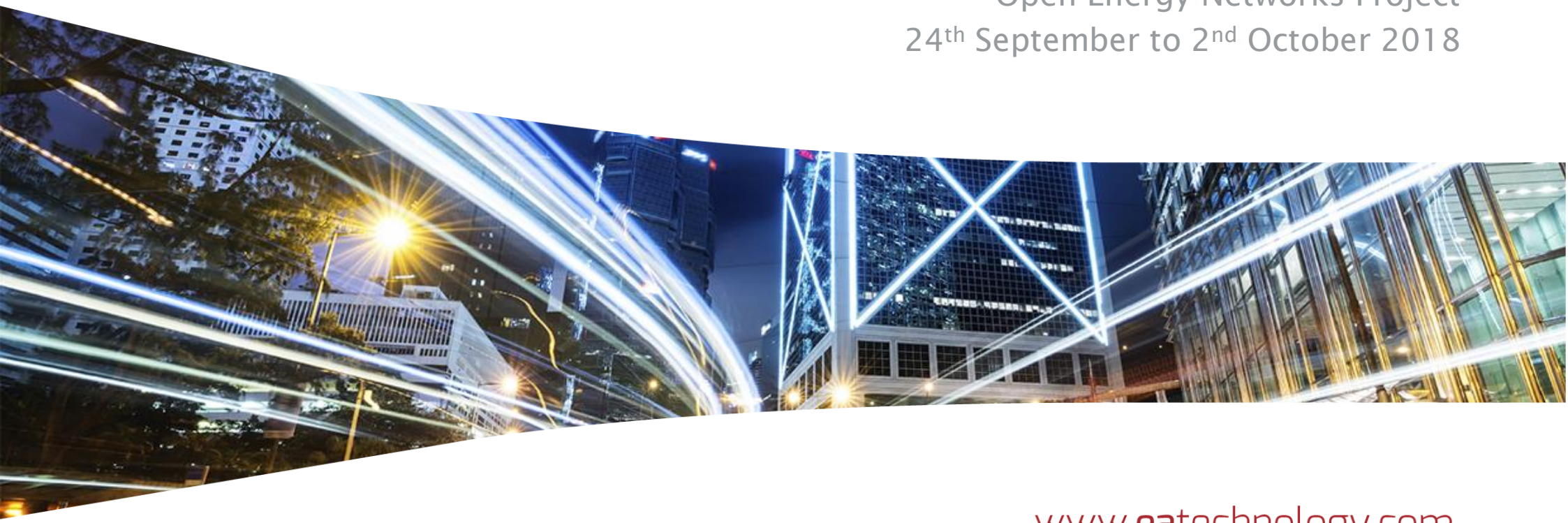
Safer, Stronger, Smarter Networks

Workshop: Development of SGAM for OpEN project

Open Energy Networks Project

24th September to 2nd October 2018



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WORKSHOP BRIEF

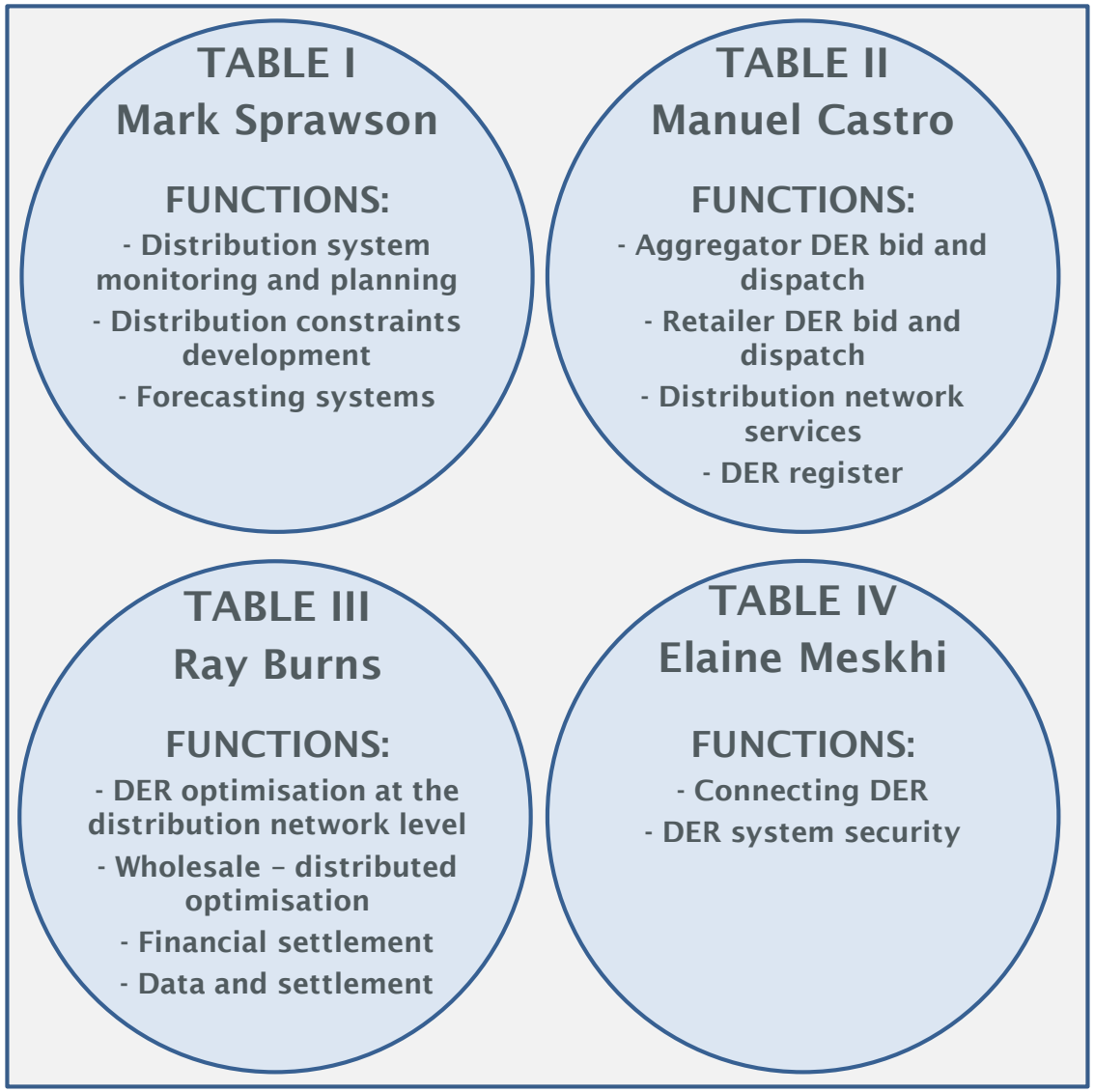
Agenda for Day 1

Item	Time	Description
1	09:00 – 09:30	Welcome, registration and coffee
2	09:30 – 10:00	Workshop briefing
3	10:00 – 10:15	Refreshment break
4	10:15 – 12:30	1st workshop session • Single Integrated Platform
5	12:30 – 13:15	Lunch
6	13:15 – 15:00	2nd workshop session • Single Integrated Platform (complete)
7	15:00 – 15:15	Refreshment break
8	15:15 – 16:30	3rd workshop session: • Two step tiered platform
9	16:30	Closure

Agenda for Day 2

Item	Time	Description
1	08:00 – 08:30	Welcome, registration and coffee
2	08:30 – 10:00	4th workshop session • Two step tiered platform (complete)
3	10:00 – 10:15	Refreshment break
4	10:15 – 12:30	5th workshop session • iDSO optimises distribution level dispatch
5	12:30 – 13:15	Lunch
6	13:15 – 15:00	6th workshop session • iDSO optimises distribution level dispatch (complete)
7	15:00 – 15:15	Refreshment break
8	15:15 – 16:00	Wrap up
9	16:00	Closure

