Project EDGE

High Level Design

Local Service Exchange (LSE)

Version Final

June 2023

This report has been developed with the support of:

Important notice

PURPOSE

This document describes the high-level design and requirements for Local Service Exchange (LSE). Project EDGE designed and developed LSE for testing viability of DER based distribution network support services or local services. This publication has been prepared by AEMO using information available on 1 June 2023. Information made available after this date may have been included in this publication where practical.

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VERSION CONTROL

Version	Release date	Changes
0.1	17/12/2021	Summary classification of Local Services
Final	30/06/2023	Updated Executive Summary and LSE Overview

Contents

1 Executive summary

From inception, trialling the use of orchestrated Distributed Energy Resource (DER) for the provision of localised distribution network support has been one of the central objectives of Project EDGE. 'Value stacking' by using the same fleet of DER to deliver both wholesale market energy services and network support services at a local (distribution) level was seen as a particularly valuable opportunity for aggregators to earn value for their customers who have invested in DER.

The EDGE trial sought to answer several questions in relation to the use of a Local Services Exchange (LSE) interface to enable scaled trade of DER-based local network support services between aggregators and Distribution Network Service Providers (DNSPs), including:

1. Is it possible to define network support services in a standardised manner such that the service definition is consistent and reliable for procuring and delivering local services?
2. Can the DNSP assess the need for and procure the defined services from aggregators?
3. Are aggregators able to enable the delivery of local services from their fleet while simultaneously managing the capacity being offered into the wholesale market?
4. Is it possible to accurately monitor and validate the delivery of local services, considering such challenges as baselining and telemetry.

The design details contained in this document remains a work in progress and only seek to convey the development of the work as trialled in EDGE. A full-scale implementation of an LSE market would likely require changes and augmentation of some aspects of this design. As such this document is meant to provide insights into how the EDGE LSE trial designed and developed the functionality.

EDGE tested a total of 3 services in the field trial – Demand High Firmness (DHF), Demand Low Firmness (DLF) and Voltage High Firmness (VHF). The EDGE LSE was designed and developed specifically to test and facilitate the local support services between the DNSP and Aggregators.

For the purpose of the trial, procurement, delivery and validation of Demand services was coordinated through the EDGE DER data exchange hub whereas the Voltage Services (VHF) were trialled via direct communications between the DNSP and Aggregator, due to their limited field testing, accordingly this document provides only a brief overview of how Voltage Services were tested in the EDGE.

For DHF and DLF this document provides the overview of the LSE service lifecycle, provides overview and requirements for defining a service, enrolment, and bidding for a service, delivering a service and finally verifying and reporting on the service delivered and conformance to service needs.

A project hypothesis is that an operationalised arrangement all LSE based network support services (Demand and Voltage) would be more efficient if its data transactions were facilitated via a common data exchange hub.

2 LSE Overview

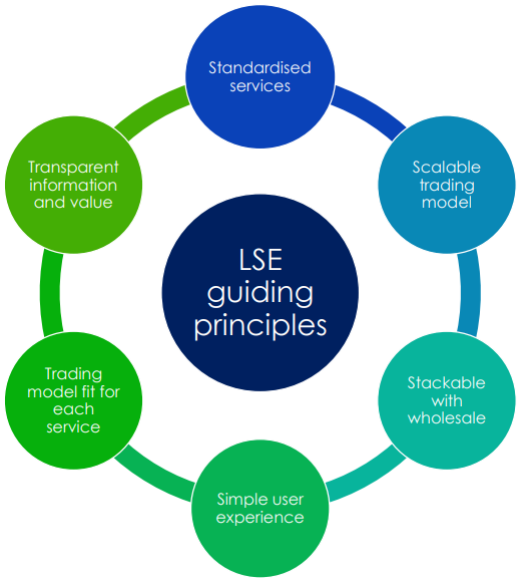
EDGE Local Services Exchange (LSE) framework will facilitate and trial visible, scalable and competitive trade of local network services that enable Distribution Network Service Providers (DNSPs) to manage network power security and reliability using distributed connected DER and in turn allow DER Aggregators to stack local network services and wholesale service value streams efficiently. This is intended to complement the existing DNSP reliance on network and non-network-based services and offer additional economic options for DNSPs

2.1 Local Services Guiding Principles

Project EDGE adopted the following guiding principles in designing the local network support services and LSE to maximise DER utilisation and generating value for both consumers and the grid.

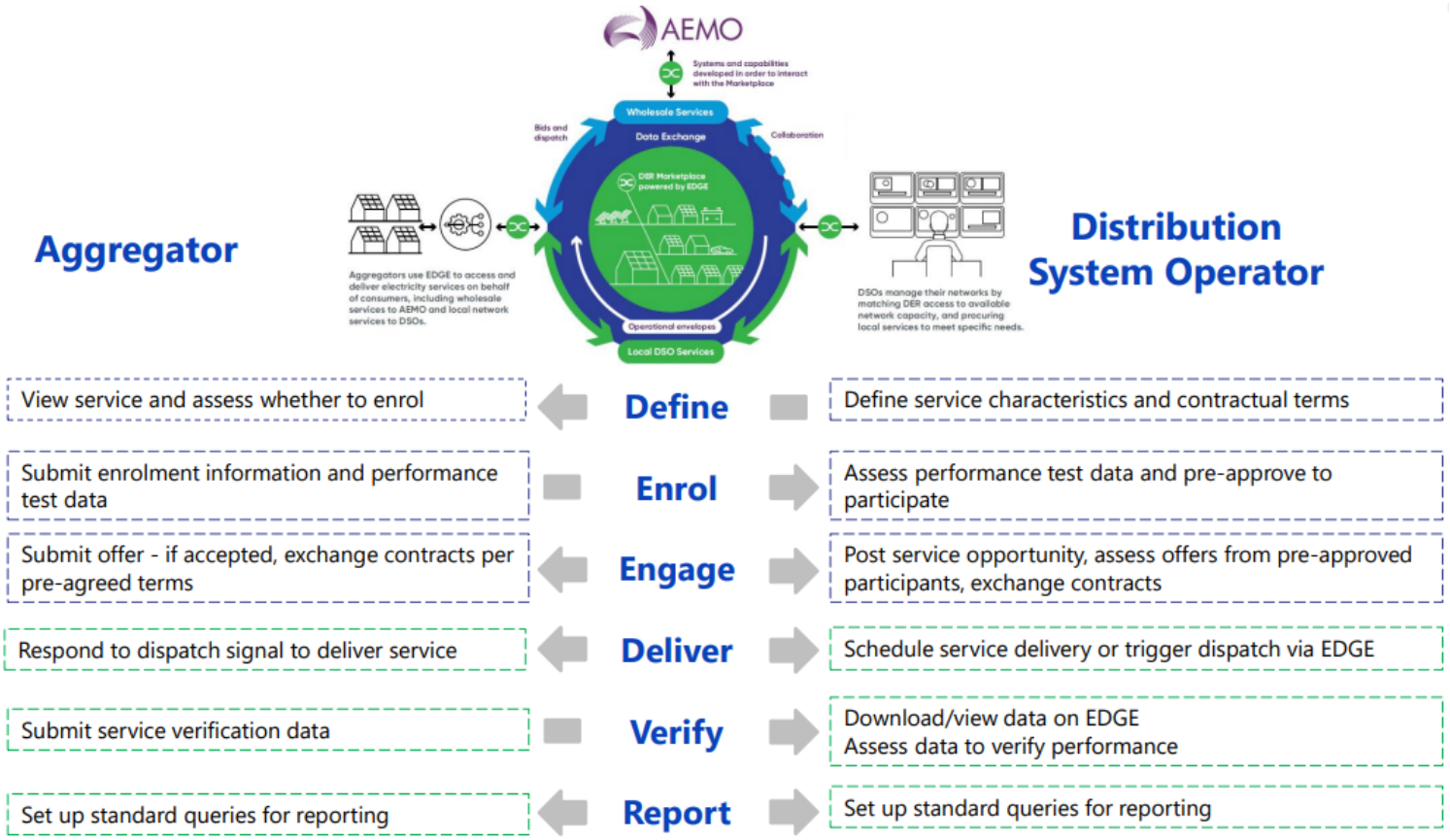
These guiding principles allowed Project EDGE to design and develop:

- standard local network support services that can be replicated across DNSP service area,
- local network support services and LSE that can be scaled up to cater greater DER penetration,
- potential to co-optimise and value stack with wholesale energy services
- make it easy for Aggregators and DNSP to interact with LSE.
- ability to facilitate long term and short-term service provision, customised trading model for each service
- capture data for verification, compliance and reporting needs



2.1 Local Service Exchange Roles and Process

The following image shows the interactions between the Aggregator and Distribution System Operator (ie., DNSP). And shows the various stages of local service life cycle starting with defining local network services to verification of delivery of services and reporting on the trade.



