IESS)

Overview

In December 2021, the Australian Energy Market Commission (AEMC) made a final determination on the IESS rule change[2] to better integrate storage and hybrid systems, taking a significant step towards a technology-agnostic market model for the National Electricity Market (NEM). Among other changes, the rule change introduces a new universal participant category—the Integrated Resource Provider (IRP)—to accommodate participants with bidirectional energy flows, but which may also classify generating units and load. The rule change is being implemented in two releases:

- an initial release, commencing in March 2023, allows Small Generation Aggregators (SGAs) to participate in Frequency Control Ancillary Services (FCAS) markets and introduces aggregate conformance for hybrid systems; and
- a final release, commencing in June 2024, for all other changes.

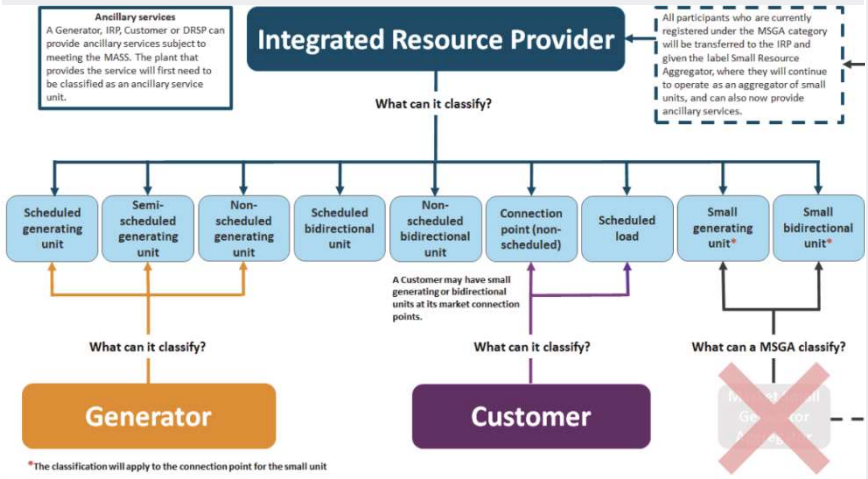
IESS would be an enabling tool for participation and registration in both Scheduled Lite models as shown in Table 2.

Relevance to Participation

Table 2 IESS relevance to Participation

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
Participation/ Registration	Providing the future registration model for the NEM	• Introduction of the IRP (near) universal registration category (from June 2024) underpins the new NEM registration model. The IRP: – accommodates a range of participants with bidirectional energy flows that may produce and consume energy and ancillary services – may classify bidirectional units, end user connection points, scheduled loads, generating units, small resource connection points and ancillary service units – subsumes the current Market SGA category, which will participate under the Small Resource Aggregator label. • Under the new Small Resource Aggregator label, IRPs will be able to aggregate small resource connection points (both small bidirectional units and small generating units). As part of the initial (March 2023) release, SGAs will be able to participate in ancillary service markets. • The rule change also explicitly integrates storage units by introducing a new unit type: the Bidirectional Unit (from June 2024).	The registration model developed for IESS may be used by Scheduled Lite traders

[2] AEMC, 2021. *Final determination: Integrating energy storage systems into the NEM*. Available at https://www.aemc.gov.au/rule-changes/integrating-energy-storage-systems-nem Integrating energy storage systems into the NEM | AEMC

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
		Classifications and services that can be provided by Market Participants under the IESS rule change  *Source*: AEMC.	

Relevance to the Dispatchability Model

Table 3 IESS relevance to the Dispatchability Model

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
Bids	Bid Structure	AEMO's draft IESS High Level Design outlines how bidirectional units would submit Energy Bids: • Bidding for energy: Up to 20 bid bands will be available to be submitted in respect of a scheduled bidirectional unit, with these being restricted to a maximum of 10 bands for capacity on the consumption side, and 10 bands on the generation side.	To inform proposed functionality/structure for dispatch processes.
Dispatch		AEMO's draft IESS High Level Design outlines how bidirectional units would be integrated into dispatch processes, this includes: • Bidding for FCAS: an ancillary service unit will be allowed up to 10 bid bands for each service – the same as for other ancillary service units. The FCAS trapezium for a scheduled bidirectional unit will be similar to that used by other units which are not bidirectional, recognising unique capabilities. • Dispatch instructions: Scheduled bidirectional units will receive a single (bidirectional) dispatch instruction representing the net flow to be achieved.	

Further information can be found in the following links:

- AEMC - IESS Rule Change Final Determination[3]
- AEMO – IESS Draft High Level Design[4]

[3] AEMC, 2021. *Final determination: Integrating energy storage systems into the NEM*. Available at https://www.aemc.gov.au/rule-changes/integrating-energy-storage-systems-nem

[4] AEMO, 2021. *IESS High Level Design*. Available at https://aemo.com.au/initiatives/submissions/integrating-energy-storage-systems-iess-into-the-nem

A1.2 Flexible Trading Arrangements

Overview

In its Final Advice on Post 2025 Market Design to Energy Ministers, the Energy Security Board (ESB) detailed models for the development of flexible trading arrangements in the NEM. Flexible trading arrangements were proposed to enable greater choice and service access for customers, as well as supporting innovation and competition among service providers. Flexible trading arrangements enable the separation of controllable electrical resources (e.g. battery, solar PV and electric vehicle charging) from passively connected electrical resources (e.g. household lighting and general appliances) in an end user's home or business. It enables end users to access competitive offers and services for their controllable resources independent from their general electricity supply, enhancing their ability to be rewarded for their flexibility and maximising the value of their distributed energy resources (DER).

Two Flexible Trader Models have been developed. The first, Flexible Trader Model 1 (FTM1), is an extension to the current arrangements for SGA connections and has been given effect via the recent IESS rule change (see A1.1 above). The second, Flexible Trader Model 2 (FTM2), is the subject of a recently submitted AEMO rule change request.

Flexible trading arrangements are expected to provide an avenue for Scheduled Lite traders to separate an end user's flexible resources for participation in Scheduled Lite (though participation via a 'standard' connection point will also be supported where a participant can meet the participation requirements).

Flexible trading arrangements would be an enabling tool for broader participation in Scheduled Lite, see Table 4.

Relevance to Participation

Table 4 Relevance of flexible trading arrangements to Participation

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
Participation	Flexible Trader Model 1 (FTM1) – SGA+ *The AEMC has progressed FTM1 through the IESS rule change process[5].*	**Second connection point to the distribution network** FTM1 allows a second connection point to the distribution network to be established, enabling the end user's controllable resources to be managed independently in wholesale settlement. The end user may appoint a different financially responsible Market Participant (FRMP) for the second connection point while retaining a traditional retailer for its passive load.	Scheduled Lite Traders may utilise the framework developed for FTM1 and FTM2 to enable the separation of controllable resources for participation in Scheduled Lite.
	FTA Model 2 (FTM2) *FTM2 arrangements are subject to a recent rule change request by AEMO[6]*	**Sub-meter connection point with end user's electrical installation** FTM2 would enable end users to establish a private metering arrangement (PMA), which includes a sub-metered connection point and separate National Metering Identifier (NMI), within their electrical installation. Resource(s) connected within the PMA are treated independently in wholesale settlement, with the option to nominate a separate FRMP to manage them. FTM2 may provide a more accessible model compared with FTM1 for many small users.	