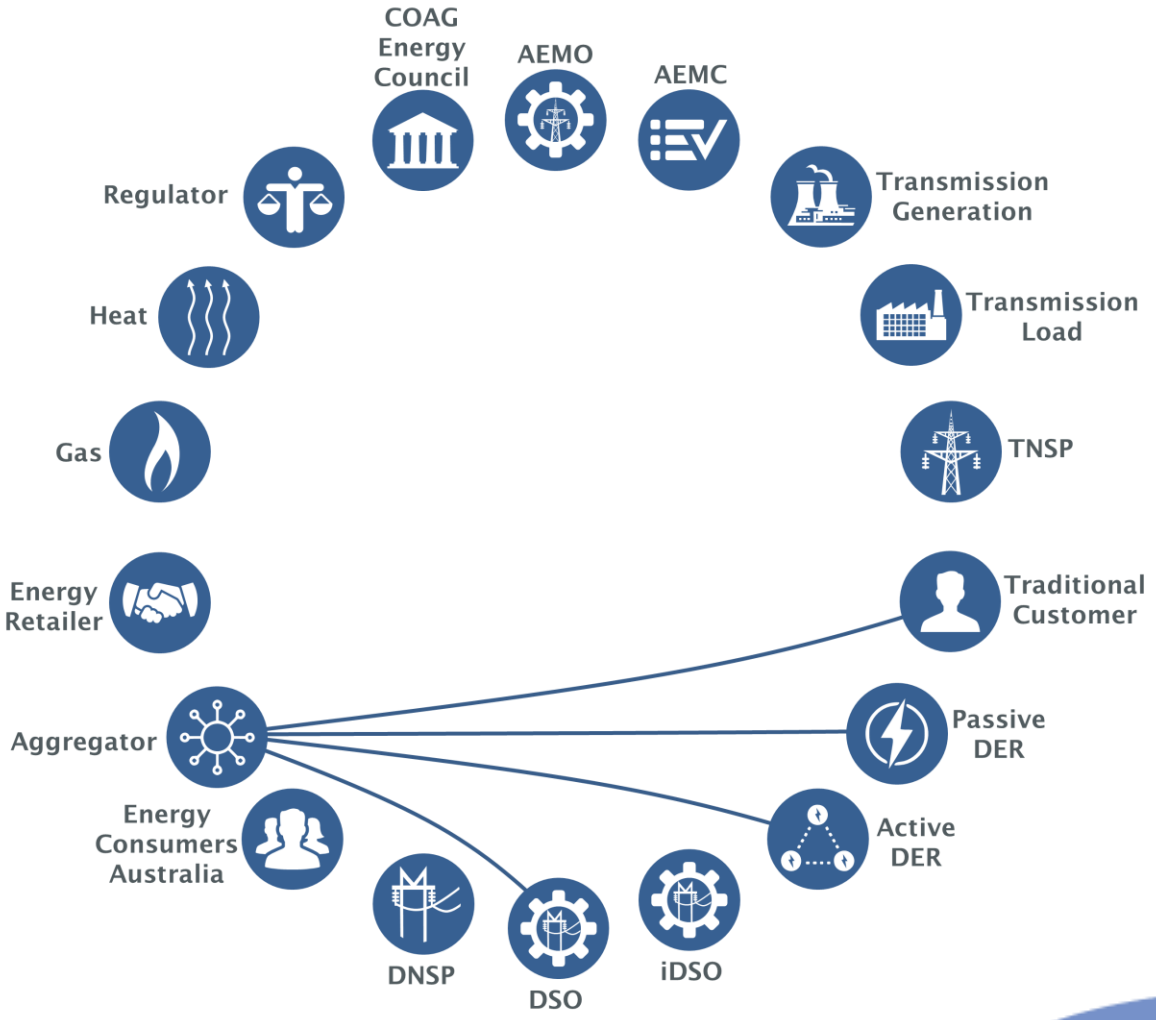
Workshop layout



- Aims:
  - Identify and define cross-actor information exchange links for each DER optimisation function and associated activities
- Objectives
  - **O1**. Identify actors (i.e. who is communicating with whom)
  - **O2**. Define communication relationship (i.e. what are they saying)
  - **O3**. Define the type of communication (i.e. how are they communicating and how often)
- Documents:
  - Actor-relationship diagrams
  - World definitions
  - DER optimisation functions and activities definition
  - Actor definitions
  - Relationship templates
  - Issues log
- Note:
  - You will be allocated to one of the four tables for the duration of the workshop

O1. Identify "activity" related actors

Framework:	**Single Integrated Platform**
Function:	**Distribution Constraints Management**
Activity:	**DER Engagement**

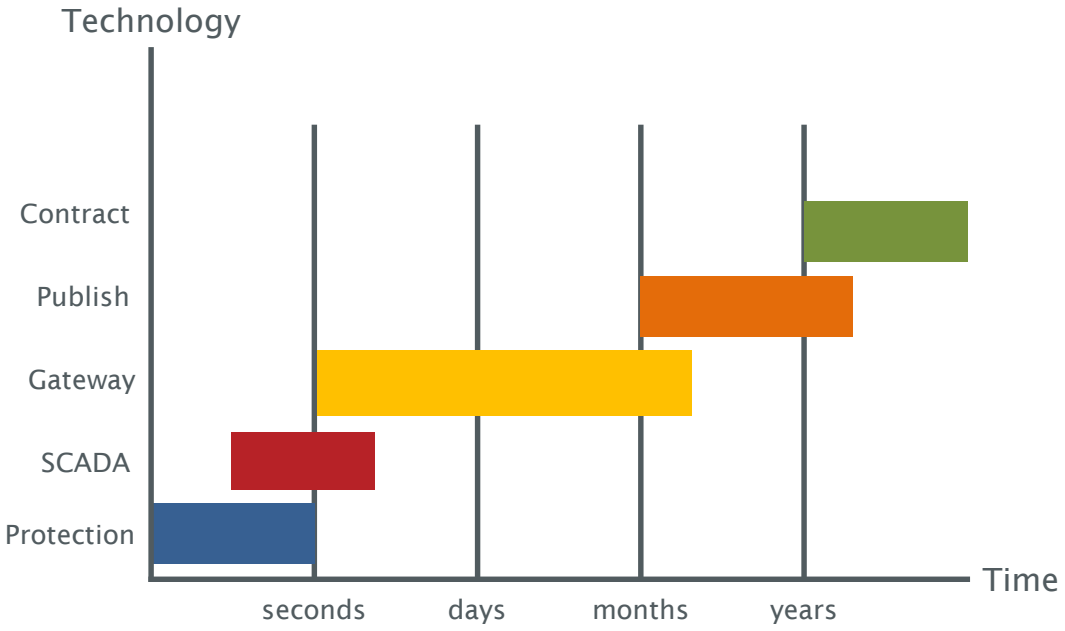


O2. Define communication relationship

Framework:	**Single Integrated Platform**
Function:	**Distribution Constraints Management**
Activity:	**DER Engagement**

No.	From actor	To actor	Information	Type
1	DSO	Aggregator; Retailer	Sign post long-term DER requirements	
2	Aggregator; Retailer	DSO	Register interest for resource provision	
3	Aggregator; Retailer	DER	Offer conditions for sign-up	
4	DER	Aggregator; Retailer	Accept terms and conditions	
5	Aggregator; Retailer	DER	Contract DER resource	
…				