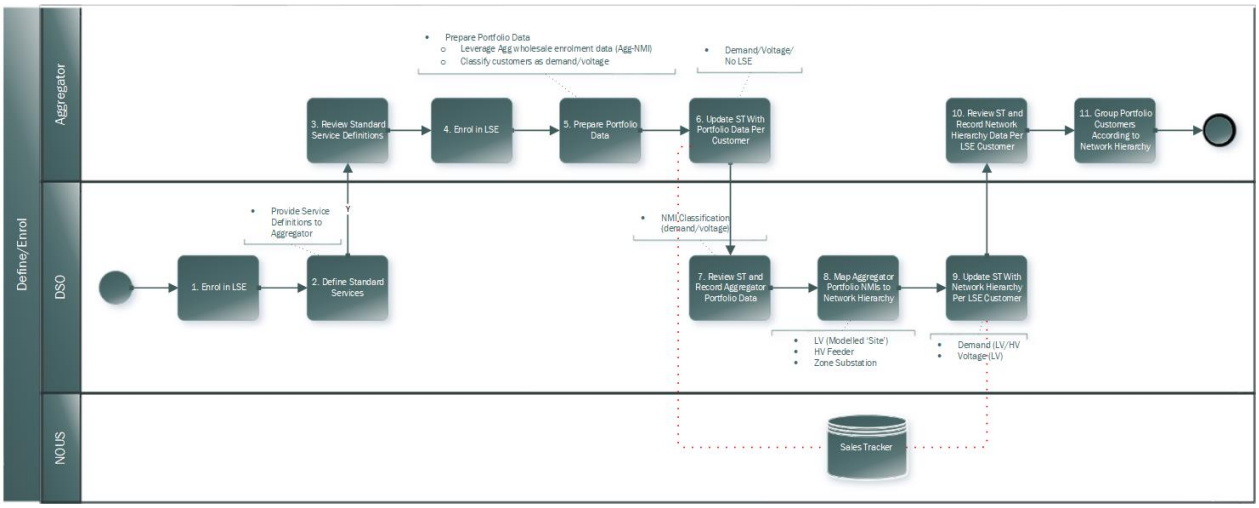
Please refer to LSE Overview and Local Network Service Definition for additional details

3 Demand Services

3.1 Define/Enrol

3.1.1 Process

- Enrolling the Aggregator in LSE and defining the standard local services that aggregator can deliver



3.1.2 Requirements

PROCESS STEP	REQUIREMENT (USER STORY)
Enrol in LSE	As a DSO, I want to enrol in the Local Service Exchange, so that I can trade local services with Aggregators
Define standard services	As a DSO, I want to define a standard service* for LSE, so that Aggregators are clear on LSE service characteristics and obligations *Note: This standard service definition should be viewable by Aggregators at time of LSE enrolment
Review standard service definitions	As an aggregator I want to review the service definitions, so I am clear on LSE service characteristics and obligations.
Enrol in LSE	As an aggregator I want to be able to enrol NMIs in LSE services so that I may later incorporate them into LSE contracts
Prepare portfolio data	As an aggregator I want to prepare portfolio data so that they can be organised into LSE services
Update ST with portfolio data per customer	As an aggregator I want to update ST with portfolio data per customer so that I can share it with the DSO and form appropriate contracts

PROCESS STEP	REQUIREMENT (USER STORY)
Review ST and record Aggregator portfolio data	As a DSO, I want to be able to review ST and record NMIs provided by an Aggregator as participating in LSE Demand or Voltage Services, so that this information can be used to determine which customers can be included in a given posted service need
Map Aggregator portfolio NMIs to network hierarchy	As a DSO, I want to be able to map portfolio NMIs provided by an Aggregator as participating in LSE demand or voltage service to the EDGE network hierarchy, so that this information can be used to determine which customers can be included in a given posted service need
Update ST with network hierarchy per LSE customer	As a DSO, I want to be able to update ST with Network Hierarchy per customer, so that I have a common understanding with the Aggregator of DER 'fleets' (i.e. Site/NMI relationships)

3.1.3 Business Rules

The following business rules apply:

a. Service definitions must be developed and published before LSE services can be used

b. Aggregators must enrol NMIs before they can be used in LSE services, but enrolling a NMI does not oblige the aggregator or the DSO to use them in an LSE service

c. No financial numbers are agreed at the time of enrolment – contracting occurs at a later stage

d. The NMI network hierarchy determines which areas are usable for LSE services – by publishing the hierarchy to an aggregator the DSO provides essential data for contract agreement

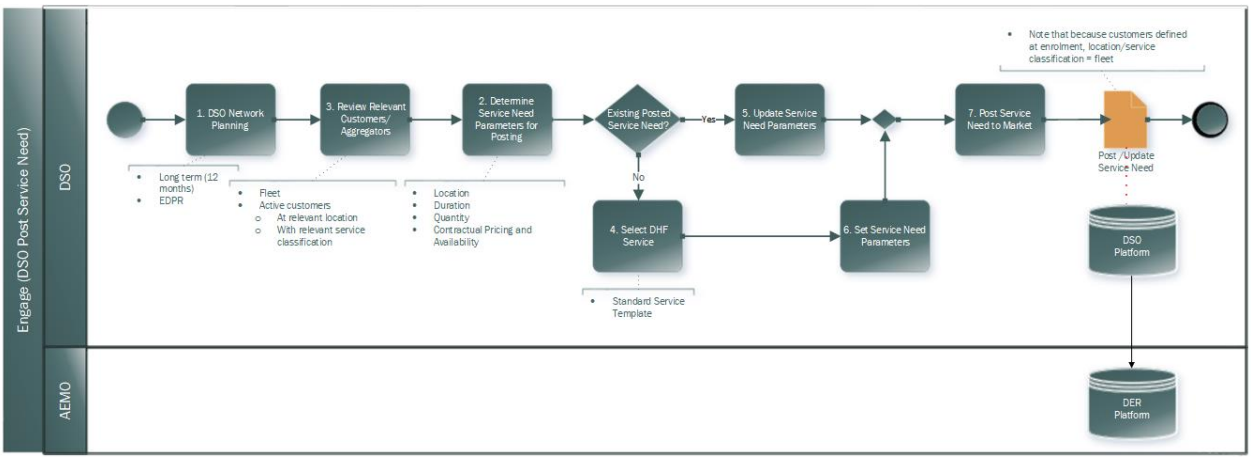
e. The Sales Tracker is the primary document for the sharing of LSE enrolment data

4 Demand High Firmness

4.1 Service Need

4.1.1 Process

- Identifying and posting a Service Need is the second (2) stage of the LSE process, after participants (customers) have been enrolled



4.1.2 Requirements

PROCESS STEP	REQUIREMENT (USER STORY)
DSO network planning	As a DSO, I want to undertake detailed level network planning for DHF, long term network planning/forecasting (e.g. multiyear), so that we can identify an opportunity to defer network augmentation in favour of a non-network solution
Determine relevant customers/aggregators	As a DSO, I want to review the relevant customers that can be used by an Aggregator for a given DHF service need*, so that I can post a service need to the market for Aggregators to respond to *Note that: The DSO and Aggregator develop a shared understanding at time of enrolment with respect to the customers at a given network location that an Aggregator can control to deliver a DHF service. The DHF posted service need specifics will be derived offline through collaboration between parties.
Determine service need parameters for posting	As a DSO, I want to determine the service need parameters for posting, so that I can post a service need to the market for DRSP (Aggregators) to respond to
Select DHF service	As a DSO (Network Planning Specialist), I want to select the DHF standard service, so that the parameters can be set for the posted service need
Set service need parameters	As a DSO (Network Planning Specialist), I want to create and save a new service need, so that I can submit a service need to the market for Aggregators to respond to

Update service need parameters	As a DSO (Network Planning Specialist), I want to update and save the parameters for an existing service need, so that I can resubmit a service need to the market for Aggregators to respond to
Post service need to market	As a DSO (Network Planning Specialist), I want to post a service need to market, so that Aggregator/s can review and respond to the posted service need with market offers