[5] AEMC, 2021. *Rule determination: National Electricity Amendment (Integrating Energy Storage Systems into the NEM) Rule 2021*. Available at https://www.aemc.gov.au/sites/default/files/2021-12/1._final_determination_-_integrating_energy_storage_systems_into_the_nem.pdf

[6] AEMC, 2021. *Rule determination: National Electricity Amendment (Integrating Energy Storage Systems into the NEM) Rule 2021*. Available at https://www.aemc.gov.au/sites/default/files/2021-12/1._final_determination_-_integrating_energy_storage_systems_into_the_nem.pdf

Further information can be found in the following links:

- FTM1: AEMC - IESS Rule Change Final Determination[7]
- FTM2: AEMO – Electricity Rule Change Proposal *Flexible trading arrangements and metering of minor energy flows in the NEM*[8]

A1.3 Semi-scheduled Self-forecast Program

Overview

In early 2018, AEMO and the Australian Renewable Energy Agency (ARENA) began undertaking a Market Participant 5-minute self-forecasting program to demonstrate the potential benefits of wind and solar generator self-forecasting for the operation of the power system. To date, participant self-forecasting has delivered system-wide benefits by providing greater autonomy to existing semi-scheduled generators and reducing generation dispatch forecast error, compared with Australian Wind Energy Forecasting System/Australian Solar Energy Forecasting System (AWEFS/ASEFS)[9] dispatch forecasts. This has led to reductions in generators' Causer Pays factors, in turn reducing participants' regulation FCAS charges. Participants currently using self-forecasting have expressed positive feedback on the program.

Knowledge and findings generated from the Semi-scheduled Self-forecast Program informed the data types and incentives elements of the Visibility Model as shown in Table 5.

Relevance to the Visibility Model

Table 5 Relevance of Semi-scheduled Self-forecast Program to the Visibility Model

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
Data types	Reliability and performance requirements	Provides an existing framework for the provision of self-forecasts. • Participant self-forecasts are assessed in three categories: – Reliability: received self-forecast at least 70s before gate closure for >95% of dispatch intervals – Sufficient Volume: Reliability and (Unit target ≥ Unconstrained Intermittent Generation Forecast [UIGF] OR SCADA Possible Power available) for > 80% of dispatch intervals over assessment window – Performance: AEMO will assess self-forecast performance for all dispatch intervals that satisfy the above criteria over the current assessment window	Informed data types/requirements to be of value to Visibility Model traders and market processes
Incentives	Incentive arrangement	Self-forecasting uses a performance equals incentive arrangement, where participants must consistently outperform AEMO in order to access the incentives. Before a participant self-forecast is eligible for use in dispatch, AEMO will assess its performance against the internal forecasts. Failure to meet minimum standards would then make the participant ineligible for incentives until performance improves.	Informed incentive arrangements formulation for Visibility Model Traders

[7] AEMC, 2021. *Rule determination: National Electricity Amendment (Integrating Energy Storage Systems into the NEM) Rule 2021*. Available at https://www.aemc.gov.au/sites/default/files/2021-12/1._final_determination_-_integrating_energy_storage_systems_into_the_nem.pdf

[8] AEMC, 2022. *Flexible trading arrangements for distributed energy resources*. Available at https://www.aemc.gov.au/rule-changes/flexible-trading-arrangements-distributed-energy-resources?utm_medium=email&utm_campaign=New-rule-request-template-2&utm_content=aemc.gov.au%2Frule-changes%2Fflexible-trading-arrangements-distributed-energy-resources&utm_source=cust49597.au.v6send.net

[9] See AEMO *Solar and wind energy forecasting* webpage. Available at https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/operational-forecasting/solar-and-wind-energy-forecasting

Further information can be found in the following links:

- ARENA Knowledge and findings generated from the short-term self-forecasting trial[10]
- AEMO Semi-Scheduled Generation Dispatch Self-Forecast – Assessment Procedure[11]

A1.4 Virtual Power Plant (VPP) Demonstrations

Overview

AEMO, in collaboration with ARENA, the AEMC, the Australian Energy Regulator (AER), and members of the Distributed Energy Integration Program (DEIP), established the VPP Demonstrations trial in March 2019.

The VPP Demonstration Project was an initial step in AEMO's broader DER Program[12], designed to provide early insights on integration of VPPs into market frameworks at scale, and develop empirical evidence to inform related changes to regulatory frameworks and operational processes.

The VPP Demonstrations aimed to:

- Allow VPPs to demonstrate their capability to deliver multiple value streams across FCAS, energy and potential network support services.
- Provide AEMO with operational visibility to help AEMO consider how to integrate VPPs effectively into the NEM.
- Assess current regulatory arrangements affecting participation of VPPs in energy and FCAS markets, and inform new or amended arrangements where appropriate.
- Provide insights on how to improve consumers' experience of VPPs in the future.
- Understand what cyber security measures VPPs currently implement, and whether their cyber security capabilities should be augmented in the future.

Participants in the VPP Demonstrations have included:

- Eight VPP portfolios across all mainland NEM states.
- A total registered capacity of 31 MW (equivalent to a small scheduled hybrid solar farm plus battery). Although participation was open to any technology, all VPPs used batteries in their portfolios.
- Approximately 7,150 consumers who signed up in the VPP Demonstrations (almost 25% of residential customers with registered batteries in the NEM).

The VPP Demonstrations concluded following the final determination of the Market Ancillary Services Specification (MASS) consultation towards the end of 2021.

[10] GHD Advisory, 2021. *Knowledge and findings generated from the short-term self-forecasting trial – analysis and reporting*. Report prepared for ARENA. Available at https://arena.gov.au/assets/2021/10/arena-short-term-forecasting-funding-round-evaluation.pdf

[11] AEMO, 2022. Semi-Scheduled Generation Dispatch Self-Forecast – Assessment Procedure. Available at https://aemo.com.au/-/media/files/electricity/nem/security_and_reliability/dispatch/policy_and_process/semi-scheduled-generation-dispatch-self-forecast---assessment-procedure.pdf

[12] See AEMO NEM Distributed Energy Resources Program webpage. Available at https://aemo.com.au/en/initiatives/major-programs/nem-distributed-energy-resources-der-program

A brief description of how the lessons learnt by the VPP Demonstrations informed the proposed Scheduled Lite design is presented in Table 6 and Table 7 below.