Communication types



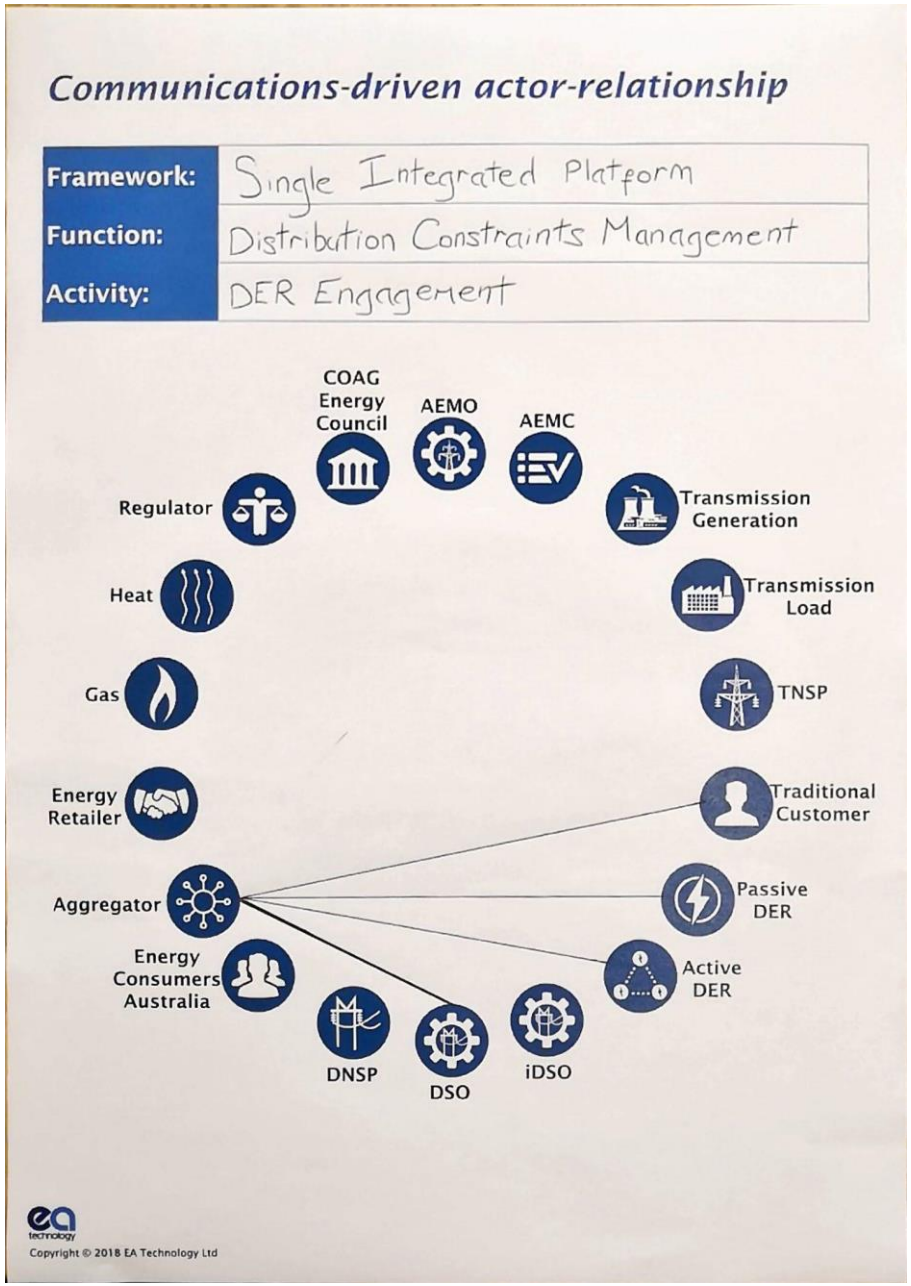
- Type: "Protection"
  - E.g.: Hard wired communications
  - Timeframe: real-time (<1sec)
- Type: "SCADA"
  - E.g.: Electronic real-time communications within DSO (1sec – 5mins)
- Type: "Gateway"
  - E.g.: Electronic communications from / to outside world
  - Timeframe:
    - Real-time (seconds)
    - Short-term (seconds to days)
- Type: "Publish"
  - E.g.: Public statement
  - Timeframe: medium-term (months)
- Type: "Contract"
  - E.g.: Pre-defined / agreed / legally enforced communications
  - Timeframe: long-term (years)

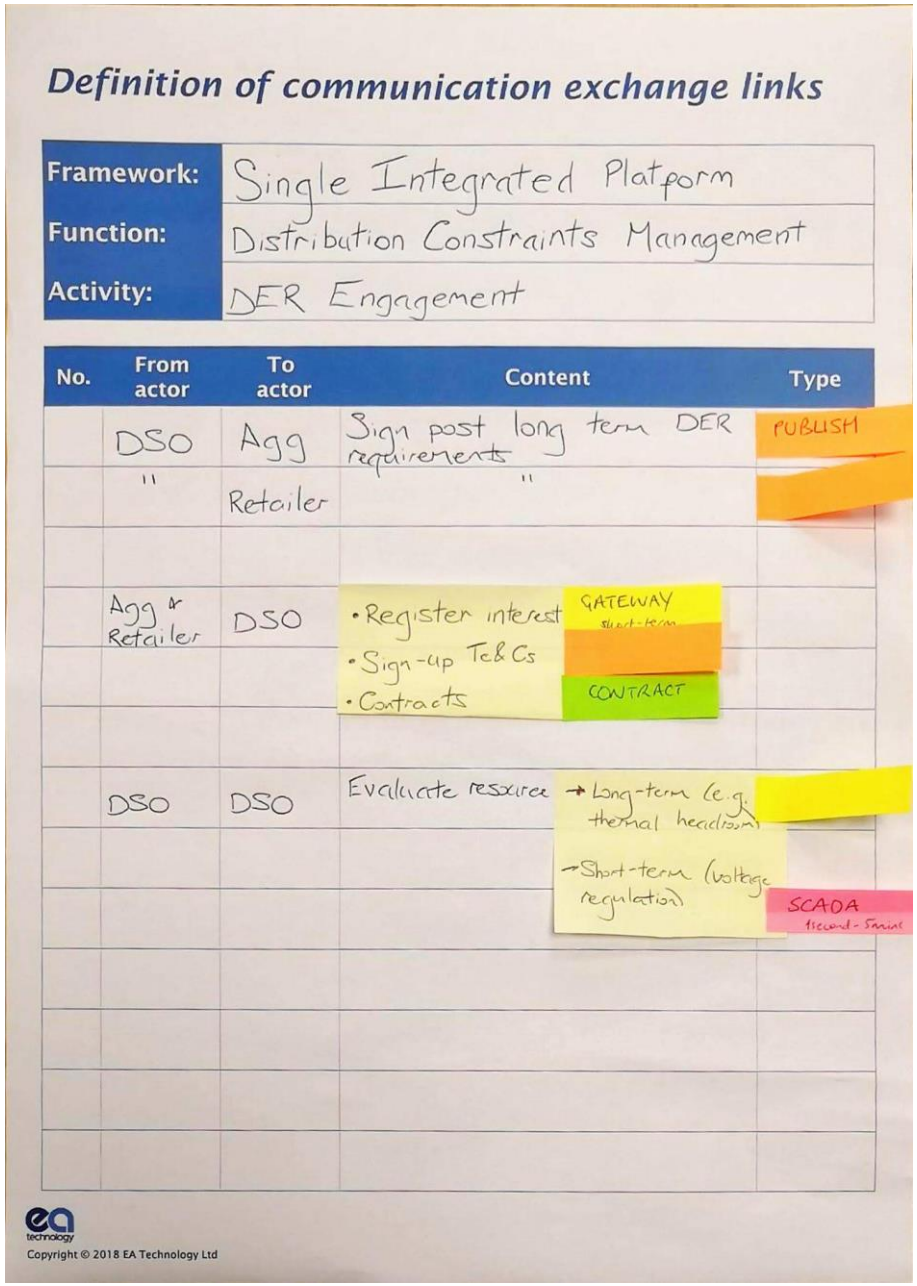
O2. Define communication relationship

Framework:	**Single Integrated Platform**
Function:	**Distribution Constraints Management**
Activity:	**DER Engagement**

No.	From actor	To actor	Information	Type
1	DSO	Aggregator; Retailer	Sign post long-term DER requirements	Publish
2	Aggregator; Retailer	DSO	Register interest for resource provision	Gateway
3	Aggregator; Retailer	DER	Offer conditions for sign-up	Publish
4	DER	Aggregator; Retailer	Accept terms and conditions	Gateway
5	Aggregator; Retailer	DER	Contract DER resource	Contract
…				

Application example





Workshop brief

- For the particular ‘Function’
- For the specified ‘Activities’
- You must decide:
  - 1. Who is communicating with whom?
  - 2. What are they saying?
  - 3. How are they communicating (and how often)?