4.1.3 Business Rules

The baseline (kW) issued for the service need will be a function of season, type of day and time of day, as follows:

a. Contract start/end date
   - DHF service needs will be issued on a seasonal basis (reflected by the contract start and end dates)
   - Baseline (kW) will be based in part on season

b. Day type
   - DHF service needs will be issued for a selected day type
   - Baseline (kW) will be based in part on day type as weekday or weekend/public holiday

c. Availability start/end time

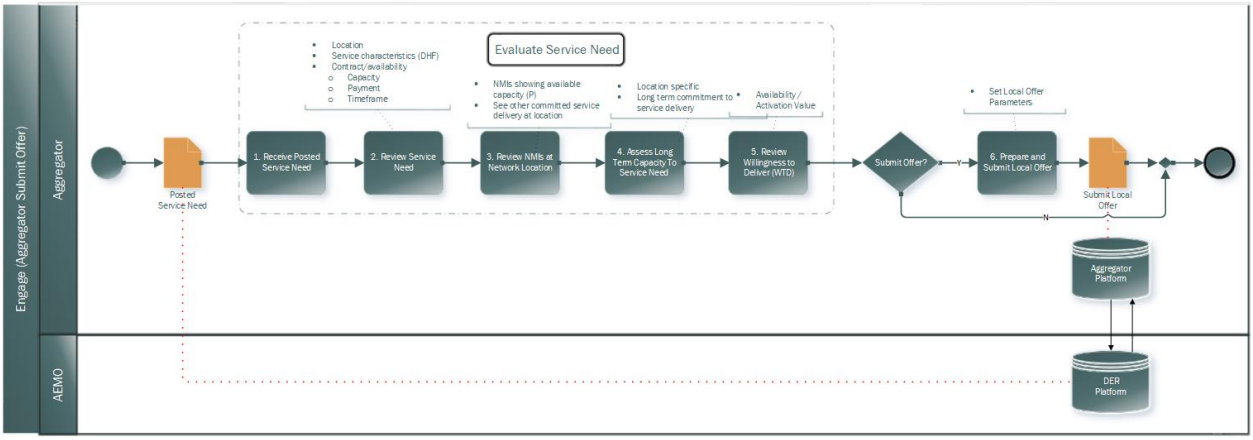
d. DHF service needs will be issued for a selected availability start and end (applicable for each day within the contract period)
   - Aggregators will be expected to be available for delivery on an 'event' day from the availability start time to end time
   - Baseline (kW) will be based in part on time of day as indicated by availability start and end (e.g. 6-9pm for an evening peak demand 'shaving' service)

e. Baseline calculation formula
   - The baseline calculation approach will be agreed between Aggregator and DSO
   - Changes to fleet composition during the contract require recalculation of the baseline
     i. If more LSE-registered devices come on board, the baseline is likely to be higher.
     ii. The Baseline stated in the contract is a starting point

4.2 Offer

4.2.1 Process

- Creating and submitting an Offer is the third (3) stage of the LSE process, in response to a Service Need



4.2.2 Requirements

PROCESS STEP	REQUIREMENT (USER STORY)
Receive posted service need	As an Aggregator, I want to receive a posted service need, so that I can review the service need
Review service need	As an Aggregator, I want to review a posted service need contract*, so that I can evaluate whether I want to respond to the service need *Note, this includes review of the following offline: • Location • Capacity to service the need • Contract length/pricing for DHF
Review NMIs at network location	As an Aggregator, I want to view all NMI's and available capacity at the desired network location*, so that I can view available capacity to be able to fulfil the post service need and be able to view other committed service deliveries at that location *Note: The network will communicate at enrolment the network locations that form the 'fleets' of customers that can service the need
Assess long term capacity to service need	As an Aggregator, I want to assess the long-term capacity to fulfil the service need*, so that I can decide whether to have a long-term commitment to service delivery at specific location/s *Note: This will again be assessed with respect to the 'fleets' determined at time of enrolment
Review willingness to deliver	As an Aggregator, I want to review the willingness to deliver (WTD) (i.e. assess the value of the long term commitment for a particular service delivery), so that I can determine whether to submit an offer in response to a service need
Prepare and submit local offer	As an Aggregator, I want to be able to set the parameters for an offer in response to a service need, so that I can submit the offer to the DSO
Prepare and submit local offer	As an Aggregator, I want to submit a response to a DSO DHF service request (i.e. local offer), so that this request can be reviewed and assessed by the DSO

4.2.3 Business Rules

When offering against a DHF service, Aggregators contractually agree to:

a. A contract payment

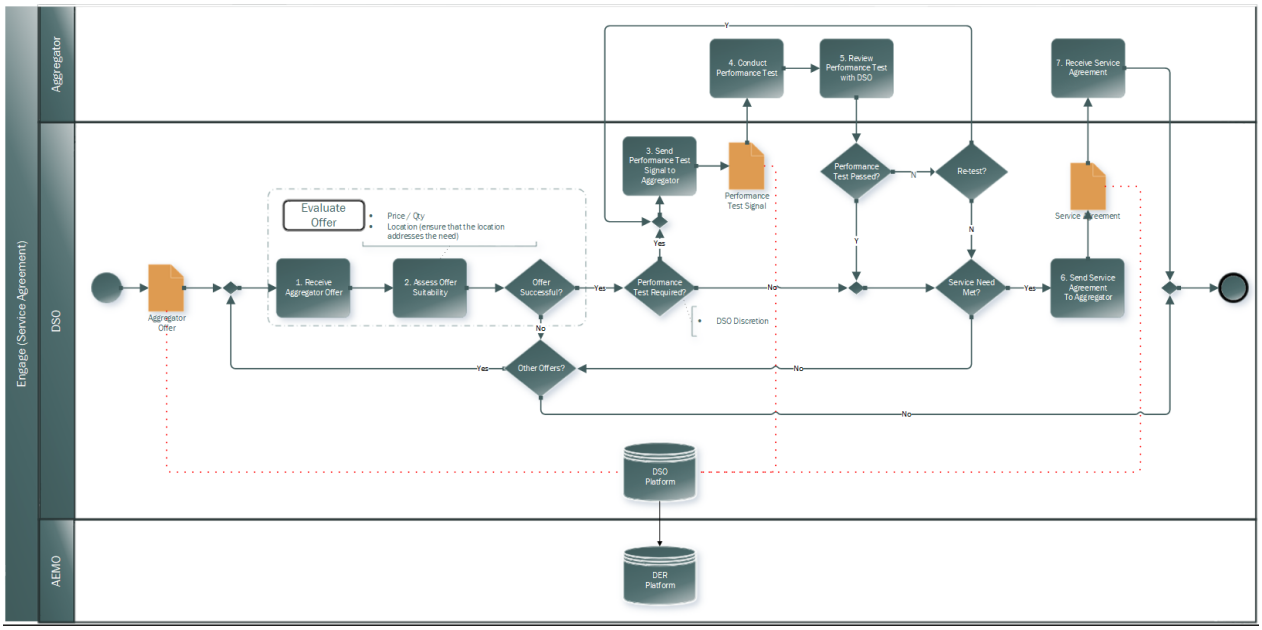
b. A contract quantity cap (DSO cannot request more than this amount of energy over a seasonal period)

c. A dispatch quantity cap (DSO cannot request more than this amount during a given availability period)

4.3 Service Agreement

4.3.1 Process

- Generating a Service Agreement is the fourth (4) stage of the LSE process, in response to an Offer



4.3.2 Requirements

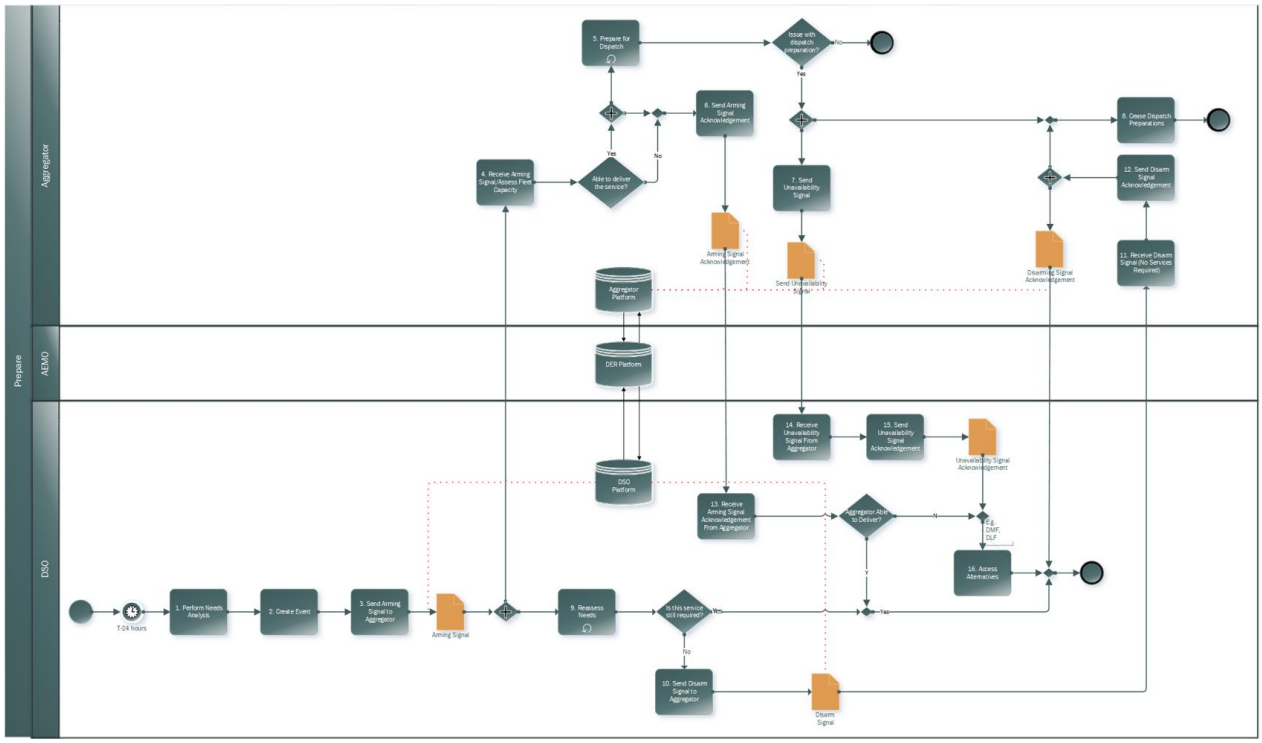
PROCESS STEP	REQUIREMENT (USER STORY)
Receive Aggregator offer	As a DSO, I want to receive and record an Aggregator offer sent in response to a posted DHF service need, so that I can proceed to assess which offer is most suitable for service delivery for DHF
Assess offer suitability	As a DSO, I want to assess an offer from an Aggregator by price, quantity and location* (i.e. customer location on circuit), so that I can select the most suitable offer(s) (i.e. cheapest offer that addresses the service need) *Note that customer location on circuit needs to be considered to assess the voltage impacts of service delivery
Send performance test signal to Aggregator	As a DSO, I want to send a performance test signal* to an Aggregator, so that the Aggregator can demonstrate their fleet capability *Note: This will likely be similar to an operational dispatch signal (i.e. 'Notice' signal)
Conduct performance test	As an Aggregator, I want to conduct a performance test according to the performance test signal that the DSO has provided, so that I can show that I can deliver a service to DSO requirements
Review performance test with DSO	As an Aggregator, I want to review the performance test results* with the DSO, so that the DSO can see my fleet capability *Note that: The process may need to be changed so that this is a DSO activity
Send Service Agreement to Aggregator	As a DSO, I want to send a Service Agreement to an Aggregator, so that I have an agreement with the Aggregator for LSE DHF service delivery