Relevance to the Visibility Model

Table 6 VPP Demonstrations relevance to the Visibility Model

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
Data types	Data Specification	The operational visibility of VPPs obtained during the VPP Demonstrations[13] was instrumental in developing AEMO's understanding of VPP behaviour. All VPP demonstration participants were required to provide data including: • Actual performance data for aggregate controlled generation, load and energy in storage. • Granularity: All data was provided on a 5-minute basis via Application Programming Interfaces (APIs). • Actual data for controlled load and generation could be aggregated to obtain the net position of the portfolio for each 5-minute interval. AEMO's analysis of this data verified the ongoing need for operational visibility of VPPs as they reach material thresholds. Drawing on evidence from the VPP Demonstrations, it is recommended that: • VPPs provide near real-time actual performance data at a portfolio level • VPPs provide forecasts of their expected operation and available capacity, potentially at different price points, to AEMO and have a requirement to meet that forecast. Data received in this trial demonstrated that VPPs are able to and are best placed to, provide forecasts with a schedule of discharge and charge activity over a variety of forecast horizons. The complex operating patterns of VPPs has made it clear that AEMO is not best placed to forecast the behaviour of these assets.	Provided valuable learnings relevant to defining the data requirements needed to fulfill Visibility Model objectives
Data Exchange/ Telemetry	Data Ingestion Capability	APIs were built and deployed to ingest the following data into the VPP cloud application: • Enrolment data (site level NMI and device information, frequency injection test data for Dispatch Unit Identifiers [DUIDs] and batteries) • VPP operational data (aggregated DUID data) – actuals and forecasts to provide AEMO with visibility of the VPPs in near real-time • Telemetry data – device level data in 5-minute resolution received daily/weekly VPPs use home wi-fi, 3/4G and public internet to source data from devices that could then be aggregated and sent to Network Service Providers (NSPs) and AEMO. • At any one time during the trial, AEMO received 70-98% of the telemetry data from each of the participants. This largely reflects house-to-VPP cloud communication dropouts due to issues with wi-fi or 3G networks.	Provided analysis on the advantages/disadvantages of exchanging data over APIs via public internet.
Operations	Operational Visibility Insights	The VPP Demonstrations highlighted key aspects to be considered once an energy resource such as a VPP is of a material size in a region to ensure appropriate scope of control and ability to accurately forecast grid conditions. The aspects related to the Visibility Model are: • Visibility: From an operational perspective, AEMO requires visibility of the controllable resources in a VPP portfolio. AEMO sees this as being any DER that can be actively controlled by an aggregator, VPP, or relevant agent. This is not limited to demand side DER (such as batteries), with the potential for rooftop PV generation to be actively controlled via smart meter functionality or other elements such as pool pumps	Provided insights into operational requirements for the Visibility Model

[13] AEMO, 2019. *VPP Demonstrations data specification*. Available at https://aemo.com.au/-/media/files/electricity/nem/der/2019/vpp-demonstrations/vpp-demonstrations-data-specification.pdf?la=en

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
		• Forecast ability: AEMO requires accurate forecasts of any 'active' shifting of distributed load or generation so it can be reflected in load forecasts that are published to the market or generation scheduling	

Relevance to the Dispatchability Model

Table 7 VPP Demonstrations relevance to the Dispatchability Model

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
Registration	Participation Models	During AEMO's VPP trials, applicants applied to enrol their VPP as: • Participating in FCAS markets and being exposed to energy market price signals (as a Market Customer), or • Participating in FCAS markets only (as a Market Ancillary Service Provider [MASP]) There were three models for participation in the VPP Demonstrations: 1. A retailer and a separate VPP coordinator (who may or may not be a registered participant) may jointly participate in the trial in respect to connection points where the retailer is the FRMP. This arrangement requires the retailer and the VPP operator to enter into a commercial agreement, and the retailer will participate as the Market Customer in contingency FCAS markets and be exposed to energy market prices. 2. A retailer, who is also the VPP coordinator, can participate as a Market Customer with respect to multiple connection points, at which it is the FRMP. 3. A VPP coordinator who is registered as a MASP may participate in the trial in contingency FCAS markets only.	Informed consideration of registration framework alternatives to participate in the Dispatchability Model.
	Required Standards	Drawing on evidence from the VPP Demonstrations, it is recommended to explore mandating compliance with AS/NZS 4777.2.2020 for new (and potentially existing) DER, providing FCAS to mitigate risk of disconnections when enabled for FCAS.	Informed considerations around standards that Traders will need to comply with to participate/register in the Dispatchability Model.
	Minimum Threshold	Outcomes from the VPP Demonstrations suggest that, if VPPs can consistently follow forecast schedules, scheduling in central dispatch may be deferred until the capacity of VPPs reaches certain thresholds. It is recommended to leverage the guidelines that have been prepared for the Wholesale Demand Response (WDR) Mechanism (see section A1.5 below).	Informed considerations on an adequate portfolio capacity size threshold to unlock value of participating in dispatch processes.
Data Exchange/ Telemetry	Data Types	In addition to Table 6 above, outcomes from the VPP Demonstrations highlighted that: Participation in central dispatch would require VPPs to effectively be 'self-forecast' with bid-offer pairs submitted, 5-minute dispatch targets followed, and availability submitted at all times. This would require full integration into AEMO's market systems with VPPs represented in Projected Assessment of System Adequacy (PASA) and pre-dispatch as both demand and generation.	Provided insights into the value of near real-time data to observe the responsiveness of VPPs to energy spot prices.
	Quantity Definition	Outcomes from the VPP Demonstrations suggest that for the purpose of operational visibility, AEMO prefers to receive live operational telemetry about VPP activity as gross data, as occurred during the VPP Demonstrations. When live data is provided as net (net connection point flows), the information of activity behind the meter is lost.	Provided insights into the value of gross data – this is being pursued through other initiatives
	MASS Review	At the beginning of 2021, AEMO launched a MASS consultation process, part of which sought to determine the appropriate ongoing arrangements for DER participation in FCAS markets.	Informed the standards/specifications with which Dispatchability Model Traders would need to comply when participating in FCAS markets

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
		In summary, the consultation outcomes affecting DER FCAS Providers are[14]: • A measurement time resolution of 200ms is adequate to verify Fast FCAS delivery from Aggregated Ancillary Service Facilities with no inertial response, provided that: – At least 25 Ancillary Service Facilities are aggregated: and – A discount of 5% is applied to the quantity of Fast FCAS delivered, if at least 25 but less than 500 Ancillary Service Facilities are aggregated. • Where those conditions are not met, the minimum acceptable measurement time resolution is 50ms for participation in the Fast FCAS markets. • The measurement location will remain 'at or close' to the connection point of each Ancillary Service Facility. • Transitional arrangements will apply for those participating in the VPP Demonstrations (Trial Participants) until 30 June 2023.	
Bid/Dispatch	Responses to energy price signals	VPPs demonstrated that they are highly capable of responding to energy market prices in real time e.g. VPPs improved their algorithms during the trial to consistently charge during the day and discharge during evening peaks that often coincide with higher energy prices. Drawing on evidence from the VPP Demonstrations, it was recommended to enable the ability for VPPs to be coordinated (or dispatched), potentially through VPPs participating in wholesale dispatch by submitting bi-directional bids/offers.	Provided insights into the ability of VPPs to value stack, by responding to energy spot price signals
Operations	Operational Visibility Insights	In addition to what is contained in Table 6 above, coordination is also a key aspect to ensure appropriate scope of control and ability to accurately forecast grid conditions, with high penetration of new energy resources such as VPPs. The VPP Demonstrations recommended that changes should be made such that VPPs are able to be considered and relied upon as a resource in the system, from a system adequacy perspective given their relative and potential size in the market, as well as ability to forecast accurately to ensure efficient dispatch and market outcomes. This would require full integration of VPPs into AEMO's market systems, represented in PASA and pre-dispatch as both demand and generation.	Provided insights into the requirements needed to operate the system with high penetration of new energy resources such as VPPs
Constraints	Dynamics Operating Envelopes (DOEs)	Drawing on evidence from the VPP Demonstrations, it is recommended to explore the implementation (over time) of tiered DOEs, sent from the Distribution Network Service Provider (DNSP) to the VPP operator, in high DER areas. The tiers could represent one DOE for system normal operation and one for contingency events that would allow the system normal envelope to be exceeded temporarily when delivering contingency FCAS.	Informed consideration of the allocation and treatment of distribution network constraints/services in the Dispatchability Model
	Local network services	Drawing on evidence from the VPP Demonstrations, it was recommended to explore an agreement between aggregators DNSPs on the control hierarchy of participating DER inverters and the prioritisation of services such as volt-VAR service (reactive power) ahead of FCAS (active power).	
Compliance	Compliance	As an on-market demonstration, it was important that VPPs complied with the rules and regulations applicable to market participants. Participants (including VPP Demonstration participants) are paid for FCAS upon enablement, however, if a Participant/VPP does not deliver what they have been enabled for, a financial clawback procedure may take place.	Informed considerations of compliance arrangements
Incentives	Provision of Contingency FCAS	Small battery VPPs, like utility-scale batteries, have proven to be highly effective at providing contingency FCAS, through various response methods[15].	Provided insights into the ability of VPPs to deliver contingency FCAS