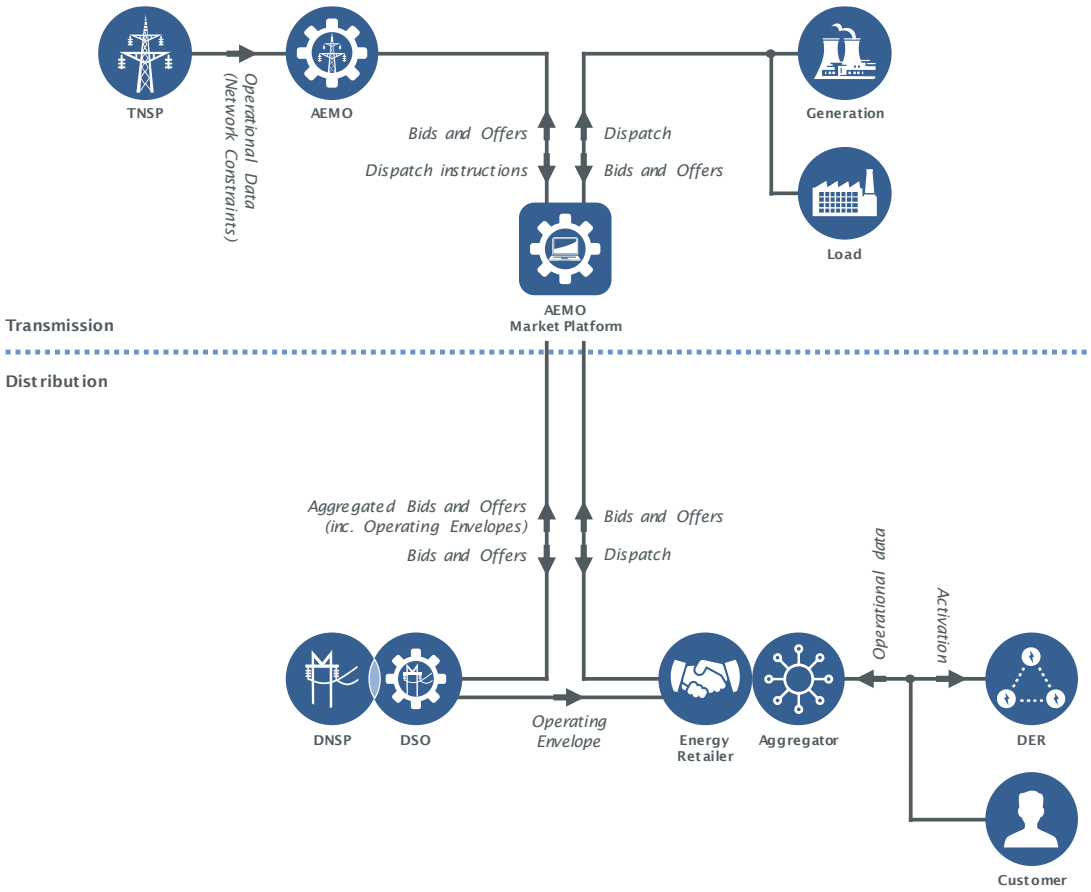
DISTRIBUTION LEVEL OPTIMISATION FRAMEWORKS

SINGLE INTEGRATED PLATFORM

Ref.: “Consultation on how best to transition to a two-way grid that allows better integration of Distributed Energy Resources for the benefit of all customers”, OpEN Energy Networks, AEMO and ENA, Jul., 2018

Actors and relationships

Single integrated platform



Key characteristics

Market arrangements	• There is a single central market comprised of wholesale and ancillary services markets (i.e. FCAS, NSCAS and SRAS) that is operated via a central market platform • Market participants, including DER via aggregators/retailers, submit bids and offers for system services to the central market platform which in turn makes them available to AEMO for whole system optimisation
AEMO	• AEMO organises and operates the central market • AEMO assesses all bids and offers and optimises the dispatch of energy resources considering T-network and D-network constraints • AEMO sends out dispatch instructions to energy resources, including DER via their respective Aggregator/Retailer
DSO	• Based on network state and DER connected to the distribution network, the DSO provides a dynamic operating envelope to aggregators/retailers for all active DER at NMI level on a 5 minute basis • The DSO receives DER bids from the central market; prequalifies them into an aggregated bids and passes them to AEMO for whole system optimisation
Aggregator / Retailer	• Aggregator/Retailer combines different DER and offer their aggregated output as system services to the central market platform

Roles and responsibilities

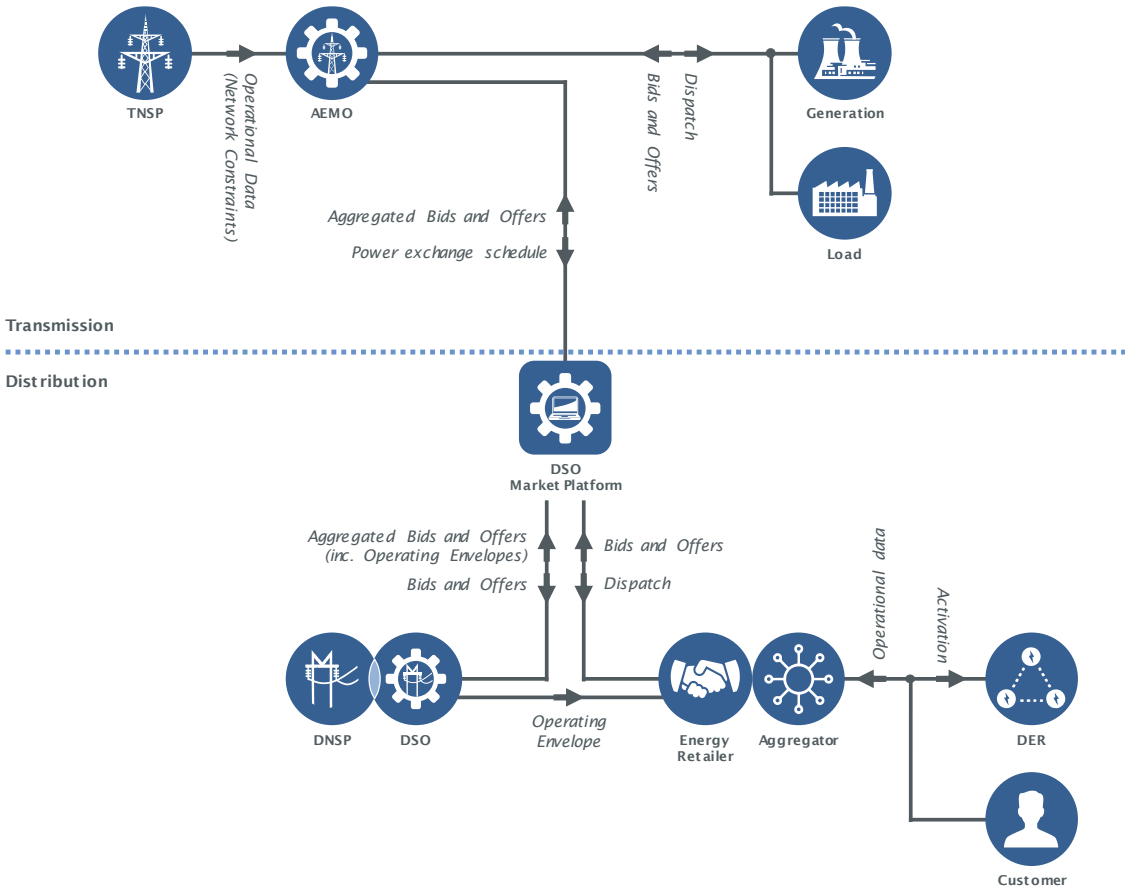
Market arrangements	• There is a central market comprised of wholesale and ancillary services markets (i.e. FCAS, NSCAS and SRAS) that is organised and operated by AEMO • There is a single central market platform that facilitates the direct access of market participants to the different markets enabling "value stacking" for energy resource owners • The central market platform collects bids and offers from market participants, including DER via aggregators/retailers, and makes them available to AEMO for whole system optimisation
AEMO	• AEMO organises and operates the central market and is responsible for the dispatch and settlement of the market and system security and reliability across the five interconnected states through T- and D-network connected energy resources • AEMO optimises the dispatch of energy resources considering T-network and D-network constraints • AEMO has a central role in coordinating how DER are used by the system as a whole • AEMO has the commercial relationship with DER via aggregators/retailers and is responsible for the financial settlement of market participants
DSO	• The DSO is responsible for the development and operation of the electricity distribution network following an active network management approach • The DSO collects bids and offers for DER service provision from the central market platform. The DSO prequalifies the DER bids into an aggregated bid stack that ensures the activation of these DER does not unduly constraint the distribution network The DSO passes the prequalified bids to AEMO for whole system optimisation • Based on network state and DER connected to the distribution network, the DSO provides a dynamic operating envelope to Aggregator/Retailer for all active DER at NMI level on a 5 minute basis. The DSO actively exchanges DER operating envelope information with AEMO to account for D-network constraints in AEMO's dispatch process • The DSO prequalifies, procures and settles the DER from aggregators/retailers for D-network constraint management via the central market platform
Aggregator / Retailer	• The aggregator/retailer combines different DER and offer their aggregated output as system services. The aggregator/retailer provides bids and offers directly to the central market platform based upon their DSO provided operating envelope. The aggregator/retailer activates DER based on dispatch instructions received from AEMO via the central market platform
Distributed Energy Resources	• Power generation technologies (including electric energy storage facilities) and end use electricity consumers (e.g. industrial and commercial) with the ability of flexing their generation or demand (i.e. demand side response) in response to control signals that are directly connected to the electricity distribution network. DER provide energy and network services to system operators (e.g. AEMO, DSOs, etc.) for electricity system balancing and network constraint management
Customer	• Domestic or industrial end-use electricity customers that are energy conscious and therefore have invested in off-the-shelf low carbon products (e.g. solar panels, heat pumps, electric vehicles, electric battery storage) to reduce energy bills. These customers may be exporting to and importing from the D-network and would seek to benefit from retailer's time of use tariffs; and/or • Domestic or smaller non-domestic end-use electricity customers with little or no interest in low carbon products or time of use tariffs