PROCESS STEP	REQUIREMENT (USER STORY)
Receive Service Agreement	As an Aggregator, I want to receive a service agreement from a DSO, so that I know that my offer to the DNSP has been successful

4.4 Arming / Disarming Signal

4.4.1 Process

- Triggering an Arming/Disarming signal is the fifth (5) stage of the LSE DHF process, after a Service Agreement has been established, also referred to as the 'Prepare' stage



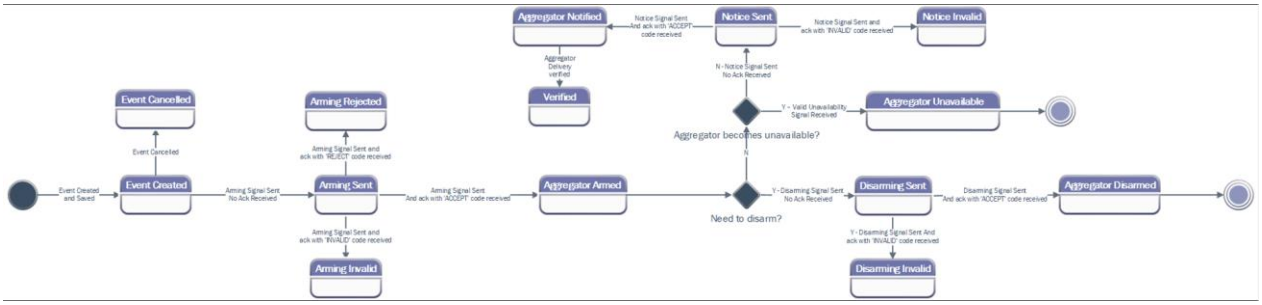
4.4.2 Requirements

PROCESS STEP	REQUIREMENT (USER STORY)
Perform Needs Analysis	As a DSO, I want to be able to perform needs analysis, so that I can determine when there is a need to call on Aggregators for service delivery
Perform Needs Analysis	As a DSO, I want to be able to access existing needs analyses*, so that I can determine when there is a need to call on call on Aggregators for service delivery
Create event	As a DSO, I want to create an event*, so that I can track and monitor Aggregator delivery against that event *Note that: • An event is intended to accommodate multi-Aggregator delivery • See state machine diagram below for the different event statuses, noting that events should be searchable by status
Send arming signal to Aggregator	As a DSO, I want to send an arming signal* for a DHF event to an Aggregator, so that the Aggregator can prepare for dispatch for the DHF event *Note that: • The arming signal baseline will be fixed

PROCESS STEP	REQUIREMENT (USER STORY)
	• The arming signal quantity is based on a short-term forecast at a given point-in-time and may change as the delivery timeframe gets closer
Receive arming signal/assess fleet capacity	As an Aggregator, I want to receive an arming signal from a DSO, so that I can assess my capacity to deliver against the arming signal for the time period requested
Receive arming signal/assess fleet capacity	As an Aggregator, I want to assess my capacity to deliver against an arming signal, so that identify/communicate any issues with delivery or prepare for dispatch
Prepare for dispatch	As an Aggregator, I want to prepare for dispatch*, so that my fleet is ready to deliver against an agreed target for an agreed timeframe Note: This activity is expected to involve a continual monitoring of fleet capability such that any issues with service delivery are surfaced and communicated asap
Send arming signal acknowledgement	As an Aggregator, I want to send an arming signal acknowledgement* to a DSO, so that I can notify the DSO regarding acceptance or rejection of the arming signal Note, the arming signal acknowledgement is: • Separate to the 'unavailability signal' • A means for an Aggregator to indicate asap to a DSO that an arming is accepted or rejected • Full or none, i.e. for the trial the simplifying assumption is that an Aggregator is either fully available or not at all
Send unavailability signal	As an Aggregator, I want to send an unavailability signal* for a DHF event, so that the DSO can assess alternative options for service delivery *Note: • Unlike the arming signal acknowledgement, the unavailability signal is Aggregator initiated • As indicated above at 'prepare for dispatch' the expectation is that the Aggregator monitors fleet capability and communicates unavailability at any time between arming and notice signals
Cease dispatch preparations	As an Aggregator, I want to be able to cease all preparation* activities for dispatch for DHF, so that I can make the capacity available for other LSE services *Note: • This may happen as a result of a disarm signal from the DSO • This may happen because there is an issue with dispatch preparation (scenarios to be unpacked)
Reassess needs	As a DSO, I want to reassess the need for service delivery for a DHF event, so that I can determine if I need to disarm Aggregators
Send disarm signal to aggregator	As a DSO, I want to send a disarm signal to an Aggregator, so that I can notify the Aggregator that they are no longer required to deliver a service
Receive disarm signal (no services required)	As an Aggregator, I want to receive the disarm signal from the DSO, so that we can proceed to cease all preparations for dispatch for DHF
Send disarm signal acknowledgement	As an Aggregator, I want to send a disarm signal acknowledgement to the DSO, so that we can proceed to cease all preparations for dispatch for DHF
Receive arming signal acknowledgement from Aggregator	As a DSO, I want to receive an arming signal acknowledgement* from an Aggregator, so that I can look at service delivery alternatives if the Aggregator rejects the arming signal

PROCESS STEP	REQUIREMENT (USER STORY)
	*Note that: • The arming signal acknowledgement will either contain validation error codes or acknowledgement codes • The acknowledgement codes are 'ACCEPT' or 'REJECT'
Receive unavailability signal from Aggregator	As a DSO, I want to receive an unavailability signal* from an Aggregator, so that I can look at service delivery alternatives if the Aggregator is unable to deliver the service
Send unavailability signal acknowledgement	As a DSO, I want to send an unavailability signal acknowledgement* to an Aggregator, so that I can confirm the receipt of the unavailability signal
Access alternatives	As a DSO, I want to be able to access alternatives (e.g. Demand Low Firmness service) to Aggregator service delivery, so that I can find an alternative when an Aggregator is unable to deliver

4.4.3 Event Statuses



EVENT STATUS	DESCRIPTION
Event created	Event has been created but no signals have yet been sent
Event cancelled	Event has been cancelled before arming signal send
Arming sent	Arming signal has been sent but no ack received
Arming rejected	Arming signal has been sent and 'REJECT' code on arming signal ack received
Arming invalid	Arming signal has been sent and 'INVALID' code on arming signal ack received
Aggregator armed	Arming signal has been sent and 'ACCEPT' code on arming signal ack received
Disarming sent	Disarming signal has been sent but no ack received
Disarming invalid	Disarming signal has been sent and 'INVALID' code on disarming signal ack received
Aggregator disarmed	Disarming signal has been sent and 'ACCEPT' code on disarming signal ack received
Aggregator unavailable	Valid unavailability signal has been received from Aggregator
Notice sent	Notice signal has been sent but no ack received
Notice invalid	Notice signal has been sent and 'INVALID' code on notice signal ack received
Aggregator notified	Notice signal has been sent and 'ACCEPT' code on notice signal ack received
Verified	Event has been verified and verification percentage and outcome recorded

