HOUSTONKEMP
Economists

Distributors' incentives to efficiently incur DER export expenditure

A report for the Independent Pricing and Regulatory Authority

22 July 2020

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Executive summary

This report has been prepared by HoustonKemp at the request of the NSW Independent Pricing and Regulatory Tribunal (IPART) and presents an assessment of options for modifying the regulatory framework to provide the NSW distribution networks with a financial incentive to relieve network constraints on customer exports from Distributed Energy Resources (DER), when it is efficient to do so.[1]

We have been asked to focus on the extent to which the options considered are capable of being implemented by 1 July 2024 (the start of the NSW distributors' next regulatory control period). We have also been asked not to rule out options that may result in near-term increases in price, where the longer-term impact is expected to provide benefits to customers.

DER is a term that captures a broad range of technologies operating behind a customer's meter that are capable of offsetting or shifting individual customer demand. DER includes:

- generation: which in Australia is predominately rooftop solar but also includes wind turbines, biofuels and diesel generators;
- demand response: that shifts or curtails certain household activities such as pool pumps, hot water systems and air conditioners; and
- storage: including batteries, thermal storage and electric vehicle (EV) charging.

The growing prevalence of rooftop solar, batteries, electric vehicles, and the emergence of new participants such as aggregators is transforming the role of the distribution network. These changes will pose challenges for the current framework of network regulation and will may require systemic changes to realise the full benefits of these new technologies. That said, in this report we have focused on incremental changes to the regulation of distributors that incentivise distributors to efficiently relieve DER export constraints (ie, DER export expenditure).

In the development of this report, we have been cognisant of the reform processes occurring currently at the national level relating to efficiently integrating DER into the energy market, including the ARENA/AEMC Distributed Energy Integration Program (DEIP) program. We also conducted a number of stakeholder interviews both with the NSW distribution networks and a cross-section of stakeholders, including customer representatives, Virtual Power Plant aggregators, regulatory bodies (AEMC and AER) and network representatives.

An increase in DER is posing challenges for distribution networks, but NSW distributors are not at the forefront

We find that the take up of DER is posing a range of challenges to the management of distribution networks across the National Electricity Market (NEM). DER penetration is projected to increase across the NEM, which means that the challenges DER penetration poses to the networks are expected to become more widespread and material.

While all distributors will be challenged by DER growth within their networks, there are a number of factors that suggest the impact of DER will be relatively modest and delayed for NSW distributors compared to other states (except Tasmania), including:

- Queensland and South Australian distributors have a higher degree of solar penetration per customer than all of the NSW distributors;

[1] In this report we refer to network expenditure that relieves network constraints on customer exports from DER, as 'DER export expenditure'.

- NSW distributors have a lower ratio of solar installed to LV transformer capacity than distributors in Queensland, South Australia and Victoria (except CitiPower); and
- distributors in Queensland and South Australia also have a longer average LV line length per customer compared to Ausgrid and Endeavour Energy, although Essential Energy's average line length is second only to SA Power Networks.

We also found evidence that:

- for the majority of DER customers there is a relatively low materiality of the cost to them of insufficient network hosting capacity (estimated to be in the order of $4 - $5 per year for one NSW network, and $3 - $12 per year in South Australia, where customers experience more substantial constraints on their exports than in NSW).
  - > While these estimates are only approximate, they suggest that the magnitude of the issue is low, a conclusion that was supported by our conversations with customer representatives;
  - > Notwithstanding, there is also evidence that a minority of DER customers experience much more substantive constraints, and so bear a disproportionate impact; and
- distributors have differing levels of visibility of DER and their LV networks, with NSW networks having limited visibility of the impact that their network has on the operation of DER. This limits the form of incentive arrangement that could be introduced, at least in the near term.