[14] Amendment of the market ancillary service specification – DER and general consultation. Available: https://aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2021/mass/final-determination/final-determination.pdf?la=en

[15] Responses characterised as either proportional, switched responses, and even dynamic switching controllers that deliver a proportional response

Further information can be found in the following links:

- AEMO - VPP Demonstrations[16]

A1.5 Wholesale Demand Response (WDR) Mechanism

Overview

In June 2020, the AEMC made a final rule to facilitate demand response in the NEM through the WDR Mechanism.

The WDR Mechanism allows demand side (or consumer) participation in the wholesale electricity market at any time, however, most likely at times of high electricity prices and electricity supply scarcity. Demand Response Service Providers (DRSPs) may classify and aggregate the demand response capability of large market loads for dispatch through the NEM's standard bidding and scheduling processes.

The DRSP receives payment for a dispatched response, measured against a baseline estimate, at the electricity spot price.

The Scheduled Lite design aims to leverage tools/analysis developed to enable the WDR Mechanism, as shown in Table 8 and Table 9.

Relevance to the Visibility Model

Table 8 WDR Mechanism relevance to the Visibility Model

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
Participation	Portfolio Management System (PMS)	The PMS enables DRSPs to view and manage their portfolios of Wholesale Demand Response Units (WDRUs) and Ancillary Service Units. The PMS allows DRSPs to: • Submit new application requests for AEMO's approval such as: – Classify new NMIs – Declassify existing NMIs – Aggregate – Disaggregate – Update baseline methodologies and parameters – Request to reinstate a NMI following suspension due to non-compliance • Continue application(s) from draft • View the status of submitted requests • Request to withdraw submitted requests • Self-assess baselines associated to a NMI or by a Portfolio • Identify their NMI as unavailable due to operational issues	It is proposed that Scheduled Lite Traders would use the PMS to manage their portfolios

[16] See AEMO VPP Demonstrations webpage. Available at https://aemo.com.au/en/initiatives/major-programs/nem-distributed-energy-resources-der-program/der-demonstrations/virtual-power-plant-vpp-demonstrations

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
Participation/ Registration	Registration checks for constraints	• Threshold for requirement of SCADA - the following criteria is to be used to determine if a WDRU needs to have SCADA: – Any WDRU (individual or aggregated) >5 MW – WDRUs connecting to a congested area (e.g. in north-west Vic or southern NSW) • Aggregated WDRUs crossing multiple constraint zones – If the aggregate WDRU is partly in a congested constraint zone then it may be requested to disaggregate	Informed Scheduled Lite participation building blocks, in terms of zonal aggregation considerations

Relevance to the Dispatchability Model

Table 9 WDR Mechanism relevance to the Dispatchability Model

Design Element	Relevance to the Design Element		
	Area	**Description**	**Relevance**
Registration	PMS	As per Visibility Model (see Table 8)	
	Registration checks for constraints	As per Visibility Model (see Table 8)	
	Regional Threshold *Portfolio Capacity Threshold*	A threshold for a region of the total quantity of WDR for which no telemetry data is provided, in MW, that may be dispatched at one time. AEMO to determine a threshold for the total quantity of WDR in a region above which AEMO will impose additional or alternative telemetry and communications equipment requirements, for any load in the region seeking to be classified as a WDRU after the threshold has been reached.	Informed threshold considerations for the scheduling and participation of new types of resources e.g. VPPs in central dispatch
Data Exchange	Telemetry/Definitions	Quantity is defined as Net but is only for the devices controlled by the DRSP.	Informed data requirements to participate in dispatch processes
	Telemetry/Thresholds	Requirements for Telemetry to apply to WDRUs when: • One NMI in the aggregation has a level maximum response component (MRC) of 5 MW or greater; • The aggregation of NMIs at or behind a single transmission node have an MRC of 5 MW or greater, regardless of whether or how the WDRUs are aggregated; or • individual or aggregated WDRUs below the 5 MW threshold in respect of a NMI-Level MRC or DUID-Level MRC, as applicable, are located in an area of the power system where existing scheduled plant: – needs to be curtailed to maintain power system security; or – is forecasted to be curtailed as a result of committed investments and works, or other changes in the power system, for at least five hours per year	Informed threshold considerations for the scheduling and participation of new types of resources e.g. VPPs in central dispatch

Bid/Dispatch	Bid structure/functionality	When engaging with the market through Central Dispatch, DRSPs are obliged to meet some of the same requirements as Scheduled Participants, namely: • Providing bids for each interval in a trading day • Providing a maximum availability bid that reflects the availability of the demand-responsive component of their load • Respond to dispatch instructions	Informed proposed requirements in dispatch processes, e.g. bid only considering the responsive component
Compliance	Arrangements	WDRU conformance is completed in post-event analysis. If a WDRU has three separate events over three months where it had been deemed to be non-conforming, then it will be issued with a non-compliance.	Informed Dispatchability Model compliance considerations.
Operations	Operations	Forecasts for Operational Demand are inclusive of WDR. The availability of WDRUs is considered in an identical fashion to other scheduled plant – therefore reserve assessments are inclusive of WDR availability.	Informed requirements in terms of data provided by Traders, as well as AEMO's utilisation of the data being provided

Further information can be found in the following links:

- AEMO - WDRM[17]
- WDR guidelines[18]

A1.6 South Australia Smart Meter Backstop Mechanism Trial

Overview

To assist in understanding the capability of smart meters, the South Australian Energy Minister formally requested AEMO to run a trial testing this capability. The trial tested, via a simulated response, the technical capabilities and communication protocols for smart meters to be used in such a way that may support power system security in rare circumstances.

The trial was developed in two phases. Phase 1 demonstrated that residential smart meters have the capability to actively manage distributed PV (DPV) generation within the timeframes and reliability levels required to support power system security. Phase 2 sought to specifically demonstrate how this functionality could be harnessed to enable new energy markets and enhanced information, as well as choice for South Australian consumers.

The proposed Scheduled Lite design was informed by the outcomes of the South Australia Smart Meter Backstop Mechanism Trial as outlined in Table 10.