4.4.4 Business Rules

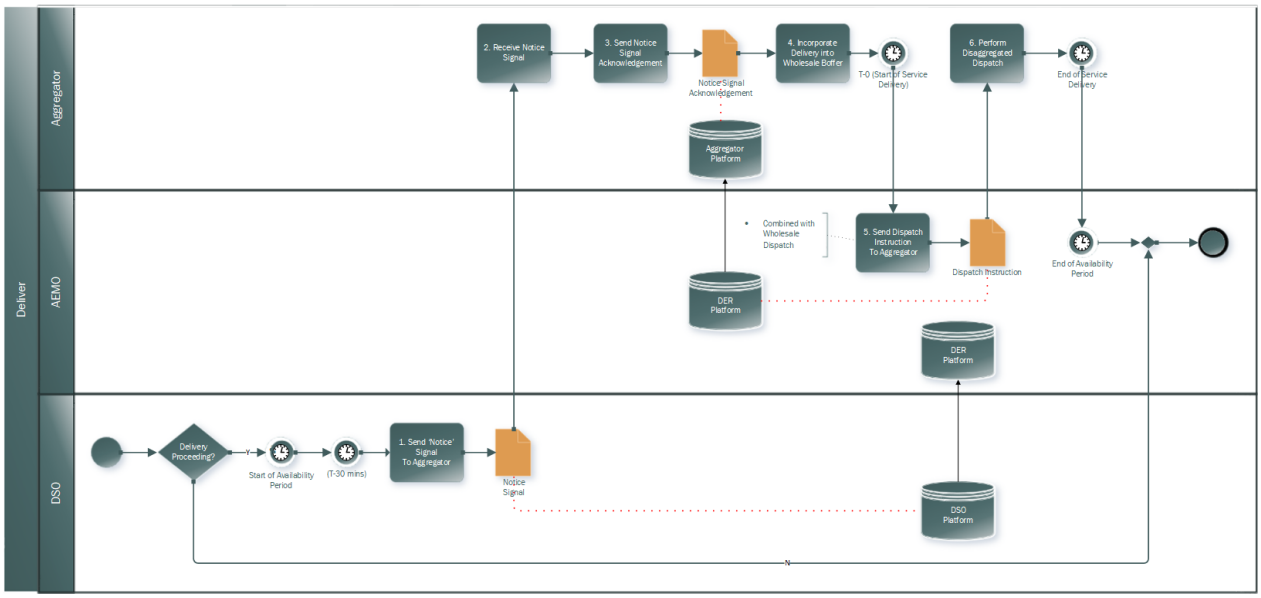
The baseline (kW) issued with the arming and notice signal will be a function of DSO needs analysis for a given demand increase or decrease event noting that:

a. The baseline issued for the arming signal may differ from the contractual baseline, but will remain fixed from that time until dispatch
    i. Note that the arming signal baseline and quantity cannot result in a target that is larger than the contractual agreement
b. The baseline issued for the notice signal will be used by the Aggregator to derive delivery target, irrespective of fleet baseline at T=0
    i. For demand increase the derived target will be baseline + quantity
    ii. For demand decrease the derived target will be baseline – quantity
c. Baseline method will be
    i. Fleet aggregated demand (kW)
    ii. 10 days prior to service delivery with exclusions
        - Day of arming/service delivery
        - Weekday baseline will exclude weekends/public holidays
        - Weekend/public holiday baseline will exclude weekdays

4.5 Notice Signal

4.5.1 Process

Triggering the Notice/Unavailability Signal is the sixth (6) stage of the LSE DHF process, after the Arming Signal has been sent, also referred to as the 'Deliver' stage



4.5.2 Requirements

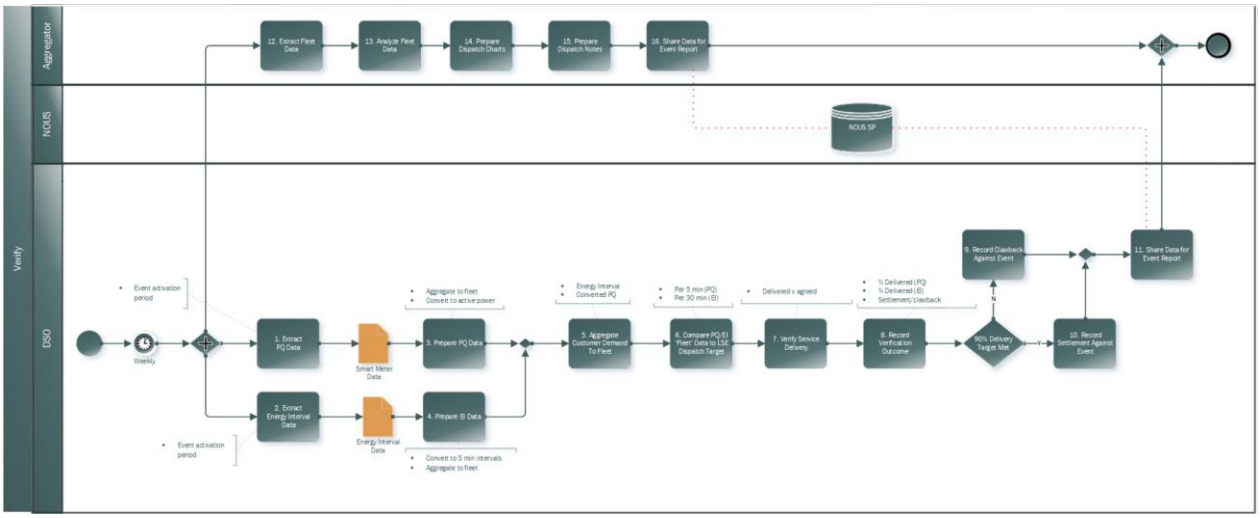
PROCESS STEP	REQUIREMENT (USER STORY)
Send notice signal to Aggregator	As a DSO, I want to issue and send the notice signal to the Aggregator*, so that the Aggregator has confirmed details for service delivery which can be incorporated into the Wholesale BOffer *Note that: • The baseline will be fixed from the arming signal to the notice signal • The quantity may be updated from the arming signal to the notice signal
Receive notice signal	As an Aggregator, I want to receive a notice signal from a DSO, so that I can deliver against the revised target contained in the notice signal for the time period requested
Send notice signal acknowledgement	As an Aggregator, I want to issue an acknowledgement signal, so that the DSO is aware of action that needs to be or will be taken in response to the notice signal
Incorporate delivery into wholesale BOffer	As an Aggregator, I want to be able to incorporate the notice signal quantity into the wholesale BOffer, so that the agreed amount can be dispatched through the wholesale BOffer
Send dispatch instruction to Aggregator	As a Market Operator (AEMO), I want aggregators to include the LSE DHF event in their whole of portfolio BOffer (awarded LSE service volume will be combined with wholesale bid quantities), so that the dispatch instructions I issue to the Aggregator represent all of their portfolio capacity commitments so I can trust that by conforming with their dispatch instruction the Aggregator will contribute to market efficiency and power system stability at the same time as delivering on all of their commercial commitments, including to DNSPs.

Perform disaggregated dispatch	As an Aggregator, I want to perform disaggregated dispatch, so that I can deliver a service as agreed with a DSO for a given DHF event

4.6 Verify service

4.6.1 Process

- Verifying that a service has been delivered as expected is the seventh (7) stage of the LSE DHF process, after a Notice Signal has been actioned



4.6.2 Requirements

PROCESS STEP	REQUIREMENT (USER STORY)
Extract PQ data	As a DSO, I want to extract PQ data* associated with Aggregator DHF service delivery, so that I can derive customer demand associated with an Aggregator DHF service delivery *Note: • This will occur through AST internal metering systems where possible • This must be PQ data that has been transformed to real and imaginary V and I
Extract energy interval data	As a DSO, I want to extract energy interval data associated with Aggregator DHF service delivery, so that I can derive customer demand associated with an Aggregator DHF service delivery *Note: • This will occur through AST internal metering systems where possible • This data may require conversion to 5 min intervals
Prepare PQ data	As a DSO, I want to derive customer demand from PQ data associated with Aggregator DHF service delivery, so that I can aggregate customer demand to use in verification of DHF service delivery
Prepare EI data	As a DSO, I want to derive customer demand from energy interval associated with Aggregator DHF service delivery, so that I can aggregate customer demand to use in verification of DHF service delivery