The current regulatory framework does not provide financial incentives for efficient DER export expenditure

The incentives for efficient DER export expenditure under the current regulatory arrangements are:

- efficient DER export expenditure can be included in a distributor's expenditure allowances, with the details of how a distributor would demonstrate efficiency the subject of a currently open AER consultation process;
- however, the inclusion of DER export expenditure in a distributor's total expenditure allowances does not require the distributor to undertake the project, instead it remains for the distributor to prioritise its expenditure within its approved opex and capex expenditure budgets;
- unlike demand management, a distributor is not provided with an additional positive incentive for DER export expenditure that allows the business to recover more than its costs whilst also delivering a net benefit to customers;
- distributors have a strong financial incentive to minimise DER export expenditure over the regulatory period without any counterbalancing service quality incentives to provide DER hosting capacity to allow greater DER exports; and
- there is no minimum service standard for DER customers that requires distributors to pay an amount to customers who experience service levels below the threshold level network hosting capacity.

Overall, the current incentive framework applied to the NSW distributors is weighted towards minimising expenditure, without any counterbalancing service quality incentives to provide DER hosting capacity to allow greater DER exports. This is likely to promote a less than efficient level of DER exports due to limited network hosting capacity.

We understand from stakeholder meetings that distributors are undertaking DER export expenditure in response to customer complaints. However, projections of future DER growth in NSW, together with the experience in other Australian jurisdictions, suggest that the need to ensure that the regulatory arrangements provide incentives to provide an efficient level of DER hosting capacity will become an important issue.

Alternative options for providing an incentive for efficient DER exports

We have assessed options for reform against the following criteria:

- whether the option improves incentives to efficiently incur DER export expenditure and addresses concerns regarding shortfalls with the current incentives ;
- whether the option provides efficient network prices which signal the future cost incurred by networks to facilitate DER exports;
- whether the option addresses concerns that network limitations on the production of DER can give rise to equity issues in that:
  - some DER customers are disproportionally impacted by network constraints; and
  - investments in DER are being undertaken by customers without easy visibility of the local area network constraints to DER generation; and
- whether the option can be implemented for the NSW distributors next regulatory control period starting 1 July 2024.

We assessed the following six DER reform options:

- an information disclosure option that required distributors to publish DER-related information;
- a new guaranteed customer service standard that would compensate individual DER customers that receive below a minimum threshold of network access to export electricity;
- a DER expenditure incentive margin option (similar to the Demand Management Incentive Scheme (DMIS) applied to demand management expenditure) that allows distributors to recover more than their efficient DER export costs so long as the costs (including the margin) remain less than the total system wide benefits of the increased DER hosting capacity;
- a removal of the prohibition on distributors charging Distribution Use of System (DUoS) charges on DER exports within the current standard control revenue cap;
- classifying DER exports as an alternative control service and removing these services from the standard control revenue cap and instead making them subject to a price cap; and
- the introduction of a DER component in the AER's STPIS mechanism that would provide explicit financial incentives for distributors to undertake efficient DER export expenditure.

IPART should consider establishing a new requirement to disclose information relating to DER constraints

We concluded that IPART/NSW Government should consider establishing a new licence requirement on the NSW distributors to disclose information relevant to the quality of service provided by each distributor to DER customers. We believe that there are no practical impediments to this option being implemented by IPART/NSW Government through a change to the NSW distributor licences by 1 July 2024. This option would:

- provide a non-monetary incentive for distributors to optimise export capacity through a combination of moral suasion and the implicit threat of future regulatory intervention; and
- provide information on the location of DER-related complaints, so that customers considering investing in DER systems have an indication of where networks are constraining DER customers; however
- this option does not improve the efficiency of network prices for DER nor address concerns about inequal access to the network for some DER customers, although this option could complement other measures more specifically targeted at these concerns.

For this option to be implemented we recommend that IPART undertake a consultation process that seeks to identify:

- the specific information to be required by the information disclosure regime, which should only include data distributors already retain so that there are not material additional costs imposed on distributors;
- the specific information that should be provided on a "best endeavours basis", which would include data that distributors can reasonably expect to collect in the medium term;
- the completeness of the information required, to ensure that the disclosure regime is effective and does not give rise to any unintended adverse incentives; and
- development of a visualisation tool for DER complaints that could be provide to the public and would be periodically updated as new information becomes available.