[17] AEMC, 2020. *Rule determination – National Electricity Amendment (Wholesale demand response mechanism) Rule 2020*. Available at https://www.aemc.gov.au/rule-changes/wholesale-demand-response-mechanism

[18] AEMO, 2021. *Wholesale demand response guidelines*. Available at: https://aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2020/wdr-guidelines/final-stage/wholesale-demand-response-guidelines-mar-2021.pdf?la=en

Relevance to the Visibility Model and the Dispatchability Model

Table 10 SA Smart Meter Backstop Mechanism Trial relevance to the Visibility Model and the Dispatchability Model

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
Data Types	Multiple element metering	• A multiple element meter was able to provide aggregate gross visibility every 5 minutes, providing: – Consumer information: Enhanced data in a consistent form, quality, accuracy and timeliness. The functionality provides clear and simple information that could be accessed in near real-time, enabling consumers to make better choices delivering greater agency and control over their energy use and devices. – Situational awareness: an increase in data sets improves accuracy in the reconstitution of the supply/demand balance in a high DER system, providing an accurate understanding as to whether the power system is expected to remain in a secure state or further action is required. – Significant forecasting accuracy improvements: The trial highlighted that visibility is improved with additional near real-time aggregate data, with some forecast scenarios having indicated a variation in the order of 200 MW for a dispatch interval. Such visibility of these variations will be critical in managing real-time contingency events.	Demonstrated technological capabilities to enable provision of gross data
Data Exchange	Metering capabilities	• The aggregate 5-minute DPV data from Smart Meters can be provided to AEMO without additional devices, communication modules or reliance on consumer internet access.	
Operations	Metering configurations	• Smart meters could be configured in a manner that could deliver: – Under-frequency load shedding (UFLS): Further testing is required but discussions indicate meters can be programmed to appropriately and automatically respond to an UFLS event. – Over-frequency generation shedding (OFGS). – System Restart Ancillary Service (SRAS): Smart meters offer near-instant management of DPV to deliver a stable load, while direct to inverter-based models of DPV control, generally utilise consumer wi-fi that appears to have a reconnection lag that may impact the utility of the inverter communications pathway to support system restart. – Cyber Security Safety Switch: Smart Meters offer redundancy via capability to disconnect DPV through a secure and independent switch.	Provided guidance on technological capabilities that enhance operational practises

Further information can be found in the following link:

- AEMO - South Australia Smart Meter Backstop Mechanism Trial[19]

[19] See AEMO Reference Information – Smart Meter Backstop Mechanism Capability Trial. Available at https://aemo.com.au/en/initiatives/major-programs/nem-distributed-energy-resources-der-program/standards-and-connections/reference-information

A1.7 Distributed Energy Integration Program (DEIP) - Dynamic Operating Envelopes Working Group

The DEIP DOE Working Group was established to explore the value that DOEs offer to the energy transition. The workstream aims to[20]:

- build a shared understanding of the opportunities and challenges
- share insights on approaches currently under investigation
- identify reforms that could be implemented to establish DOEs.

The proposed Scheduled Lite design has considered the outcomes of the DEIP DOE Working Group, as outlined in Table 11.

Relevance to the Dispatchability Model

Table 11 DEIP DOE Working Group relevance to the Dispatchability Model

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
Constraints	DOE	The working group agreed on the principle that DOEs can be initially allocated at the connection point to the network (regardless of the number or configuration of devices behind the connection point) as a first step in DOE roll out. Highlighting that DOEs are expected develop further as DER penetration increases and markets or business models are created to provide customers with value.	To inform the DOE integration alternatives for the different stages of the Dispatchability Model

Further information can be found in the following links:

- Dynamic Operating Envelopes Working Group Outcomes Report[21]
- ARENA - Dynamic Operating Envelopes Workstream[22]

A1.8 AEMO DER Program - Project MATCH

AEMO has established a dedicated DER program to understand and integrate high levels of DER into the NEM. It aims to ensure a smooth transition from a one-way energy supply chain – starting with large-scale generation units to consumers – to a decentralised, two-way energy system.

AEMO's DER program contains several workstreams, including the DER Operation workstream which examines how DER assets behave during power system disturbances and develops models to predict and manage DER performance in the future power system, together with ensuring adequate tools are in place to manage a high-DER world.

[20] ARENA Dynamic Operating Envelopes Workstream webpage. Available at https://arena.gov.au/knowledge-innovation/distributed-energy-integration-program/dynamic-operating-envelopes-workstream/

[21] DEIP, 2022. DOE Working Group Outcomes Report. Available at https://arena.gov.au/assets/2022/03/dynamic-operating-envelope-working-group-outcomes-report.pdf

[22] ARENA Dynamic Operating Envelopes Workstream webpage. Available at https://arena.gov.au/knowledge-innovation/distributed-energy-integration-program/dynamic-operating-envelopes-workstream/

Project MATCH is a project being developed under this workstream. Project MATCH aims to establish a robust monitoring and analysis toolbox to better understand the behaviour of DER and implications for power system security. It will investigate DER behaviour during power system disturbances and seeks to support secure power system operation under high penetrations of DER. The project is being led by UNSW in partnership with AEMO and Solar Analytics, supported by ARENA funding. The Project is scheduled to be completed in March 2024.

The proposed Scheduled Lite design is being informed by the findings of the ongoing work in AEMO DER Program, as outlined in Table 12.

Relevance to the Visibility Model and the Dispatchability Model

Table 12 AEMO DER Program – Project MATCH relevance to the Visibility Model and the Dispatchability Model

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
Registration	Standards	Findings highlight the relevance of conformance with the AS/NZS4777.2:2020 Standard, to enable required capabilities to support high level penetration of DER e.g. voltage ride-through capabilities	Informed relevant requirements that Traders will need to comply with, to participate/register in Scheduled Lite.

Further information can be found in the following links:

- AEMO - DER Program[23]
- ARENA - Project MATCH[24]
- UNSW - Project MATCH[25]

A1.9 Project Energy Demand and Generation Exchange (EDGE)

Overview

Project EDGE is a multi-year project to demonstrate an off-market, proof-of-concept DER Marketplace that efficiently operates DER to provide both wholesale and local network services within the constraints of the distribution network in a way that promotes the long-term interests of all customers. The project's primary intent is to identify NEM capabilities and to inform the development of a two-sided market that incentivises innovation and participation.

Project EDGE will demonstrate three key function sets that are vital to the efficient and scalable integration of DER, and that will ultimately deliver value to customers:

- DER wholesale energy market integration
- Scalable DER data exchange
- Local Service Exchange for network support services.

Project EDGE will test these functions and their interactions, in a DER Marketplace. The field trial is expected to finish in Q1 2023.

[23] AEMO NEM DER Program webpage. Available at https://aemo.com.au/initiatives/major-programs/nem-distributed-energy-resources-der-program

[24] ARENA Project MATCH webpage. Available at https://arena.gov.au/projects/project-match/

[25] UNSW Project MATCH webpage. Available at https://www.ceem.unsw.edu.au/project-match

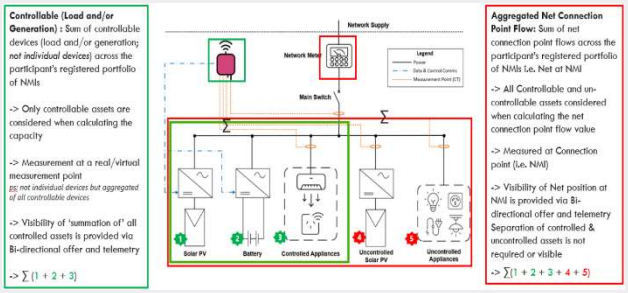
The evidence base generated by Project EDGE will continue to inform the design of Scheduled Lite through a range of elements as shown in Table 13 and Table 14 along with other ESB Post-2025 reform items.