TWO STEP TIERED PLATFORM

Ref.: “Consultation on how best to transition to a two-way grid that allows better integration of Distributed Energy Resources for the benefit of all customers”, OpEN Energy Networks, AEMO and ENA, Jul., 2018

Actors and relationships

Two step tiered platform



Key characteristics

Market arrangements	• There is a single central market comprised of wholesale and ancillary services markets that is operated by AEMO • There is a local market(s) for regional and national system service provision from DER that is operated via a local market platform
AEMO	• AEMO organises and operates the central market • AEMO assesses all bids and offers and optimises the dispatch of energy resources considering T-network and D-network constraints • AEMO sends out dispatch instructions to energy resources directly or via a power exchange schedule at the D-network boundary
DSO	• DSO(s) organise and operate the local market(s) • The DSO receives DER bids and offers from the local market; prequalifies them into an aggregated bids stack per transmission connection point and passes them to AEMO • The DSO allocates dispatch to individual DER based on the power exchange schedule at the D-network boundary optimised for DER operating envelopes and network constraints • The DSO prequalifies, procures, dispatches and settles the DER from aggregators/retailers for D-network constraint management via the local platform

Roles and responsibilities

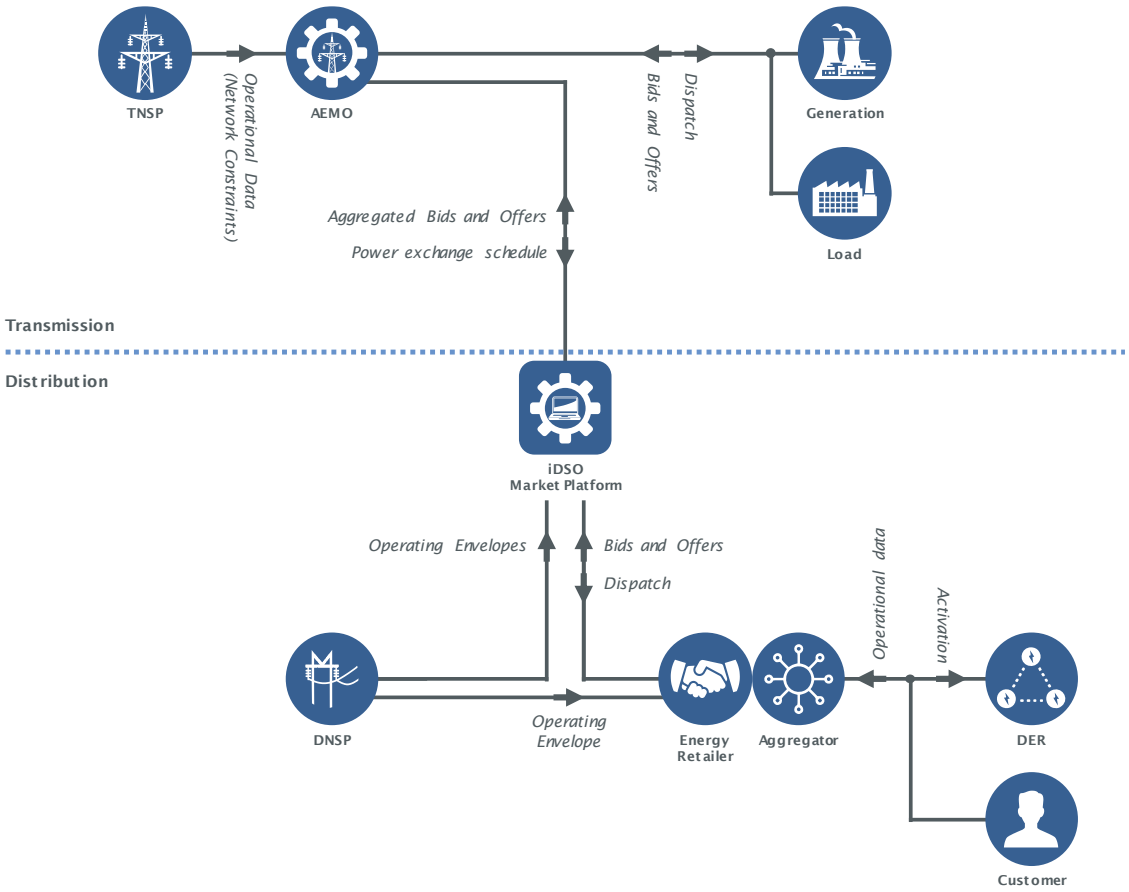
Market arrangements	• There is a central market comprised of wholesale and ancillary services markets (i.e. FCAS, NSCAS and SRAS) for energy resources connected at the T-network that is organised and operated by AEMO • The central market collects bids and offers directly from T-network connected market participants and indirectly from D-network connected market participants via the DSOs, to facilitate AEMO's whole system optimisation process • There is a local market for DER that is facilitated by the DSO of the respective geographical region via a local market platform • The local market platform collects bids and offers from DER via aggregators/retailers for T- and D-networks constraint management and electricity transmission system balancing • Both central and local markets facilitate the direct access of market participants to different markets enabling "value stacking" for energy resource owners
AEMO	• AEMO organises and operates the central market and is responsible for the dispatch and settlement of the market and system security and reliability across the five interconnected states through T- and D-network connected energy resources • AEMO assesses all bids and offers and optimises the dispatch of energy resources considering T-network and D-network constraints • AEMO optimises dispatch across the D-network boundary based on a power exchange schedule technically and commercially agreed with the DSO at every transmission connection point
DSO	• The DSO is responsible for the development and operation of the electricity distribution network following an active network management approach and for the organisation and operation of the local market for DER • Based on network state and DER connected to the distribution network, the DSO provides a dynamic operating envelope to Aggregator/Retailer for all active DER at NMI level on a 5 minute basis. The DSO actively exchanges DER operating envelope information with AEMO to account for D-network constraints in AEMO's dispatch process • The DSO collects bids and offers for system service provision by DER from the local market platform, prequalifies them into an aggregated bid stack per transmission connection point and passes them to AEMO for whole system optimisation • The DSO allocates dispatch to individual aggregators/retailers based on the power exchange schedule across D-network boundary resultant from AEMO's whole system optimisation process (i.e. market dispatch engine process) • The DSO acts as a non-commercial Aggregator over a defined geographic area offering regional and national services to the central market. The DSO becomes a balance responsible party from a national energy balancing perspective • The DSO prequalifies, procures, dispatches and settles DER from aggregators/retailers for D-network constraint management via the local market platform
Aggregator / Retailer	• The aggregator/retailer combines different DER and offer their aggregated output as flexibility services. The aggregator/retailer provides bids and offers directly to the local market platform. The aggregator/retailer activates the DER based on the dispatch instructions received from DSO via the local market platform

IDSO OPTIMISES DISTRIBUTION LEVEL DISPATCH

Ref.: “Consultation on how best to transition to a two-way grid that allows better integration of Distributed Energy Resources for the benefit of all customers”, OpEN Energy Networks, AEMO and ENA, Jul., 2018

