09 August 2018

Energy Networks Australia
Unit 5, Level 12, 385 Bourke St
Melbourne
VIC 3000
Australia

Our ref:	33/99999/99 62916
Your ref:	

Dear Sir/Madam

Open Energy Networks Consultation Submission

The integration of Distributed Energy Resources under an Open Energy Networks is a strategic imperative for the future of the Australian electricity industry.

GHD notes and agrees with the imperatives of immediate actions outlined in the joint AEMO-ENA discussion paper. These actions will pave the way for successful management, optimisation and dispatch of DER.

GHD is pleased to provide the following direct answers to the Consultation Questions:

Section 2: *Pathways for DER to provide value* describes both passive and active DER and poses two Consultation Questions:

1. *Are these sources of value [explained therein] comprehensive and do they represent a suitable set of key use-cases to test potential value release mechanisms?*

An additional use-case to determine DER value, lies in the potential of Electric Vehicles (EVs). While still fairly infantile in Australia. As EVs slowly gain in popularity, and as existing passive inverters for PV systems eventually reach end-of-life, there is increased likelihood that, through replacement, the majority of DER will be active. This will be seen as cooperating with the EV charger, either by balancing export with import (charging), or by sharing a d.c. bus. The role of aggregators will be significant to be able to manage the variability of the car's presence at the charging point, and also thresholds that will be set by the driver (not wanting a vehicle with an empty charge purely for electricity gain). All-day parking lots (e.g. inner city) could offer charging points for customers and offer aggregated energy storage if it can be predicted each car will be fully charged when the motorist returns. Such arrangements would be more useful for virtual power plants. GHD recommends that this is explored further.

It would be important that the design of any implementation systems allow for the dynamic locational aspect of electric vehicles. For instance a rooftop PV system, in house battery energy storage system and electric vehicle would allow the one prosumer to generate power at on geographic location but to inject and withdraw it at multiple locations. Each location may be subject to different congestion signals and hence the relative value of electricity at each location may be different. Maximising the value from active DER will require systems that support prosumers to efficiently optimise their consumption and or generation decisions for their portfolio of devices at different locations. GHD recommends considering whether the different implementation options being considered offer relative advantages for prosumers wanting to manage decisions across a portfolio of devices at different locations.

2. *Are stakeholders will to share work they have undertaken and may not yet be in the public domain, which would help to quantify and prioritise these value streams now and into the future?*

Nothing to contribute.

Section 3: ***Maximising passive DER potential*** describes the projected increase in passive DER, challenges, and ways to manage them. The Consultation Questions posed are:

1. *Are there additional key challenges presented by passive DER beyond those identified here?*

The example provided in Figures 5 highlights the potential growth in passive roof top PV in the South West Interconnected System (SWIS). Most of that PV will be located in a relatively small geographic area around Perth. The relatively condensed geography creates the risk that a severe cloud cover event creates a relatively rapid and very large change in the PV output which would be difficult to manage given the very low levels of other forms of generation that would be dispatched at the time.

Active DER could alleviate this issue providing confidence that domestic battery energy storage systems responded to the cloud cover event. This is an important challenge for the SWIS given its lack of interconnection.

Both Figure 5 and Figure 6 indicate the potential for DER to become the largest source of generation on the power system when viewed at an aggregate level. The technical performance requirements of large individual generators is currently extensively investigated as part of the connection process resulting in the negotiation of generator performance standards and a regime that requires generators to demonstrate ongoing compliance with those requirements. Currently DER generators are not subject to the same process for negotiating an acceptable level of technical performance or for demonstrating ongoing compliance with a performance standard. This difference in approach is consistent with an individual DER not being of sufficient size to impact system security. However when viewed at an aggregate level it becomes clear that the technical performance of the aggregate collection of DER in a regional can have a significant impact on system security.

A key challenge with continued expansion of passive DER is that there is a lack of control over the aggregate technical behaviour creating uncertainty regarding the aggregate technical performance. With no party being responsible for ensuring compliance of the aggregated DER with a required level of technical performance. While the proposed active DER frameworks may address this, it is recommended that design of those frameworks give careful attention to whether they provide sufficient confidence for the system and network operators that the anticipated aggregate response will be delivered when required. Any serious lack of confidence may limit the benefits delivered by active DER.

2. *Is this an appropriate list of new capabilities and actions required to maximise network hosting potential for passive DER?*

The list is appropriate, but there is insufficient clarity about what is ‘smart DER’ as opposed to ‘active DER’. Research has been done on the limits of smart DER: inverters that can absorb or provide reactive VArs (Volt/VAr control) can be partially effective at voltage control, but do not address the problem of thermal network limits. Only inverters that have Volt/kW curtailment are effective at this problem. Therefore it is useful to break ‘smart DER’ into at least these two categories.

3. *What other actions might need to be taken to maximise passive DER potential?*

Regarding undiversified exports from solar systems that may exceed peak demand levels on local network infrastructure, and assuming DNSPs do not install batteries themselves, there is a need to locally identify opportunities for batteries in network hotspots. This could be in-market or out-of-market, but the opportunity information (desired storage magnitude and detailed geographical information) should be published in a transparent way.