Relevance to the Visibility Model

Table 13 Project EDGE relevance to the Visibility Model

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
Data types	Data Specification *Progressive 'step/horizon'*	Project EDGE has defined data requirements with the purpose to enable visibility of DER aggregator portfolios in a way that provides value to the participant and to market systems. Data requirements are in accordance with the progressive 'step/horizon' that the participant is part of. The steps/horizons informing the Visibility Model are: • Step 1: Visibility. the aggregator is providing operational visibility via a forecast of anticipated operation and instantaneous 1-minute measurement, and submission of aggregated DUID level telemetry of actual operation. Main features include: – Providing operational visibility to AEMO – No market participation – Dispatch target sent by AEMO – Aggregator is not required to act on or respond to the dispatch target • Step 2: Self Dispatch. Features: – Aggregator participates in the Market by being a price taker and self-nominating their dispatch target by offering quantity in the Energy Fixed Loading[26] field only. Main features include: ▪ Passive market participation ▪ Price taker and doesn't influence NEM clearing price ▪ Dispatch target sent by AEMO ▪ Aggregator is required to act on and respond to the dispatch target	Informs data requirements in a progressive framework
Data Exchange	Real time data	Project EDGE is trialling two quantity definitions: Net Connection Point Flow (Net NMI) – measured at the connection point (NMI-level) and aggregated across the aggregator's portfolio, including both controllable and uncontrollable generation and load. As such, Net NMI is unlikely to provide clear visibility of the portion of the load pertaining to controllable DER devices • Flex Only – measured at a common measurement point behind the meter – representing the aggregation of all controllable DER assets at a site – and aggregated across the aggregator's portfolio. Flex Only ignores uncontrollable customer load and generation at a site. Any DER asset that can be remotely and actively controlled – turned on, turned off, ramped–up or ramped-down is classified as a controllable asset. Project EDGE is trialling the collection of data as follows: • Granularity: All data to be provided on a 1-minute basis • Data coverage: The data is provided for the whole of the portfolio (i.e. in Project EDGE, the DUID represents the entire aggregator portfolio)	To inform the participation capability of different participation options, including standard connection point participation and separation of controllable resources

[26] Fixed unit output in kW. This is the fixed level of load or generation offered by the Aggregator into the market

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
		Project EDGE quantity definitions  *Source:* Project EDGE DUID telemetry overview.	
	DER Data Hub	Project EDGE is examining the potential benefits and costs of a scalable data exchange hub approach. Two approaches are being tested: • Centralised hub: all data is provided to, and stored in, a centralised hub which may be hosted within a single organisation's environment, into which parties integrate and can access required data, based on their role-based permissions and credentials • Decentralised data hub: represents shared digital infrastructure where multiple parties host nodes that facilitate the exchange of data, messages, and services. This mitigates the risk of a single point of failure, as the loss of one node would not disrupt the ability of the decentralised hub to continue to operate	Outcomes and learnings to inform what data communication methods are fit for purpose for aggregated DER

Relevance to the Dispatchability Model

Table 14 Project EDGE relevance to the Dispatchability Model

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
Data exchange	Data specification *Progressive 'step/horizon'*	The step/horizon informing the Dispatchability Model is 'Step 3: Scheduled', see Design Element 'Bid' in this Table.	To inform data requirements needed to participate in dispatch processes
	Telemetry/Definitions	Refer to Table 13 above	
	DER Data Hub	Refer to Table 13 above	
Bid/Dispatch	Definition of Quantity	As noted in Table 13, Project EDGE is aiming to trial the use of aggregated net connection point flow (Net NMI) and controllable only (Flex Only) quantity definitions. Net NMI bidding is being contrasted with Flex bidding in Project EDGE to gain insight into the risk and operability in the market for aggregators where their bid, dispatch and telemetry quantity is different to DOE quantity adopted by industry as the starting point principle for the roll out of DOEs (Net NMI connection point).	To provide evidence-based learnings on the value delivered from each approach to inform the design.
	Bi-directional Offer ('Boffer') *An Offer that includes both generation and load. May be referred to as "Boffer". May contain 20 price bands.*	Project EDGE is trialling the proposed dispatch functionality in the IESS High Level Design[27] (see Table 3), through the Boffer structure, particularly in Step 3: Scheduled. In this Step, the Aggregator submits Price/Quantity pairs to offer quantity (i.e. provide intent) to deliver wholesale energy services. Step 3: Scheduled main features include: • Active market participation • Price Setter Boffer.	To inform key bid structures/functionality parameters.

[27] AEMO, 2021. *IESS High Level Design*, section 3. Available at https://aemo.com.au/initiatives/submissions/integrating-energy-storage-systems-iess-into-the-nem

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
		• Data submitted is for 48 hours i.e. has data for all 576 5-minute intervals in the next 48 hours from time of submission • Dispatch target sent by AEMO and expectation on aggregator to meet dispatch target	
	Dispatch Instruction	Consistent with current NEM wholesale market arrangements, Project EDGE will provide dispatch instructions as follows: • Dispatch Instructions are generated and sent by AEMO to Aggregators every 5 minutes. – Aggregator on receipt of the Dispatch Instructions will send acknowledgement of successful receipt to AEMO • Dispatch Target is an absolute value • AEMO will send the dispatch instructions to DNSP for information only	To inform the design of the dispatch instruction process, including exploring potential data sharing collaboration.
Constraints	DOEs	In Project EDGE, DOEs will be considered by participants prior to submission of bids and offers. DOE purposes include: • to enforce distribution level constraints in market clearing • to self-constrain Aggregator Boffer DOEs are used in DOE Compliance by the DNSP after the fact.	To inform most effective way to integrate DOE and local network services into proposed Dispatch Model operation
	Local Network Services/ Local Services Exchange	Project EDGE is exploring how DNSPs could procure network support services from DER aggregators in a Local Services Exchange, where DNSPs post network service requirements and aggregators bid and respond via a Local Services Exchange (LSE).	
Operations	Roles and Responsibilities	Project EDGE is trialling a DER Marketplace, where roles and responsibilities are defined as follows[28]: • AEMO's role primarily relates to its statutory responsibilities in the National Electricity Rules (NER) to establish the spot market (NER 3.4), operate a central dispatch process (NER 3.8.1) and to determine and represent network constraints in dispatch (NER 3.8.10). As DNSPs are the experts in their distribution networks, AEMO must collaborate with DNSPs to gain confidence that wholesale dispatch will not lead to distribution network limits being breached. • DNSP (AusNet)'s transitioning to a Distribution System Operator (DSO) role, will dynamically optimise their network, calculate the network limits and communicate them as 'DOEs' to aggregators via the DER Marketplace. AusNet will also define local network services and engage aggregators to deliver them using the Local Service Exchange function. • Aggregators represent consumers in a DER Marketplace and delivery multiple services on their behalf, including wholesale services to AEMO and local network services to distribution networks. Aggregators are granted permission by consumers to use their DER and data to deliver services according to the consumer's preferences. Project EDGE anticipates testing the operation of the DER Marketplace with multiple aggregators.	To inform the identification of operational responsibilities of involved actors taking part in the Dispatchability Model
Compliance	Dispatch Conformance	Assessment of conformance and compliance to the dispatch target is completed within post-dispatch interval by AEMO. DUID Telemetry data is used for monitoring conformance with dispatch instructions or self-dispatch targets.	To inform conformance arrangements being considered in the Dispatchability Model.