Actors and relationships

iDSO optimises distribution level dispatch



Key characteristics

Market arrangements	• There is a central market comprised of wholesale and ancillary services markets that is operated by AEMO • There is local market(s) for regional and national system service provision from DER that is operated via a local market platform
AEMO	• AEMO organises and operates the central • AEMO assesses all bids and offers and optimises the dispatch of energy resources considering T-network and D-network constraints • AEMO sends out dispatch instructions to energy resources directly or via a power exchange schedule at the D-network boundary
iDSO	• iDSO(s) organises and operates the local market(s) • iDSO(s) receives DER bids and offers from the local market; prequalifies them according to their dynamic operating envelopes and provides aggregated bids to AEMO for whole system optimisation • iDSO(s) allocates dispatch to individual DER based on the power exchange schedule across the D-network boundary
DNSP	• The DNSP actively exchanges dynamic DER operating envelopes with the iDSO(s) to account for D-network constraints in AEMO's dispatch process • The DNSP procures and settles the DER from aggregators/retailers for D-network constraint management via the local market platform

Roles and responsibilities

Market arrangements	• There is a central market comprised of wholesale and ancillary services markets (i.e. FCAS, NSCAS and SRAS) for energy resources connected at the T-network that is organised and operated by AEMO • The central market collects bids and offers directly from T-network connected market participants and indirectly from D-network connected market participants via the iDSO(s), to facilitate AEMO's whole system optimisation process • There is a local market platform for DER that is facilitated by the iDSO(s). The local market platform collects bids and offers from DER via aggregators/retailers for T- and D-networks constraint management and electricity transmission system balancing • Both central and local markets facilitate the direct access of market participants to different markets enabling "value stacking" for energy resource owners
AEMO	• AEMO organises and operates the central market and is responsible for the dispatch and settlement of the market and system security and reliability across the five interconnected states through T- and D-network connected energy resources • AEMO procures energy resources connected to the T-network directly and to the D-network through the iDSO(s), optimising via the market dispatch engine • AEMO optimises dispatch across D-network boundary based on a power exchange schedule technically and commercially agreed with the iDSO(s) at every transmission connection point
iDSO	• The iDSO organises and operates the local market for DER • The iDSO collects collects bids and offers for system service provision by DER from the local market platform, prequalifies them into an aggregated bid stack per transmission connection point and passes them to AEMO for whole system optimisation • The iDSO allocates dispatch to individual aggregators/retailers based on the power exchange schedule across D-network boundary resultant from AEMO's whole system optimisation process (i.e. market dispatch engine process) • The iDSO acts as a non-commercial Aggregator over a defined geographic area offering regional and national services to the central market. The iDSO becomes a balance responsible party from a national energy balancing perspective
DNSP	• The DNSP is responsible for the development and operation of the distribution network following an active network management approach • Based on network state and DER connected to the distribution network, the DNSP provides a dynamic operating envelope to Aggregator/Retailer for all active DER at NMI level on a 5 minute basis. The DNSP actively exchanges DER operating envelope information with AEMO to account for D-network constraints in AEMO's dispatch process • The DNSP actively exchanges information with the iDSO(s), such as DER operating envelopes, network operational status and forecasts, to facilitate the consideration of distribution network constraints in the whole system dispatch process • The DNSP procures and settles distributed flexibility resources from aggregators/retailers for D-network constraint management via the iDSO's local market platform
Aggregator / Retailer	• The aggregator/retailer combines DER and offer their aggregated output as flexibility services. The aggregator/retailer provides bids and offers directly to the local market platform. The aggregator/retailer activates the DER based on the dispatch instructions received from iDSO via the local market platform

FUNCTIONS IN DER OPTIMISATION

Ref.: “Consultation on how best to transition to a two-way grid that allows better integration of Distributed Energy Resources for the benefit of all customers”, OpEN Energy Networks, AEMO and ENA, Jul., 2018

Functions in DER optimisation

No.	Function	Table
1	Distribution system monitoring and planning	I
2	Distribution constraints development	I
3	Forecasting systems	I
4	Aggregator DER bid and dispatch	II
5	Retailer DER bid and dispatch	II
6	DER optimisation at the distribution level	III
7	Wholesale - distributed optimisation	III
8	Distribution network services	II
9	Financial settlements (network services)	III
10	Data and settlement (wholesale and FCAS)	III
11	DER register	II
12	Connecting DER	IV
13	Network and system security with DER	IV

1. Distribution system monitoring and planning

No.	Function	Description	Activities	Description
1	Distribution system monitoring and planning	Enhanced function: distribution network monitoring to inform distribution network constraint development.	Gather network data	Gather historic and current distribution network data to facilitate distribution network forecasting and planning.
			Gather DER performance data	Gather historic and current DER data to facilitate distribution network forecasting and planning.
			Distribution network capacity requirements (long-term)	Forecast upcoming network capacity requirements and identify shortfalls in current distribution network design to meet future capacity requirements.
			Network planning and investment	Plan distribution network design in collaboration with other NSPs (both TNSPs and DNSPs), (i)DSOs and AEMO in order to make traditional and non-traditional investment decisions to satisfy distribution network thermal, voltage, system stability, security of supply, fault level and power quality requirements.

2. Distribution constraints development

No.	Function	Description	Activities	Description
2	Distribution constraints development	New function: to develop distribution network constraints in the form of operating envelopes that will be a key input into the distribution level optimisation.	Distribution network DER requirements (long-term)	Identify expected shortfalls in meeting distribution network thermal, voltage, stability, security of supply, fault level and power quality requirements through DNSP/DSO assets.
			DER engagement	Ensure that future DER requirements are reported within Distribution Annual Planning Reports which are used to engage with interested parties to understand the availability and requirements for resources.
			DER operating envelopes (real-time)	Based on network state and DER connected to the distribution network, the (i)DSO provides a dynamic operating envelope to Aggregators and Retailers for all active DER at NMI level on a 5 minute basis.

3. Forecasting systems

No.	Function	Description	Activities	Description
3	Forecasting systems	New function: provide key forecasting information to allow for distribution level optimisation - may be available to market participants	Advanced forecasting for distribution network operation	Better understand and estimate distribution network user response and requirements giving consideration to external factors including but not limited to: weather, market prices, non-electrical energy vectors (e.g. gas prices) and commercial arrangements between other network parties.
			Forecast network state (short-term)	Evaluate upcoming short-term network state giving consideration to user response and network configuration (Inc. planned outages).
			Distribution network DER requirements (short-term)	Identify upcoming short-term DER requirements to meet distribution network thermal, voltage, stability, security of supply, fault level and power quality requirements.

4. Aggregator DER bid and dispatch

No.	Function	Description	Activities	Description
4	Aggregator DER bid and dispatch	New function: aggregates local DER installation to provide bids into the energy, FCAS and Network Markets (within the provided operating envelopes).	Engage with DER to create Aggregator portfolio	Aggregator engages with and enters into commercial contracts with DER in order to create a portfolio of resources it may offer to other market participants.
			Aggregator bilateral reserve contracts	Aggregator enters into bilateral reserve contracts (short or long-term) to maintain network security and reliability. AEMO and/or the (i)DSO monitors market conditions and if necessary triggers the activation of reserves.
			Aggregator market engagement	Aggregator bids into the wholesale, FCAS, NSCAS and SRAS markets within its provided operating envelope and responds to dispatch instructions.

5. Retailer DER bid and dispatch

No.	Function	Description	Activities	Description
5	Retailer DER bid and dispatch	Enhanced function: retailer aggregates customer DER installations to provide bids into the Wholesale Market for scheduled generation, scheduled load, FCAS and Network Markets (within its provided operating envelope).	Engage with DER to create Retailer portfolio	Retailer engages with and enters into commercial contracts with DER in order to create a portfolio of resources it may offer to other market participants.
			Retailer bilateral contracts	Retailer enters into bilateral reserve contracts (short or long-term) to maintain network security and reliability. AEMO and/or the (i)DSO monitors market conditions and if necessary triggers the activation of reserves.
			Retailer market engagement	Retailer bids into the wholesale, FCAS, NSCAS and SRAS markets within its provided operating envelope and responds to dispatch instructions.

6. Distribution level optimisation

No.	Function	Description	Activities	Description
6	DER optimisation at the distribution network level	New function: optimise operating envelopes to ensure aggregated bid stacks for DER per area can feed into wholesale optimisation taking account of distribution network constraints.	Aggregation of market bids	(i)DSO receives bids via the market platform and tests these aggregate bids against operating envelopes.
			Allocation of DER dispatch within operating envelopes	Based upon required dispatch per DER area allocate dispatch within operating envelopes to individual customers, Retailers and/or Aggregators.