IPART should remain open to introducing a new Guaranteed Customer Service Standard targeted at DER customers, once adequate systems are in place

We recommended that IPART/NSW Government remain open to implementing a new Guaranteed Customer Service Standard (GCSS) targeted at DER customers in the future when NSW distributors have systems capable of validating curtailment of individual customer DER systems. A NSW GCSS targeted at DER customers would compensate individual DER customers experiencing very poor network hosting capacity which would:

- create a financial incentive for distributors to reduce the level of network constraints experienced by DER customers with the worst network access, although it would not provide an effective incentive for distributors to efficiently optimise network hosting capacity for all customers; and
- mitigate stakeholder concerns that a small number of DER customers experience very poor levels of network access.

The primary reason that we consider that a GCSS cannot practically be introduced at this point in time is that NSW distributors do not currently have the capabilities to independently verify breaches of the GCSS. This would require distributors to have greater visibility of customer DER production and to ensure that any curtailment was due to insufficient network hosting capacity.

Reforms to introduce national DER incentive arrangements should allow flexibility for different approaches

The final four options we considered would need to be introduced through changes to the national regulatory framework, although IPART/NSW Government could provide support through the consultation process for the adoption of one or more of these options by the AEMC and AER. If a national DER incentive mechanism is introduced, we recommend that NSW advocates that it be sufficiently flexible so that different incentive mechanisms could be applied to different distributors. That is, the Rules should allow the AER to determine and apply an incentive mechanism that is proportionate to the materiality of the issue for that network as well as the capabilities of the network's information collection systems.

DER incentive margin

The first of the four national reform options assessed was a DER incentive margin mechanism that would allow distributors to recover more than their efficient DER export costs so long as the costs (including the margin) is less than the total system wide benefits of the increased DER hosting capacity. This option would:

- provide distributors with a positive incentive to propose and deliver efficient DER export projects; and
- requires no additional information than that already required of distributors to propose DER export expenditure as part of their regulatory proposals.

However, this option encourages distributors to propose efficient DER export projects that maximise incentive payments, rather than projects that have the largest net benefits. Further this option, would not:

- improve the efficiency of pricing signals to DER customers;
- address the issues of inequal network access between DER customers; or
- provide DER investors with information on the location of network constraints.

This option represents a targeted and credible solution to the imbalances in the current incentive framework for DER export expenditure. In our opinion, this option would be appropriate to apply to the NSW distributors from 1 July 2024.

Removing the restriction on distributors charging DUoS

The second reform to the national regulatory framework assessed was removing the restriction on distributors charging DUoS on DER exports. This option would allow distributors to appropriately signal to DER customers the costs they impose on the network. More efficient DER network tariffs would promote the efficient use of the network by DER customers. However, while distribution standard control services remain regulated using a revenue cap, this option would not provide any financial incentive for distributors to efficiently increase DER export capacity. Further this option, would not:

- address the issues of inequal network access by between DER customers; or
- provide DER investors with information on the location of network constraints.

In our opinion, reforms that allow distribution tariffs to be more efficient should be supported, including those that allow distributors to charge DUoS to DER exporters. That said, more fundamental reforms to network tariffs may be necessary to realise the full benefits of new technologies, such as local use of system, full two-way, or aggregate retailer pricing.[2]

A result of the Distributed Energy Integration Program (DEIP) the AEMC has received three rule change requests that seek to remove the prohibition on distributors charging DUoS on DER exports.[3] The AEMC has indicated that it is considering these requests and will announce the next steps on initiating a public consultation on these requests in the near future.

Classifying DER exports as an Alternative Control Service

The third potential reform to the national regulatory framework is similar to the option above in that it would allow distributors to charge DER customers for the export of electricity. However, under this option DER exports would be classified as an alternative control service (ACS) rather than a standard control service, which would allow this service to be regulated by way of a price cap. A price cap on DER exports would incentivise distributors to reduce the network constraints on DER generation to benefit from increased DER export revenues.