Section 4: *Maximising active DER potential* describes challenges of active DER and virtual power plants. The Consultation Questions posed are:

1. *Are these the key challenges presented by active DER?*

As per section 2 question 1 response.

2. *Would resolution of the key impediments listed be sufficient to release the additional value available from active DER?*

Ramp rates should not be stated as a critical barrier, they are similar to existing AS4777 requirements and inverter set-points. In WA, Horizon Power allows PV beyond nominal hosting limits only with storage and certain stated ramp rates, to allow generation to respond. While figure 9 is revealing, one would think that ramp rate restrictions when coupled with network limits applied through inverter control (i.e. curtailment) would be sufficient to moderate these spikes. Customers charging their storage prior to a storm is a new peak phenomenon (like A/C peak on hot days), and should be forecast along with other weather events. If aggregated as a VPP, this would be controlled via central dispatch.

3. *What other actions might need to be taken to maximise active DER potential?*

Forecasting how passive/active DER changes when each respective system (or sub-component) reaches end-of-life, as customers decide to upgrade or decommission parts of their installation in response to technology changes, market signals, and their own financial circumstances.

4. *What are the challenges in managing the new and emerging markets for DER?*

Nothing to contribute at this point. This will depend upon the structure of these markets.

5. *At what point is coordination of the Wholesale, FCAS and new markets for DER required?*

The new and emerging markets, including the potential FFR market, will need to be carefully planned and structured. Coordination will be required in the planning phase, to ensure that the markets work together and that market works as a whole.

A new registration process will also need to be developed to allow for registration of DER in both the existing markets, and any new markets.

Section 5 *Frameworks for DER optimisation within distribution network limits* describes three possible model frameworks. It poses the Consultation Questions:

1. *How do aggregators best see themselves interfacing with the market?*

Nothing to contribute.

2. *Have the advantages and disadvantages of each model been appropriately described?*

There is more to add, particularly the speed of implementation. In this regard, the two-step-tiered platform may have an advantage, since adding aggregation of bids to their existing systems which have detailed information and management of network limits may be faster than options (1) or (3). For option (1) (single integrated platform by AEMO), AEMO's existing platform would have to be extended below existing transmission connection points, into distribution networks; this extension may be problematic and cause delay.

3. *Are there other reasons why any of these (or alternative) models should be preferred?*

While each DNSP is different, a common platform could be used by all DNSPs for communication of dispatch and aggregation of bids. This platform could even by hosted and maintained by AEMO (i.e. software as a service), with a common I/O interface that each DNSP can tailor to their respective network management platforms. Where existing standards or solutions exist, they should be utilised.

Section 6: *Immediate actions to improve DER coordination* describes seven immediate 'no regrets' actions. GHD agrees with the "no regrets" actions outlined. Section 6 also poses Consultation Questions:

1. *Are these the right actions for the AEMO and Energy Networks Australia to consider to improve the coordination of DER?*

In principle GHD agrees with the proposal objectives. However, we believe that at least some of those objectives have already been met in readily available standards and technologies which were specifically created to meet such objectives on the international stage. We would therefore recommend initiatives that choose to invest in the use of these existing mechanisms from the outset.

2. *Are there other immediate actions that could be undertaken to aid the coordination of DER?*

Yes. The key actions must be to inform the industry on the existence of the existing solutions and create a common approach to using these solutions.

The "no regrets" action *Standards for DER monitoring and management* describes the need to develop technical standards and protocols to encourage interoperability. The power sector has already achieved this goal with the IEC 61850 series of Standards.

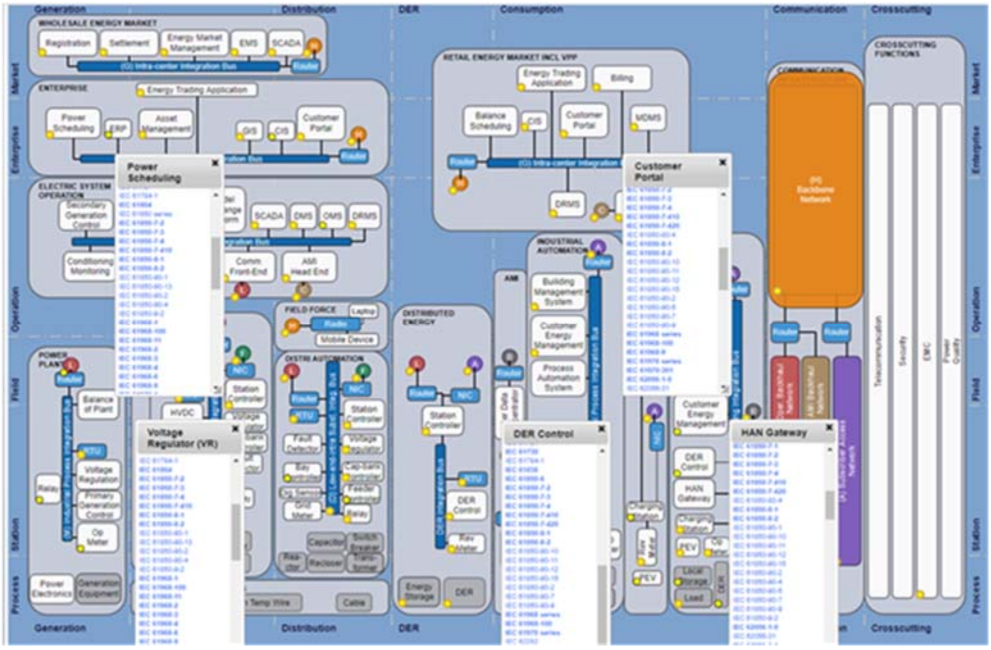
GHD, having one of Australia's leading practitioners in the IEC 61850 protocol in Rod Hughes, provides the following information and recommended actions in response to this Consultation Question.