7.Wholesale - distributed optimisation

No.	Function	Description	Activities	Description
7	Wholesale - distributed optimisation	Enhanced function: Integrate distribution level optimisation results into existing wholesale market optimisation.	Update market dispatch engine	Determine and implement a transparent regulatory framework to create a network dispatch engine.
			Determine dispatch schedules for bilateral reserve contracts	Collaborate with market participants to determine dispatch schedules and triggers for the activation of reserve contracts.
			Receive market bids	Receive market bids within operating envelopes set by the (i)DSO and engage with the (i)DSO to test aggregate bids per DER area against operating envelopes.
			Receive market requirements	Receive TNSP and DNSP/(i)DSO network requirements for constraint management.
			Run dispatch engine	Run the dispatch engine for the wholesale, FCAS, NSCAS and SRAS markets and send out dispatch instructions per DER area.

8. Distribution network services

No.	Function	Description	Activities	Description
8	Distribution network services	Enhanced function: distribution network services, such as power quality/voltage control, which can be provided by aggregated DER, either through bilateral contract or potential through an optimisation.	Smart grid network solutions	Collaborate with the market participants to determine a dispatch schedule for DNSP/DSO smart grid network solutions and resolve conflicts.
			Bilateral reserve contracts for DSO network support and control ancillary services	(i)DSO enters into bilateral reserve contracts (short or long-term) and calls on these reserves to resolve distribution network constraints (non-network solutions).
			DSO market engagement for network support and control ancillary services	(i)DSO sends requirements for network support and control ancillary services to the market to resolve distribution network constraints (within the RIT/D process).

9. Financial settlements (network services)

No.	Function	Description	Activities	Description
9	Financial settlements (network services)	Enhanced function: financial settlement of distributed network services dispatched Network Market.	Settlement of bilateral contracts for network services	Gather metering data and make agreed availability and activation payments with 'clawback' arrangements.
			Settlement of NSCAS market	Determine NSCAS market clearing and settlement prices, gather metering data and facilitate payments with 'clawback' arrangements.

10. Data and settlement (wholesale and FCAS)

No.	Function	Description	Activities	Description
10	Data and settlement (wholesale, RERT and FCAS)	Enhanced function: AEMO settles wholesale and distributed level transaction. AEMO already settles the existing market to the NMI.	Settlement of bilateral contracts for wholesale reserve trading (RERT)	Gather metering data and make agreed availability and activation payments.
			Settlement of wholesale, FCAS and SRAS markets	Determine market clearing and settlement prices, gather metering data and facilitate payments.

11. DER register

No.	Function	Description	Activities	Description
11	DER register	New function: AEMO to provide DER register based on AEMC rule requirements.	Establish, maintain and update a DER register	Gather DER information from market participants as gathered through the network connection process and connection contract.
			Provide appropriate access to the DER register	AEMO will share locational and technical data of FER with relevant market participants.

12. Connecting DER *(N.B.: Suggested function)*

No.	Function	Description	Activities	Description
12	Connecting DER	Enhanced function: Regulatory, technical and commercial arrangements around the connection of DER to the distribution network.	Determine the regulatory framework for connections	Determine regulatory frameworks and arrangements for the connection of distribution network assets giving consideration to connection types, access rights and queue managements.
			Connect DER assets	Assess network capacity and requirements for connection within a network area and offer appropriate connection point and connection agreement.
			Manage DER connections	Manage arrangements for the commercial and technical control of connections - as allowed by the signed connection agreement and regulatory frameworks.
			Contribute to DER register	Gather and provide information on DER to AEMO for the purposes of establishing, maintaining and updating a DER register.

13. DER system security *(N.B.: Suggested function)*

No.	Function	Description	Activities	Description
13	Network and system security with DER	New function: DER contribution to, and influence on, system security.	Asset security	Determine regulatory framework and arrangements ensuring DER possesses adequate resilience and response to system disturbances (Inc. protection requirements).
			Distribution network security for high impact events	Determine regulatory framework and arrangements for DER to contribute to distribution network security during localised high impact events (e.g. extreme weather, fire, asset damaging accidents and incidents) giving consideration to emergency operating instruction sets and additional emergency DNSP/(i)DSO powers.
			Distribution network security under localised market failure	Determine regulatory framework and arrangements for DER to contribute to distribution network security during localised market failure giving consideration to emergency operating instruction sets and additional emergency DNSP/(i)DSO powers.
			Whole system security	Determine regulatory framework and arrangements for DER to contribute to whole system network security during widespread market failure and/or system emergency giving consideration to emergency operating instruction sets and additional emergency AEMO powers.
			System Restart	Determine arrangements for and enter into bilateral contract with DER for system restart ancillary services.

DEFINITION OF ACTORS AND GOALS

Actors

A-DER	Active DER	**SC**	Supply Chain
AEMC	Australian Energy Market Commission	**SGNS**	Smart Grid Network Services
AEMO	Australian Energy Market Operator	**TC**	Traditional Customer
Agg	Aggregator	**TNSP**	Transmission Network Service Provider
COAG-EC	Council of Australian Governments Energy Council	**T-Gen**	Transmission connected Generation
DNSP	Distribution Network Service Provider	**T-Load**	Transmission connected Load
DSO	Distribution System Operator		
ECA	Energy Consumers Australia		
ER	Energy Retailer		
Gas	Gas		
Heat	Heat		
iDSO	Independent Distribution System Operator		
P-DER	Passive DER		
Reg	Australian Energy Regulator		

Active DER

Actor	Definition	Goals
A-DER	Active DER are distribution level network customers with controllable behaviours who can adjust their electricity usage in response to price or dispatch signals. Active DER includes storage solutions, such as household batteries, and energy management systems which incorporate external control inputs or data feeds coordinated by an aggregator or retailer that can be used to actively 'orchestrate' their behaviour in response to high prices or other conditions.	• To be supplied with safe, secure and reliable electricity with high quality of service and at value for money. • Establish commercial relationship with energy suppliers and/or aggregators to maximise revenue from their energy assets through the provision of system services to the electricity markets.

Australian Energy Market Commission

Actor	Definition	Goals
AEMC	The Australian Energy Market Commission creates and amends the National Electricity Rules, National Gas Rules and National Energy Retail Rules. They also act as expert energy policy advisor to the COAG Electricity Council.	• Develop new energy rules as required by legislature. • Review and enact requests for amendments to energy rules. • Provide expert energy policy advice to government.

Australian Energy Market Operator

Actor	Definition	Goals.
AEMO	The Australian Energy Market Operator has responsibility for the management of the National Electricity Market and the Wholesale Electricity Market. AEMO sets the clearing and settlement prices of the markets, determines optimised dispatch schedules, sends out dispatch instructions and facilities market settlement. AEMO is tasked with maintains the frequency balance, system security and reliability of the electricity network across the five interconnected states through the use of T- and D-network connected energy resources and works with the TNSPs to develop transmission investment plans.	• Facilitate, dispatch and settle the wholesale, FCAS, NSCAS and SRAS electricity markets. • Balance the electricity system and maintain frequency. • Coordinate whole system security through defence and restoration plans. • Coordinate with TNSPs to develop transmission investment plants.

Aggregator

Actor	Definition	Goals
Agg	An aggregator facilitates the grouping of DER in order to act as a single entity when engaging in power system markets (wholesale, FCAS, NSCAS and SRAS). This grouping cancels out the uncertainties of non-delivery that would exist if only a single small asset was engaging with the markets. Aggregators will enter into commercial arrangements with DER in order to exercise control over their behaviour and adjust their electricity usage.	• To manage its portfolio of DER to maximise benefit to its customers. • To maximise revenue from its portfolio by bidding services into the electricity market and/or establishing bilateral contracts for services.

Council of Australian Governments Energy Council

Actor	Definition	Goals
COAG-EC	The Council of Australian Governments Energy Council represents federal, state, territorial and local government which work together to develop energy policy that delivers secure, clean, efficient and affordable energy supplies to consumers.	• To deliver a secure and resilient national energy system. • To deliver secure low-carbon energy at the least cost to consumers, taxpayers and the economy. • To reduce carbon emissions cost-effectively. • To secure ambitious international action on climate change. • To manage the nation's energy legacy safely and responsibly.