To balance the expenditure incentives this option would include a mechanism that would allow the distributor to retain any incremental increases (decreases) in throughput due to increased (decreased) hosting capacity for a period of six years. However, this option would not address issues of inequal network access or provide DER investors with information on the location of network constraints (which could be addressed by a DER export GCSS).

Consequently, classifying DER exports as ACS provides additional advantages compared with just removing the prohibition on charging DUoS on DER exports. In our opinion, this option should be supported for the NSW distributors if a more expansive option to address DER export incentives is warranted.

[2] See CEPA, *Distributed Energy Resources Integration Program – Access and pricing Reform options | Australian Energy Market Commission*, 9 April 2020, pp 99-111.

[3] AEMC, https://www.aemc.gov.au/news-centre/media-releases/stakeholders-start-ball-rolling-proposals-regulatory-makeover-so, accessed 22 July 2020.

Inclusion of a DER component in the AER's STPIS mechanism

The final option assessed would be to expand the AER's existing Service Target Performance Incentive Scheme (STPIS) mechanism to include a DER component. Under this option the distributor would be rewarded (penalised) when the quantum of DER exports constrained by insufficient hosting capacity of the network is less (more) than the STPIS target. Where the incentive rate is set by reference to the value of DER exports, the STPIS would internalise the costs and benefits of DER export expenditure and foster efficient levels and locations of DER export expenditure. However, this option would not:

- improve the efficiency of the pricing signals to DER customers;
- address the issues of inequal network access by between DER customers; or
- provide DER investors with information on the location of network constraints.

While this option provides superior incentives for efficient DER export expenditure, NSW distributors do not currently have visibility on the extent that their networks constrain DER exports. Consequently, it is not currently possible for NSW distributors to either estimate the DER STPIS targets or measure DER outcomes. This option may be possible to implement in other jurisdictions which have superior information systems or could be applied in NSW in the longer term, if investments are made to directly monitor DER generation within their networks.

1. Introduction

This report has been prepared by HoustonKemp at the request of the NSW Independent Pricing and Regulatory Tribunal (IPART) and presents an assessment of options for modifying the regulatory framework to provide the NSW distribution networks with an incentive to relieve network constraints on customer exports from Distributed Energy Resources (DER), when it is efficient to do so.[4]

Our engagement is in the context of IPART's review of electricity distribution reliability standards in NSW, where IPART has been tasked with recommending:[5]

- any changes to electricity distribution reliability standards for the NSW distribution network businesses that could deliver bill savings to NSW electricity customers; and
- any other measures that could be imposed on or implemented by the NSW distribution network businesses within the current regulatory framework that would be likely to reduce network prices and are consistent with the National Electricity Objective.

As part of its review, IPART:

- has published an issues paper – March 2020;
- will publish a draft report – September 2020;
- will conduct a public hearing – October 2020; and
- will publish a final report – December 2020.

IPART's issues paper identified that NSW customers are increasingly taking up technologies that allow them to generate electricity and export this energy to the grid. However, the NSW distribution networks were not designed for two-way flows. As part of IPART's review, IPART:[6]

> …will consider whether reliability standards should be set to take into account changes in the network to enable two-way energy flows, what that could look like in practice, the barriers to implementation, and what might be an appropriate transition path.

To this end, IPART has engaged HoustonKemp:

> To provide advice on an appropriate regulatory framework and associated measures to incorporate the value that customers place on reliably exporting power to distribution networks using DER.

This report identifies and assesses a number of options that, individually or in combination, have the potential to provide the NSW distribution networks with incentives to relieve network constraints on DER exports, where it is efficient to do so. In doing so, it recognises and has regard to various workstreams that are currently on-going at a national level, that are considering similar issues.

We also note that the growing prevalence of rooftop solar, batteries, electric vehicles, and the emergence of new participants such as aggregators is transforming the role of the distribution network. These changes will pose challenges for the current framework of network regulation and will may require systemic changes to realise the full benefits of these new technologies. That said, in this report we have focused on incremental

[4] In this report we refer to network expenditure that relieves network constraints on customer exports from DER, as 'DER export expenditure'.