PROCESS STEP	REQUIREMENT (USER STORY)
Aggregate customer demand to fleet	As a DSO, I want to aggregate customer demand (kW) for a given Aggregator at a given network location*, so that I can compare the aggregated customer demand to the agreed service delivery target for a DHF event *Note: • This may be an LV or HV network location • Only customers that the Aggregator has registered to deliver a demand service should be aggregated
Aggregate customer demand to fleet	As a DSO, I want to aggregate customer demand (kWh) for a given Aggregator at a given network location, so that I can compare the aggregated customer demand to the agreed service delivery target for a DHF event
Compare PA/EI 'fleet' data to LSE dispatch target	As a DSO, I want to derive the LSE dispatch target from the relevant notice signal*, so that I can compare aggregated (i.e. 'fleet') active power (kW) data and energy (kWh) to the LSE dispatch target *Note, LSE dispatch target should be: • Baseline + quantity for demand increase • Baseline - quantity for demand decrease • The LSE dispatch target should be derived from the baseline and quantity in the notice signal
Compare PA/EI 'fleet' data to LSE dispatch target	As a DSO, I want to compare aggregated (i.e. 'fleet') active power (kW) data and energy (kWh) to the LSE dispatch target*, so that I can determine whether an Aggregator has met or exceeded the target 90% of the time over an agreed service delivery period *Note: LSE dispatch target should be: • Notice signal baseline + quantity for demand increase • Notice signal baseline - quantity for demand decrease Comparison should be done: • Per 5 min inst active power (kW) value • Per 30 min energy interval (kWh) value
Verify service delivery	As a DSO, I want to determine whether an Aggregator has met or exceeded their delivery target 90% of the time over an agreed service delivery period*, so that I can record a verification outcome as either 'settlement' or 'clawback' (i.e. verify the service delivery) *Note, this will be calculated as: • The percentage of 5 min inst measurements that met or exceeded the LSE dispatch target • The percentage of 30 min energy measurements that met or exceeded the LSE dispatch target
Verify service delivery	As a DSO, I want to verify that an agreed service delivery by an Aggregator for a DHF event has had the desired impact at a given network location, so that I can record the verification outcome at the network location
Record verification outcome	As a DSO, I want to record the outcome of Aggregator service delivery verification (% PQ delivered to agreed target) over the service delivery period, so that the verification outcome can be included in event reporting
Record verification outcome	As a DSO, I want to record the outcome of Aggregator service delivery verification (% EI delivered to agreed target) over the service delivery period*, so that the verification outcome can be included in event reporting
Record clawback against event	As a DSO, I want to record the outcome of service delivery verification as clawback, so that the verification outcome can be included in event reporting

PROCESS STEP	REQUIREMENT (USER STORY)
Record settlement against event	As a DSO, I want to record the outcome of service delivery verification as settlement, so that the verification outcome can be included in event reporting
Share data for event report	As a DSO, I want to share data for an event report*, so that the data can be added to the relevant draft event report *Note, this will include relevant charts and tables
Extract fleet data	As an aggregator I want to extract event data so I can analyse it
Analyse fleet data	As an aggregator I want to analyse the fleet data so I can discover the success of the event, or what needs to be done to succeed better at future events
Prepare dispatch charts	As an aggregator I want to prepare dispatch charts to visualise the event results
Prepare dispatch notes	As an aggregator I want to prepare dispatch notes to describe the event results including the behaviour of the fleet and any anomalies or obstacles encountered
Share data in event report	As an aggregator I want to share data in an event report so I can update the DSO and external analysers regarding my findings

4.6.3 Business rules

Verification

a. Where the service is demand increase the Aggregator must deliver >= agreed increase (i.e. the derived target as an absolute value)
b. Where the service is demand decrease the Aggregator must deliver >= agreed decrease (i.e. the derived target as an absolute value)
c. Delivery will be verified
    i. Through instantaneous demand measurement (aggregated kW across fleet taken every 5 minutes over relevant time period)
    ii. Through 30 minute energy interval data

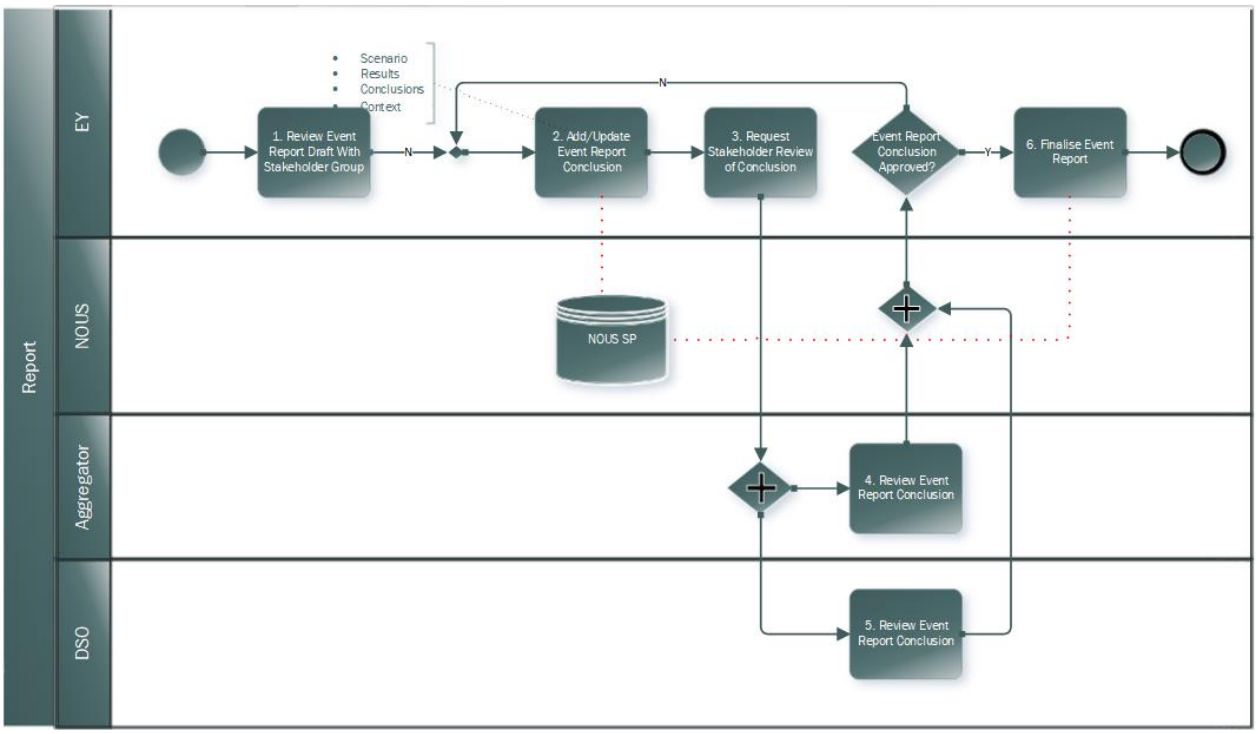
Settlement

a. Settlement will be based on
    i. 90% of measurements during delivery time period >= agreed increase or decrease (i.e. the derived target as an absolute value)
    ii. An understanding that this process only leads to a recording of 'settlement' (according to the criteria outlined) or 'clawback' (i.e. there is no actual compensation as part of EDGE)

4.7 Report on Service

4.7.1 Process

- Reporting on the service delivery is the eighth (8) and last stage of the LSE DHF process, after the service delivery has been verified



4.7.2 Requirements

PROCESS STEP	REQUIREMENT (USER STORY)
Review event report draft with stakeholder group	As a reporting vendor, I want to review an event report draft with the relevant stakeholder group*, so that I can discuss the results and see if a conclusion can be reached *Note that: • The stakeholder group will be members of the DSO and Aggregator • The event report draft will likely be hosted on Nous SP for EDGE trial purposes
Add/update event report conclusion	As a reporting vendor, I want to add/update an event report conclusion, so that I can request that the relevant stakeholder group reviews the conclusion
Request stakeholder review of conclusion	As a reporting vendor, I want to request that the relevant stakeholder group reviews the conclusion that I have written for an event report, so that the stakeholder group reviews the event report conclusion
Review event report conclusion	As an Aggregator, I want to review an event report conclusion, so that I can identify areas of update for the event report conclusion
Review event report conclusion	As a DSO, I want to review an event report conclusion, so that I can identify areas of update for the event report conclusion
Finalise event report	As a reporting vendor, I want to finalise an event report, so that I can recognise when an event report conclusion is approved by the stakeholder group

5 Demand Low Firmness

5.1 Summary

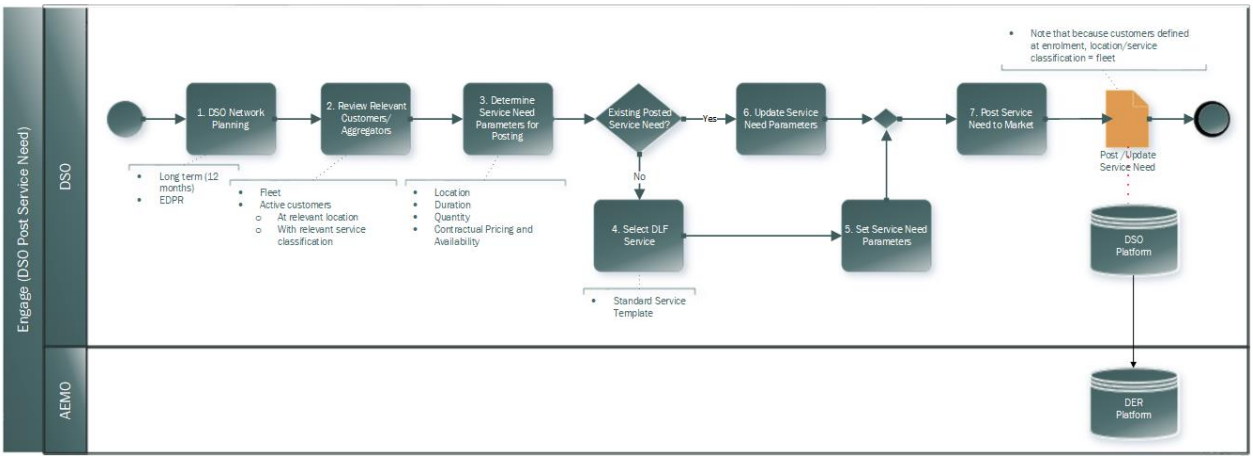
Signals used for Demand Low Firmness (DLF) are a subset of Demand High Firmness (DHF) signals, the schema remains the same however, business validations for DLF are different.