Distribution Network Service Provider

Actor	Definition	Goals
DNSP	In the 'iDSO optimises distribution level dispatch world' the DNSP will not transition to a DSO business model. Distribution Network Service Providers are responsible for the development and operation of the distribution network following an active network management approach in order to facilitate the secure, safe and reliable delivery of power flows between network connections. To overcome the challenges of increasing DER penetration on their networks DNSPs will engage with iDSOs to facilitate the consideration of distribution network constraints in the whole system dispatch process and, based on network state and DER connected, provide a dynamic operating envelope for all active DER.	• Invest, build, maintain and operate the electricity distribution network to maintain a safe and secure system. • Provide fair and cost-effective distribution network access that meets customer requirements and system needs efficiently. • Provide data / information to facilitate markets and service provision. • Develop Smart Grid Network Services to control distribution network constraints and derive revenue from the electricity markets. • Actively exchanges information with the iDSO to facilitate the consideration of distribution network constraints in the whole system dispatch process. • Deliver a dynamic operating envelope to all aggregators/retailers for all active DER at NMI level on a 5 minute basis.

Distribution System Operator

Actor	Definition	Goals
DSO	To overcome the challenges of increasing DER penetration on their networks DNSPs will transition to Distribution System Operator business models responsible for the development and operation of the distribution network following an active network management approach in order to facilitate the secure, safe and reliable delivery of power flows between network connections. DSOs will engage with the NSCAS market to alleviate distribution network constraints while also supporting the optimised participation of DER assets in the electricity markets through the provision of a dynamic operating envelope for all active DER.	• Invest, build, maintain and operate the electricity distribution network to maintain a safe and secure system. • Provide fair and cost-effective distribution network access that meets customer requirements and system needs efficiently. • Provide data / information to facilitate markets and service provision. • Develop Smart Grid Network Services to control distribution network constraints and derive revenue from the electricity markets. • Engage with the NSCAS market to alleviate distribution network constraints. • Deliver a dynamic operating envelope to all aggregators/retailers for all active DER at NMI level on a 5 minute basis.

Energy Consumers Australia

Actor	Definition	Goals
ECA	Energy Consumers Australia is an independent organisation created to promote the long-term interests of consumers with respect to the price, quality, safety, reliability and security of supply of energy, and to give residential and small business energy consumers a voice and advocate in the energy market.	• Ensure the consumer impact is considered through the industry change process. • Promote consumer value in industry discussions. • Provide consumer advice and support to other actors. • Ensure appropriate consumer protection arrangements are in place.

Energy Retailer

Actor	Definition	Goals
ER	An energy retailer is a company that primarily acts within the wholesale electricity market in order to buy and sell electricity from/to end-use electricity users. The retailer sets the prices that consumers pay for the electricity that they use and works in a competitive market where customers can choose any energy supplier to provide them with electricity. An energy retailer may enter into commercial arrangements with their DER customers to gain control over their behaviour and adjust their electricity use so that they may engage with the FCAS, NSCAS and SRAS power system markets.	• Buy and sell electricity on the wholesale market to derive revenue from the supply of electricity to customers at value for money. • Establish and mange a portfolio of DER to derive revenue through bidding services into the electricity market and/or establishing bilateral contracts for services.

Gas

Actor	Definition	Goals
Gas	Gas represents an energy system from which useful gas energy resources can be extracted or recovered either directly or by means of a conversion or transformation process (e.g. conversion of natural gas and derivatives into chemical energy). The gas energy vector makes this energy available for use away (time and space) from its source.	• To meet the gas needs of Australian consumers at value for money.

Heat

Actor	Definition	Goals
Heat	Heat represents an energy system from which useful heat energy resources can be extracted or recovered either directly or by means of a conversion or transformation process (e.g. conversion of heat exchanging fluids into thermal energy). The heat energy vector makes this energy available for use away (time and space) from its source.	• To meet the heat needs of Australian consumers at value for money.

Independent Distribution System Operator

Actor	Definition	Goals
iDSO	In the 'iDSO optimises distribution level dispatch' platform an independent Distribution System Operator is created as a separate entity for each DNSP. The iDSO is responsible for the transparent and unbiased aggregation of DER market bids, taking into account distribution network limits through close collaboration with the given DNSP, and will allocate dispatch to individual aggregators/retailers based on the power exchange schedule across D-network boundary set by AEMO.	• Aggregate DER bids per D-network boundary area to prevent dispatch which will worsen distribution network constraints. • Pass aggregated bids to AEMO to include in the central dispatch process. • Allocates dispatch to individual aggregators/retailers based on the power exchange schedule across D-network boundary resultant from AEMO's whole system optimisation process • Collaborate with the DNSP to identify and understand distribution network constraints.

Passive DER

Actor	Definition	Goals
P-DER	Passive DER are distribution level network customers with energy assets such as rooftop PV or batteries, and/or internal energy management systems which operate under local algorithms and are not controllable by third parties through external price or dispatch signals.	• To be supplied with safe, secure and reliable electricity with high quality of service and at value for money. • To derive revenue from their energy assets.

Australian Energy Regulator

Actor	Definition	Goals
Reg	The Australian energy regulator (AER) is responsible for regulating the electricity industry. The energy regulator carries out functions to protect the interests of current and future consumers of electricity wherever appropriate by promoting effective competition between persons or entities engaged in the generation, transmission, distribution or supply of electricity.	• Investigate and enforce compliance with national energy legislation and rules. • Monitor market operations including: bidding, prices, forecasts and dispatch. • Drive effective market competition.

Supply Chain

Actor	Definition	Goals
SC	Supply chain refers to a technology provider that designs, manufactures and supplies equipment and devices for the electricity network.	• To design, construct and supply products that comply with legal requirements when placed on the market or put into service and that can be used safely and without harm.

Smart Grid Network Services

Actor	Definition	Goals
SGNS	Smart grid network services are built and utilised by DNSPs/DSOs to help control active and reactive power flow on their networks either for constraint management purposes or in order to offer services to the FCAS, NSCAS or SRAS electricity markets. Smart grid network solutions include power electronic systems such as FACTS (Flexible AC Transmission Systems).	• To alleviate distribution network constraints and minimise the curtailment of network customers. • To derive revenue by bidding services into the electricity markets.

Traditional Customer

Actor	Definition	Goals
TC	Traditional customers are network customers without DER assets or energy management systems and are instead load only customers. They do not respond to dynamic pricing signals or dispatch instructions and they are not engaged with the power system markets. Traditional customers will include end-users from low economic backgrounds without access to financial capital for DER or energy management system engagement.	• To be supplied with safe, secure and reliable electricity with high quality of service and at value for money.

Transmission Network Service Provider

Actor	Definition	Goals
TNSP	Transmission Network Service Providers develop and operate the transmission network areas to facilitate the secure, safe and reliable delivery of power flows between network connections. TNSPs will engage with the NSCAS market to alleviate transmission network constraints and collaborate with AEMO to determine a long term asset investment plan.	• Invest, build, maintain and operate the electricity transmission network in collaboration with AEMO. • Provide fair and cost-effective transmission network access that meets customer requirements and system needs efficiently. • Provide data / information to facilitate markets and service provision. • Engage with the NSCAS market to alleviate transmission network constraints.

Transmission connected Generation

Actor	Definition	Goals
T-Gen	Transmission connected generators (e.g. nuclear, gas powered or coal fired power stations, etc.) are dispatchable assets which can operate in the wholesale, FCAS, NSCAS and SRAS electricity markets to: support the system operator in the matching of supply and demand and in responding to unbalance; manage transmission network constraints; and offer system restart services. Transmission connected generators can offer services through the increase or reduction of electricity volume being generated.	• Establish a commercial relationship with AEMO to derive revenue from the provision of services to the wholesale, FCAS, NSCAS and SRAS electricity markets.

Transmission connected Load

Actor	Definition	Goals
T-Load	Transmission connected load (e.g. industrial demand such as steelworks, refineries, etc.) operate in the wholesale, FCAS, NSCAS and SRAS electricity markets to: support the system operator in the matching of supply and demand and in responding to unbalance; manage transmission network constraints; and offer system restart services. Transmission connected load can offer services through the increase or reduction of electricity volume being demanded.	• Establish a commercial relationship with AEMO to derive revenue from the provision of services to the wholesale, FCAS, NSCAS and SRAS electricity markets.

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