The IEC 61850 Standard has been in existence for 25 years, and is increasingly becoming the base Standard for information exchange about all parts of the power system operations and is therefore a key enabler of the “Smart Grid”. GHD would encourage the ENA and other parties to invest in adoption of this Standard.

The vast array of stakeholders, functions and device suppliers involved in DER implementation demands appropriate solutions based on interoperability. The term interoperability has two facets:

- the common reference of real time communication messages between intelligent electronic devices (IEDs), their functions and the associated applications – i.e. the “protocol” of the communication,
- the engineering process, engineering file exchange and engineering tools to define application requirements and multitude of disparate vendor device capabilities with the aim of ultimately configuring the devices to communicate interoperably.

Due to the imperative of interoperability, the IEC themselves reference IEC 61850 as one of the base Standards that will enable the so-called Smart Grid to be established. In this reference, http://smartgridstandardsmap.com/, the <<Architecture View>> interactive tab shows that IEC 61850 has some role to play for most of the functional elements (example below) from generation to DER through to home automation.



IEC 61850 - A Mature System

The development of IEC 61850 was initiated some 25 years ago in the early 1990’s.   The series was first released as 14 Parts over the 2002-2004 period and therefore already has some 15 years of in-service maturity and experience. It has now evolved to some 30 available parts and many additional Parts dealing with more expansive application of the IE 61850 principles.

Some Parts strictly define the communication protocol for the exchange of commands and information between applications (IEC 61850-8-1, IEC 61850-9-2)

The Standard also has established two additional components which sets this apart from other protocols and forms the basis of smart systems:

- A common data semantic i.e. the naming of each piece of information pertaining to the power system and its operation (IEC 61850-7-x)
- A vendor-agnostic engineering process for the exchange of capability and configuration data between engineering tools, ultimately creating the individual IED configurations of the communication and operation parameters (IEC 61850-6)

The Standard is already being deployed in an array of domains directly involved in creating a flexible DER regime including:

- Condition Monitoring
- Metering
- Hydro- electric models
- Wind turbine models
- Distributed Energy Resources
- Electric vehicle models
- Battery Energy Storage Systems

This vast array of applications implies that are more than a few communication interfaces and certainly a plethora of information exchanges that are required. Devices providing those functions and pieces of information need to provide a consistently named set of information in a way that allows the thousands of individual devices from hundreds of different vendors to be integrated into the overall system engineering to make these devices communicate using appropriate vendor-agnostic tools.

IEC 61850 Implementation Strategy

In recognising the imperative of using IEC 61850 to facilitate the system engineering of a DER landscape, we must recognise that there is a vast array of experience over the last 15 years internationally and within Australia on the deployment of IEC 61850. It is also necessary to recognise that some of that experience has been more successful than others. The large international commitment over some 25 years, and the ongoing commitment to expanding the application and benefits of IEC 61850, shows that this Standard is intended to make engineering of intelligent systems easier, in fact that it is an imperative to do so in the “Big Data” and “Internet of Things” that will characterise emerging DER systems. On the other hand these experiences indicate that there are many ways engineering processes can use the Standard. The clear lesson of that is the implementation of the Standard must be supported with appropriate education, application guidelines and tools sets to ensure the system engineering provides a successful outcome for all stakeholders.

GHD therefore suggests the following actions:

1) Engage IEC 61850 specialists to inform the ENA/AEMO and stakeholders about the objectives and applications of IEC 61850.

2) Convene a Working Group to define all interfaces between AEMO, TNSP, DNSP and DER providers to be defined by IEC 61850 semantics.
3) Engage with Standards Australia EL-050 as the liaison with IEC TC57 WG10 responsible for the evolution of IEC 61850 to ensure Australian needs are identified and met, as well as early identification of new facilities within the Standard that can be implemented in Australia.
4) Establish a 2-year horizon deadline, with an appropriate action plan, for all interfaces to be implemented as IEC 61850.
5) Establish educational upskilling opportunities to create a formally qualified practitioner engineering cohort.
6) Engage with specialist IEC 61850 tool providers to ensure there is an appropriate tool set for IEC 61850 based DER engineering

GHD's Rod Hughes is a well-known Australian vendor-independent specialist trainer and thought leader in this Standard and is a representative on EL-050. GHD would welcome the opportunity to work with AEMO and the ENA to develop and implement these actions.

Sincerely

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