Processes used in DLF include:

- Define/Enrol – as per 1.1 Define/Enrol
- Service Need
- Offer
- Service Agreement
- Notice Signal
- Verify service – as per 2.6 Verify Service
- Report on service – as per 2.7 Report on Service

5.2 Service Need

5.2.1 Process



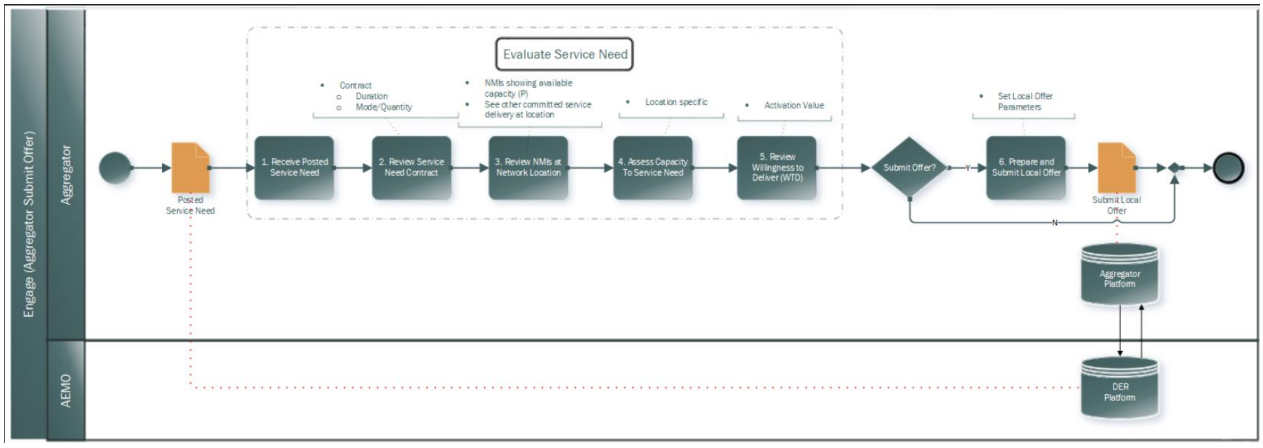
5.2.2 Requirements

PROCESS STEP	REQUIREMENT (USER STORY)
DSO network planning	As a DSO, I want to undertake detailed network planning for DLF, so that I can identify load-at-risk network areas that may benefit from a DLF Service Agreement
Determine relevant customers/aggregators	As a DSO, I want to determine the relevant Aggregators available for a given DLF service need*, so that I can post a service need to the market for those Aggregators to respond to *Note that: • The DSO and Aggregator develop a shared understanding at time of enrolment with respect to the customers at a given network location that an Aggregator can control to deliver a demand service • The DLF posted service need specifics will be derived offline through collaboration between parties
Determine service need parameters for posting	As a DSO, I want to determine the service need parameters for posting*, so that I can post a service need to the market for a DRSP (Aggregator) to respond to *Note that: • This will involve the DSO working with an Aggregator to determine the DLF service attributes for a given service need, e.g. Location, duration, quantity, availability • In BAU terms this is an outcome of the network planning activity mentioned above, and is a precursor to submission of the posted service need to market
Select DLF service	As a DSO (Network Planning Specialist), I want to select the DLF standard service, so that the parameters can be set for the DLF service need in question

PROCESS STEP	REQUIREMENT (USER STORY)
Set service need parameters	As a DSO (Network Planning Specialist), I want to create and save a new DLF service need, so that I can submit a service need to the market for an Aggregator to respond to
Update service need parameters	As a DSO (Network Planning Specialist), I want to update and save the parameters for an existing DLF service need, so that I can resubmit the DLF service need to the market for an Aggregator to respond
Post service need to market	As a DSO (Network Planning Specialist), I want to post a DLF service need to market, so that the relevant Aggregator can review and respond to the posted service need with an offer

5.3 Offer

5.3.1 Process



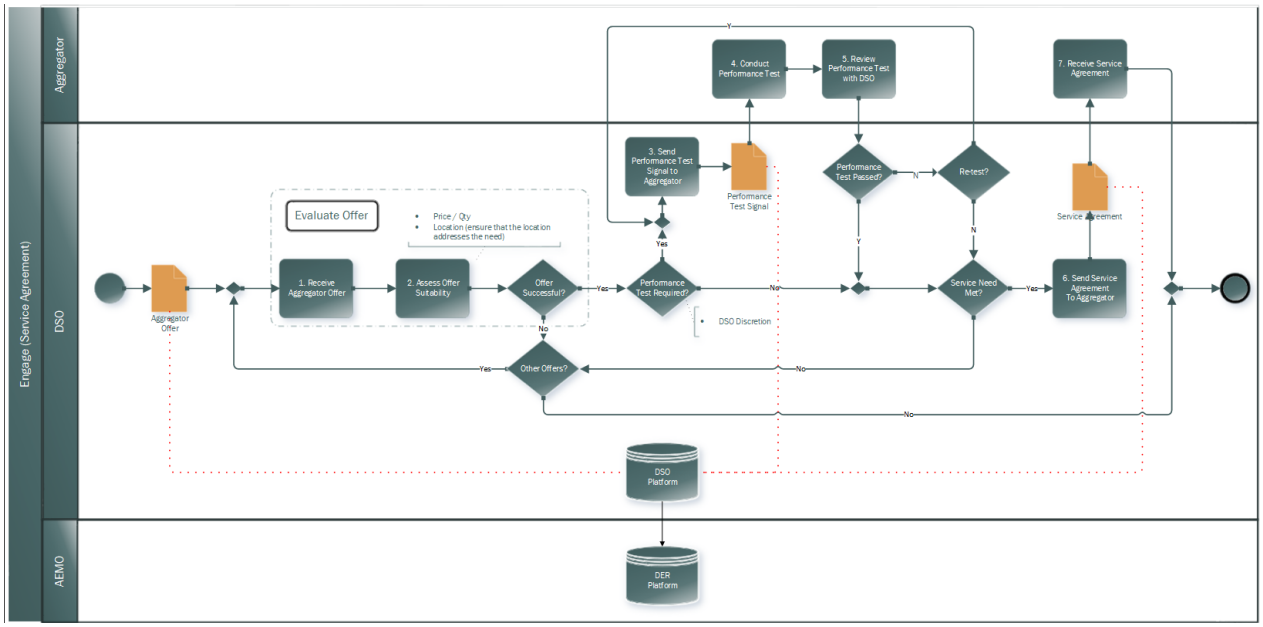
5.3.2 Requirements

PROCESS STEP	REQUIREMENT (USER STORY)
Receive posted service need	As an Aggregator, I want to receive a posted service need, so that I can review the service need
Review service need	As an Aggregator, I want to review a posted service need contract*, so that I can evaluate whether I want to respond to the service need *Note, this includes review of the following offline: • Location • Capacity to service the need • Contract length/pricing for DLF
Review NMIs at network location	As an Aggregator, I want to view all NMI's and available capacity at the desired network location*, so that I can view available capacity to be able to fulfil the posted service need and be able to view other committed service deliveries at that location *Note: The network will communicate at enrolment the network locations that form the 'fleets' of customers that can service the need
Assess capacity to service need	As an Aggregator, I want to assess the capacity to fulfil the service need*, so that I can decide whether to perform service delivery at specific location/s *Note: This will again be assessed with respect to the 'fleets' determined at time of enrolment Note: With Low Firmness services we are not obliged to deliver
Review willingness to deliver	As an Aggregator, I want to review the willingness to deliver (WTD) (i.e. assess the value of the service for a particular service delivery), so that I can determine whether to submit an offer in response to a service need
Prepare and submit local offer	As an Aggregator, I want to be able to set the parameters for an offer in response to a service need, so that I can submit the offer to the DSO

Prepare and submit local offer	As an Aggregator, I want to submit a response to a DSO DLF Service Need (i.e. local offer), so that this request can be reviewed and assessed by the DSO