Further information can be found in the following links:

[28] Project EDGE, 2022. *Project EDGE Research Plan*. Available at https://aemo.com.au/-/media/files/initiatives/der/2022/master-research-plan-edge.pdf?la=en

- AEMO- Project EDGE[29]
- ARENA- Project EDGE[30]

A1.10 Project Symphony

Overview

Project Symphony is an innovative project in Western Australia (WA) where consumer DER such as rooftop solar, batteries, and other major appliances, like air conditioning and pool pumps, will be orchestrated as a VPP to participate in a future energy market; unlocking greater economic and environmental benefits for customers and the wider community.

Project Symphony aims to provide key learnings to the development of the DER Orchestration Model in the WEM and nationally by:

- Demonstrating roles for AEMO, DSO and Aggregator.
- Building and piloting integration components between actors and simulated market systems, including demonstrating dispatch of DER.
- Demonstrating the capability of DER to participate in Wholesale Energy Market (WEM) markets (post WEM Reform), in parallel with providing network support services (NSS).
- Developing stakeholder understanding of expectations for DER orchestration.

The Project is being part-funded by ARENA and is a collaboration between Western Power, Synergy, AEMO and Energy Policy WA (EPWA); working together with residential and small business electricity customers located in the pilot area of Southern River. The Project is scheduled to be completed in June 2023.

Project Symphony will continue to inform the design of Scheduled Lite as it progresses, as outlined in Table 15.

Relevance with the Dispatchability Model

Table 15 Relevance to the Dispatchability Model

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
Registration	Registration	DER aggregated groups will register facilities, meaning that an Aggregator will be able to combine the capacity of DER into one or more facilities in order to provide market services. The Aggregator registers the facilities via the Market Platform. This involves entering the required device standing data, facility operation data and validation tests. Once these are complete, the facility is registered by AEMO and is ready for market operations. Features, include: • 1 NMI will be part of only 1 registered facility • A Facility exists to deliver one or more types of market services	To support identification of relevant requirements for Traders wishing to participate in the Dispatchability Model.
Data Exchange	DER Data Hub	Project Symphony is trialling the same data exchange platform as Project EDGE, refer to section A1.9.	See section A1.9

[29] AEMO Project EDGE webpage. Available at https://aemo.com.au/en/initiatives/major-programs/nem-distributed-energy-resources-der-program/der-demonstrations/project-edge

[30] ARENA Project EDGE webpage. Available at https://arena.gov.au/projects/project-edge-energy-demand-and-generation-exchange/

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
	Telemetry requirements	Aggregator provides data with 4s resolution	To support identification of relevant data requirements to enable participation in dispatch processes.
	Data requirements	Features of data requirements, include: • Aggregator will determine the current operating capacity of each registered DER facility on a high frequency basis – Calculation of the available flexible energy capacity for a facility, incorporating DOE constraints for all NMIs within the facility and the DER asset operating or opt-out constraints • The Aggregator will monitor multiple aspects of the DER facilities, sites and DER assets during and outside of control events including: – Asset performance metrics – Asset availability data – Aggregated site performance metrics – Aggregated facility performance metrics • The Aggregator will provide – View of current state of DER assets – availability and performance – Provision of behind-the-meter demand and generation forecasts – Provision of generation, load and flexible energy capacity forecasts – Provision of optimised control event schedule for each enrolled DER asset that will ensure fulfilment of market bids	
Bid/Dispatch	Structure *Boffer*	Project Symphony is using the concept of Energy bi-directional offers from the Real Time Market. The bi-directional offers can be up to 10 bands with Load and Generation	To inform desirable dispatch functionality where non-scheduled resources are actively participating.
	Dispatch *Submitting bids and offers in a bi-directional energy market*	As the Aggregator, Synergy will submit bids and offers into the Real Time Market for energy services that take into account available capacity of DER facilities and market pricing. Bids and offers will be cleared by the Distribution Market Operator (DMO) (see Design Element 'Operation,' in this Table) and the Aggregator will be dispatched for the energy clearance shortly thereafter following requirements for a Scheduled Facility.	
Constraints	DOE	DSO (see Design Element 'Operation,' in this Table) will dynamically calculate, allocate and publish operating envelopes for the Aggregator to use in DER optimisation. The DSO will monitor compliance with published operating envelopes.	To inform integration considerations of constrains emerging in the distribution network, when participating in central dispatch.
	Network services	Project Symphony will trial different platforms and market simulation environments, including: • NSS, a contracted service provided by a market participant to the network operator/DSO (Western Power) to help manage localised network constraints. – The DSO and Aggregator will enter bi-lateral agreement(s) for NSS. – AEMO will have visibility of the contracted operational requirements and provide the pre-dispatch instruction to the Aggregator on receiving the operation request from the DSO.	
Operations	Roles and Responsibilities	Project Symphony will pilot a model for delivering a two-way power grid that supports better integration of DER. The model defines three key roles: • DMO: defined as a market operator that is equipped to operate a market that includes small-scale devices aggregated and is able to be dispatched at appropriate scale – Organise and operate the market and assess all bids and offers and optimises the dispatch of energy resources in consideration of transmission network and distribution network constraints. • Aggregator: defined as parties which facilitate the grouping of DER to act as a single entity when engaging in power system markets (both wholesale and retail) or selling services to the system operator(s). • DSO: enables the optimal use of DER within distribution networks to deliver security, sustainability, and affordability in the support of whole system optimisation.	To provide guidance on operational responsibilities to enable Dispatchability Model functionality

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
Incentives	Market Participation	Project Symphony will trial different platforms and market simulation environments, including: • Wholesale energy services, a market for bulk energy that is cleared by AEMO's dispatch engine to determine the least-cost allocation of generation and load to meet system demand. • Constrain to zero, a pre-emergency service provided by a VPP to the market operator to constrain energy output from DER to zero export (net) or zero output (gross). • Contingency raise Essential System Services (ESS), a market-provided response to a locally detected frequency deviation to help restore (raise) frequency to an acceptable level in the case of a 'contingency event' such as the sudden loss of a large generator or sudden surge in load. Two secondary use case scenarios will be developed and tested subject to limitations, these being: • Contingency lower ESS, a market-provided response to a locally detected frequency deviation to help restore (lower) frequency to an acceptable level in the case of a 'contingency event' such as a sudden surge in supply or a sudden drop in demand. • Regulation raise ESS and regulation lower ESS, a market-provided response to automatic generation control signals to correct small deviations in frequency during a dispatch interval.	To inform how to unlock value to a Trader wishing to take participate in the Dispatchability Model

Further information can be found in the following links:

- ARENA - Western Australia Distributed Energy Resources Orchestration Pilot[31]
- AEMO – Project Symphony[32]

A1.11 Review of Power System Data Communications Standard (PSDCS)

Overview

The Power System Data Communications Standard for the NEM sets out the standards with which Data Communication Providers (DCPs) must comply when transmitting power system data to and from AEMO control centres.

The PSDCS is currently undergoing a review to identify the changes required to make the standard fit for purpose, by addressing issues that were identified through engagement during October and November 2021 with internal and external stakeholders.