[5] The Hon Gladys Berejiklian MP, *Terms of Reference for IPART to review electricity distribution reliability standards*, 26 February 2019, p 2.

[6] IPART, *Review of distribution reliability standards*, March 2020, p 34.

changes to the regulation of distributors that incentivise distributors to efficiently relieve DER export constraints (ie, DER export expenditure).

We have been asked to focus on the extent to which the options considered are capable of being implemented by 1 July 2024 (the start of the NSW distributors' next regulatory control period). We have also been asked by IPART not to rule out options that may result in near-term increases in price, where the longer-term impact is expected to provide benefits to customers.

In the development of this report, we have conducted a number of stakeholder interviews both with the NSW distribution networks and also a cross-section of networks and network representatives in jurisdictions where constraints on DER exports are more pronounced, customer representatives and Virtual Power Plant aggregators, as well as the Australian Energy Regulator (AER) and the Australian Energy Market Commission (AEMC).

We have incorporated feedback and observations from this consultation throughout the report, which have provided insight into:

- the issues DER pose to distribution networks;
- customer perspectives;
- current workstreams relating to DER at the national level; and
- the services being offered by market participants in relation to DER constraint issues.

1.1 Structure of this report

We have considered six options that have the potential to provide the NSW distribution networks with an incentive to relieve network constraints limiting DER exports. These options are assessed against criteria that summarise the issue and practicability of IPART implementing these options. In particular, we have focused on the extent to which the options would be able to be implemented in time for the upcoming 2024-25 to 2028-29 regulatory period for the NSW distribution networks.

Our report is structured as follows:

- section 2: provides background on the issues that DER poses to the management of distribution networks and how this varies between both the NSW distribution networks and distributors across the rest of the National Electricity Market (NEM);
- section 3: provides context relating to recent and on-going workstreams at the national level relating to DER;
- section 4: discusses the current regulatory framework and its implications for the financial incentives for distributors to efficiently incur expenditure to increase DER hosting capacity;
- section 5: presents our framework for assessing alternative incentive options;
- section 6: presents six potential incentive mechanisms and considers these against the assessment criteria; and
- section 7: concludes.

2. Background

DER is a term that captures a broad range of technologies operating behind a customer's meter that is capable of offsetting or shifting individual customer demand. DER includes:

- generation: which in Australia is predominately rooftop solar but also includes wind turbines, biofuels and diesel generators;
- demand response: that shifts or curtails certain household activities such as pool pumps, hot water systems and air conditioners; and
- storage: including batteries, thermal storage and electric vehicle (EV) charging.

The penetration of DER is increasingly posing challenges for the management of distribution networks. Whilst some networks are more capable of tolerating higher levels of DER penetration than others, penetration is projected to increase across all networks. The extent to which this translates into widespread challenges will ultimately depend on the interaction between higher levels of distributed generation and storage (including from EVs). However, the increasing uptake of DER clearly has the potential to result in increased challenges in accommodating the demand from customers to use those resources to export power back into the distribution networks.

In this section, we consider:

- the impact on distribution networks from increasing DER penetration;
- differences in DER penetration between distribution networks, both:
  - between different jurisdictions in the NEM; and
  - within NSW;
- projections for future DER uptake; and
- the materiality of constraining DER output.

2.1 The impact of increasing DER penetration

Australia is currently experiencing the highest uptake of solar PV per capita in the world, with 'nearly 2 million rooftop solar installations covering 20 per cent of all homes (and up to a third in some regions).'[7] When not properly managed, DER (particularly passive DER) can impact the operation of distribution networks.

The effects of DER penetration on distribution businesses has been heavily documented.[8] AEMO provides a summary of these impacts, set out in table 2.1 below.

[7] AEMO, *Maintaining power system security with high penetration of wind and solar generation | International insights for Australia*, October 2019, p 13.