5.4 Service Agreement

5.4.1 Process



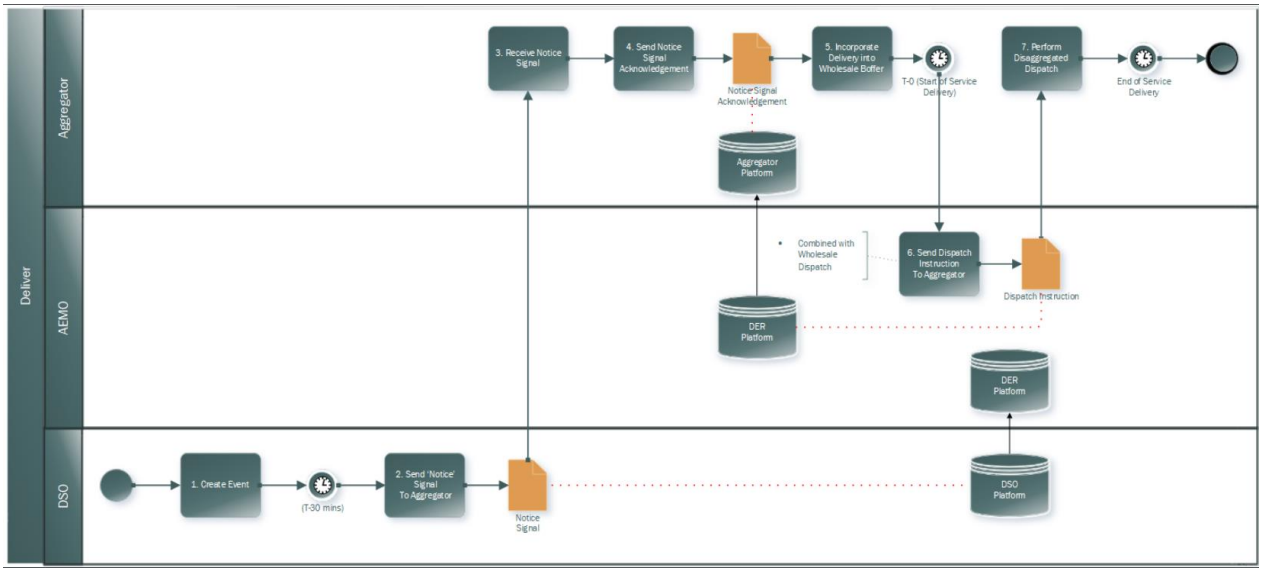
5.4.2 Requirements

PROCESS STEP	REQUIREMENT (USER STORY)
Receive Aggregator offer	As a DSO, I want to receive and record an Aggregator offer sent in response to a posted DLF Service Need, so that I can proceed to assess which Offer is most suitable for service delivery for DLF
Assess offer suitability	As a DSO, I want to assess an Offer from an Aggregator by price, quantity and location* (i.e. customer location on circuit), so that I can select the most suitable offer(s) (i.e. cheapest offer that addresses the service need) *Note that customer location on circuit needs to be considered to assess the voltage impacts of service delivery
Send performance test signal to Aggregator	As a DSO, I want to send a performance test signal* to an Aggregator, so that the Aggregator can demonstrate their fleet capability *Note that: This will likely be similar to an operational dispatch signal (i.e. 'notice' signal)
Conduct performance test	As an aggregator, I want to conduct a performance test, so that I can determine my fleet's capability
Review performance test with DSO	As an Aggregator, I want to review the performance test results* with the DSO, so that the DSO can see my fleet capability *Note that: The process may need to be changed so that this is a DSO activity

PROCESS STEP	REQUIREMENT (USER STORY)
Send Service Agreement to Aggregator	As a DSO, I want to send a Service Agreement to an Aggregator, so that I have an agreement with the Aggregator for LSE DLF service delivery *Refer Interface #11 in Appendix 1.1
Receive Service Agreement	As an Aggregator, I want to receive a service agreement, so that I am clear of the agreed contractual situation

5.5 Notice Signal

5.5.1 Process



5.5.2 Requirements

PROCESS STEP	REQUIREMENT (USER STORY)
Create event	As a DSO, I want to create an event*, so that I can track and monitor Aggregator delivery against that event *Note that: An event is intended to accommodate multi-Aggregator delivery
Send Notice Signal to Aggregator	As a DSO, I want to send a Notice Signal to the Aggregator*, so that the Aggregator has confirmed details for service delivery which can be incorporated into the Wholesale Boffer *Note that: • The notice signal will contain a baseline and quantity • If the notice signal contains a maximum increase or decrease operating mode, this overrides the baseline and quantity
Receive Notice Signal	As an Aggregator, I want to receive a notice signal from a DSO, so that I can deliver against the revised target or operating mode contained in the notice signal for the time period requested

PROCESS STEP	REQUIREMENT (USER STORY)
Send Notice Signal acknowledgement	As an Aggregator, I want to issue an acknowledgement signal, so that the DSO is aware of action that needs to be or will be taken in response to the notice signal
Incorporate delivery into wholesale BOffer	As an Aggregator, I want to be able to incorporate the notice signal quantity into the wholesale Boffer, so that the agreed amount can be dispatched through the wholesale Boffer
Send dispatch instruction to Aggregator	As a Market Operator (AEMO), I want aggregators to include the LSE DLF event in their whole of portfolio BOffer (awarded LSE service volume will be combined with wholesale bid quantities), so that the dispatch instructions I issue to the Aggregator represent all of their portfolio capacity commitments so I can trust that by conforming with their dispatch instruction the Aggregator will contribute to market efficiency and power system stability at the same time as delivering on all of their commercial commitments, including to DNSPs.
Perform disaggregated dispatch	As an Aggregator, I want to perform disaggregated dispatch, so that I can deliver a service as agreed with a DSO for a given DLF event and maximise my benefit from the event

5.6 Verification and Settlement

No compliance verification is required for Low Firmness events, as there is limited obligation on the Aggregator to meet targets, however event reports occur as per DHF events for improved learning for DSO and Aggregator.

No settlement occurs during the EDGE trial.

6 Voltage High Firmness

Voltage High Firmness (VHF) services occur through the EDGE trial, however communication of events occurs manually (while Demand services are communicated through the standardised interface).

6.1 Conduct Event

6.1.1 Requirements

PROCESS STEP	REQUIREMENT (USER STORY)
Issue event request	As a DSO, I want to request the Aggregator to apply a specific Volt-VAR curve to a defined set of NMIs for a duration
Receive event request	As an Aggregator, I want to receive the event request so I know which Volt-VAR curve to which NMIs for the duration
Apply Volt-VAR curve	As an Aggregator, I want to apply the Volt-VAR curve as instructed to the NMIs
Revert Volt-VAR curve	As an Aggregator, I want to revert the NMIs to their default Volt-VAR curve after the event duration expires

6.2 Report on Service

6.2.1 Requirements

PROCESS STEP	REQUIREMENT (USER STORY)
Extract PQ data	As a DSO, I want to extract PQ data* associated with Aggregator VHF service delivery, so that I can derive voltage/VAR performance associated with an Aggregator VHF service delivery *Note: • This will occur through AST internal metering systems where possible • This must be PQ data that has been transformed to real and imaginary V and I
Extract energy interval data	As a DSO, I want to extract energy interval data associated with Aggregator DHF service delivery, so that I can derive voltage/VAR performance associated with an Aggregator VHF service delivery *Note: • This will occur through AST internal metering systems where possible • This data may require conversion to 5 min intervals
Compare voltage data to VAR (Q) data for each NMI in the event	As a DSO, I want to graph voltage/VAR data pairs so I can observe the apparent Volt-VAR curve for the NMI
Compare voltage data to VAR (Q) data for each NMI in the event	As a DSO, I want to compare the apparent Volt-VAR curves to the directed Volt-VAR curve
Verify service delivery	As a DSO, I want to determine whether an Aggregator's NMIs have sufficiently behaved according the directed Volt-VAR curve

PROCESS STEP	REQUIREMENT (USER STORY)
Record verification outcome	As a DSO, I want to record the outcome of Aggregator Volt-VAR performance over the service delivery period, so that the verification outcome can be included in event reporting
Share data for event report	As a DSO, I want to share data for an event report*, so that the data can be added to the relevant draft event report *Note, this will include relevant charts and tables
Extract fleet data	As an aggregator I want to extract event data so I can analyse it
Analyse fleet data	As an aggregator I want to analyse the fleet data so I can discover the success of the event, or what needs to be done to succeed better at future events
Prepare dispatch charts	As an aggregator I want to prepare dispatch charts to visualise the event results
Prepare dispatch notes	As an aggregator I want to prepare dispatch notes to describe the event results including the behaviour of the fleet and any anomalies or obstacles encountered
Share data in event report	As an aggregator I want to share data in an event report so I can update the DSO and external analysers regarding my findings

7 Relevant Reading

Document Name	Description	Link
Network Advisory Group – Briefing Formation (Meeting 4)	Provides overview of the proposed "Local Services Exchange	https://aemo.com.au/-/media/files/initiatives/der/2023/project-edge-nag/nag_meeting-4_briefing-information.pdf?la=en
Network Advisory Group – Output Packs (19th May 2021)	Local Service Exchange and Local Network support services – definition and key considerations	https://aemo.com.au/-/media/files/initiatives/der/2023/project-edge-nag/nag_meeting_6.pdf?la=en
Network Advisory Group – Briefing Formation (Meeting 7)	Provides overview of the Demand and Voltage - Local network support services	https://aemo.com.au/-/media/files/initiatives/der/2023/project-edge-nag/nag_meeting_7_briefing-information.pdf?la=en