The Scheduled Lite design needs to consider the outcomes from the Power and Data Communications Standard review, as outlined in Table 16.

[31] ARENA Western Australia DER Orchestration Pilot webpage. Available at https://arena.gov.au/projects/western-australia-distributed-energy-resources-orchestration-pilot/

[32] AEMO Project Symphony webpage. Available at https://aemo.com.au/initiatives/major-programs/wa-der-program/project-symphony

Relevance to the Visibility Model and the Dispatchability Model

Table 16 Review of PSDCS relevance to the Visibility Model and the Dispatchability Model

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
Data Exchange	Relevant requirements	Outcomes from the current PSDCS review will define relevant requirements for transmitting power system data to and from AEMO	Schedule Lite Traders will need to comply with the PSDCS

Further information can be found in the following links:

- AEMO - Review of Power System Data Communication Standard[33]

A1.12 SCADA Lite

Overview

SCADA Lite is part of the NEM 2025 roadmap and has been identified as a foundational initiative. SCADA Lite aims to reduce entry barriers for smaller generators and demand side resources to provide greater visibility to AEMO and to participate in the market with SCADA that is fit for purpose for distribution connected resources.

The scope of SCADA Lite is under development. It aims to enable capabilities for providing a service that aggregators or distribution network connected generators/loads can utilise if they cannot access the service through their network. This work is part of an operational data exchange strategy that includes cost, resilience and technology considerations for the changing system with a higher volume of active DER.

Relevance to the Dispatchability Model

Table 17 SCADA Lite relevance to the Dispatchability Model

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
Data Exchange	SCADA for DER	SCADA Lite will provide a mechanism for participants such as VPPs, to exchange operational data with AEMO and provide visibility of their DER device activities	Dispatchability Units may be able to use SCADA Lite to communicate telemetry data

Further information can be found in the following links:

- NEM2025 Implementation Roadmap – Initiative Briefs, section 6.4[34]

A1.13 Industry Data Exchange (IDX)

Overview

IDX is providing the framework for data exchange across industry. IDX is intended to establish unified access to AEMO services across all markets, using modern authentication and communication protocols, facilitating a

[33] AEMO, 2022. Review of the Power System Data Communication Standard. Available at https://aemo.com.au/consultations/current-and-closed-consultations/review-of-power-system-data-communication-standard

[34] AEMO, 2022. NEM2025 Implementation Roadmap – Initiative briefs. Available at https://aemo.com.au/consultations/current-and-closed-consultations/review-of-power-system-data-communication-standard

cohesive approach to industry data exchange. Table 18 outlines its relevance to the proposed Scheduled Lite design.

Relevance to the Visibility Model and the Dispatchability Model

Table 18 IDX relevance to the Visibility Model and the Dispatchability Model

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
Data Exchange	Data Exchange Framework	The standards, protocols and architecture delivered by IDX will enable the data exchange elements of all NEM2025 reforms. All reforms – particularly those introducing new markets and new cohorts of Participants, will use the new IDAM and IDX frameworks.	Scheduled Lite Traders will need to comply/follow the framework defined by IDX

Further information can be found in the following links:

- NEM2025 Implementation Roadmap – Initiative Briefs, section 5.4[35]

A1.14 Dispatch Notification (DNx) by Transpower (NZ TSO)

Overview

The Dispatch Notification (DNx) Project is part of a broader project called the Real Time Pricing (RTP) project, which aims to enhance the spot market to improve retail competition and make spot prices more efficient in the New Zealand context.

DNx's purpose is to enable smaller-scale purchasers and generators to participate in dispatch and the price setting process, as part of implementing RTP. The New Zealand Electricity Authority considers that encouraging greater participation would strengthen the net benefits that are expected from the delivery of RTP. To do this, it is being proposed to introduce a new form of dispatchable demand for smaller purchasers, coupled with a new form of dispatch for smaller generators.

Scheduled Lite design considers best practices from related projects in an international context; Table 19 outlines considerations related to DNx.

Relevance to the Dispatchability Model

Table 19 DNx Project relevance to the Dispatchability Model

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
Opt – in arrangement Dispatchability Model	Dispatch Notification (DNx) — System and Market Operation Considerations	Features of the Dispatch Notification project, include: • No requirement to provide indications and measurements (SCADA) – Real time compliance is assumed – Compliance assessed on a monthly review basis • Bidding and Offering – Able to bid/offer "non-dispatchable"	Informed potential parameters to enable the opt-in arrangement being proposed in the Scheduled Lite Design.

[35] AEMO, 2022. NEM2025 Implementation Roadmap – Initiative briefs. Available at https://aemo.com.au/consultations/current-and-closed-consultations/review-of-power-system-data-communication-standard

Design Element	Relevance to the Design Element		
	Area/Item	**Description**	**Relevance**
		– Dispatch notifications via web services over internet – Participant has the ability to reject a dispatch notification under certain circumstances - i.e. physical or technical issues • Instructions/Directions – DNx not eligible for constrained off/on payments	

Further information can be found in the following links:

- Electricity Authority - Real time pricing industry engagement sessions[36]

Glossary

The following is a list of abbreviations used in this document.

Term	Definition
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
API	Application Programming Interface
ARENA	Australian Renewable Energy Agency
AWEFS	Australian Wind Energy Forecasting System
ASEFS	Australian Solar Energy Forecasting System
DCP	Data Communication Providers
DEIP	Distributed Energy Integration Program
DER	Distributed Energy Resources
DMO	Distribution Market Operator
DNSP	Distribution Network Service Provider
DNx	Dispatch Notification Project
DOE	Dynamic Operating Envelope
DPV	Distributed PV
DRSP	Demand Response Service Provider
DSO	Distribution System Operator

[36] NZ Electricity Authority. Real time pricing industry engagement sessions. Available at https://www.ea.govt.nz/development/work-programme/pricing-cost-allocation/spot-market-settlement-on-real-time-pricing/events/real-time-pricing-industry-engagement-sessions/

Term	Definition
DUID	Dispatch Unit Identifier
EDGE	Energy Demand and Generation Exchange
EPWA	Energy Policy Western Australia
ESB	Energy Security Board
ESS	Essential System Services
FCAS	Frequency Control Ancillary Service
FRMP	Financially responsible Market Participant
FTM1	Flexible Trader Model 1
FTM2	Flexible Trader Model 2
IDAM	Identity and Access Management
IDX	Industry Data Exchange
IESS	Integrating Energy Storage Systems
IRP	Integrated Resource Provider
MASP	Market Ancillary Service Provider
MASS	Market Ancillary Service Specification
MRC	Maximum Responsive Component
NEM	National Electricity Market
NER	National Electricity Rules
NMI	National Metering Identifier
NSP	Network Service Provider
NSS	Network support services
OFGS	Over-frequency generation shedding
PASA	Projected Assessment of System Adequacy
PMA	Private Metering Arrangement
PMS	Portfolio Management System
PSDCS	Power System Data Communications Standard
RTP	Real Time Pricing
SCADA	Supervisory Control and Data Acquisition
SGA	Small Generation Aggregator
SRAS	System Restart Ancillary Service

Term	Definition
UFLS	Under-frequency load shedding
UIGF	Unconstrained Intermittent Generation Forecast
VPP	Virtual Power Plant
WA	Western Australia
WDR	Wholesale Demand Response
WDRU	Wholesale Demand Response Unit
WEM	Wholesale Electricity Market