[8] For example, see: AEMO, *Renewable Integration Study | Stage 1 Report | Appendix A*, April 2020; and Heslop, S. et al. (UNSW), *Voltage Analysis of the LV Distribution Network in the Australian National Electricity Market*, May 2020

Table 2.1: Impact of distributed generation on distribution network operation

Issue	Requirement	Impact of distributed generation
Voltage management	Managing customer voltages within an allowable range and quality of supply.	Distributed generation export into the grid result in lower load on feeders and consequential voltage rises in the middle of the day. DNSPs must also still manage voltage drops during the evening load peak. Voltage must be kept within allowable limits for an increasingly wide range of scenarios.
Thermal ratings	Maintaining electrical flows within permissible loading levels of network elements.	Distributed generation on the LV network introduces reverse flows on feeders and transformers. Where this bi-directional cycling on distribution assets does not allow for some lighter loading periods, the thermal limits of plant may be exceeded, impacting service life.
Protection coordination	Effective operation of protection schemes.	Distributed generation introduces fault current in the reverse direction impacting the ability of protection systems to see or discriminate between fault locations.

Source: AEMO, Renewable Integration Study | Stage 1 Report | Appendix A, April 2020, p 16.

Current evidence suggests that the magnitude of these impacts increases as DER penetration increases. For example, SA Power Networks (SAPN) find that:[9]

> Once rooftop PV penetration exceeds around 25%-30% of households in a local area [(ie, served by a single LV transformer)], voltage at customer connection points can, at certain times, exceed the range specified in AS60038. This causes customer inverters to trip off and can cause quality of supply issues for other customers in the area (including those without rooftop PV), including damage to customer equipment.

Further, CSIRO find:[10]

> that reverse power flows at a zone substation occurred at 30% rooftop solar load but were common from around 40% of load.

In our consultation with the NSW Distribution Network Service Providers (DNSPs), voltage impacts on low voltage (LV) networks were cited as the primary operational issue resulting from DER, as power flows from distributed generation increase network voltage. Automatic management of voltage issues occurs via in-built inverter settings and response modes such as Volt-VAR and Volt-Watt response modes and over and under-voltage limits set within the inverter. Depending on the age of the inverter and which standard applies, inverters may have different capabilities and have different inverter settings.[11] In addition, the distributors noted that there have been studies by other networks indicating that even for inverters certified under the new standards, compliance by installers at setting the inverters to the correct settings according to relevant DNSP network standards is poor.

In addition to inverter characteristics and settings, whether a customer is constrained from exporting will also depend on a range of other factors. These include timing of DER exports on a given day, the local network characteristics (including where the customer is located from the distribution transformer), the connection asset details of how the customer is connected to the network and the customer's installation wiring configuration and location of the inverter within the electrical installation.

For DER customers attempting to export energy to the grid, when voltage gets too high, inverters start to ramp down and eventually cut-off (or 'trip'). This has implications for both exporting and self-consumption:[12]

[9] SAPN, *LV Management Business Case (attachment 5.18 to SAPN's 2020-2025 Determination)*, 25 January 2019, p 4. Further, they find that thermal constraints materialise as 'rooftop PV penetration grows in a local area.'

[10] Graham, P. et al. (CSIRO), *Review of cost-benefit analysis frameworks and results for DER integration*, April 2019, p 12.

[11] For example, Volt-Watt and Volt-VAR response modes and a lower sustained over-voltage limit were only introduced in the new AS4777 inverter standards that came into effect in 2016.

[12] CitiPower, *Business case 6.02 | Enabling residential rooftop solar*, 31 January 2020, p 8.

When solar inverters trip they are incapable of both exporting and producing solar for in-home use.

These network constraints limit the ability for DER customers to export to the grid and represent a potential loss of value both for the DER customers and to the NEM as a whole, where it results in more expensive grid-sourced generation needing to be used to meet load requirements.

This issue is exacerbated by the generally limited visibility distributors have over their LV networks. Without visibility, identification of voltage issues and network constraints on DER exports is primarily reactive, based on customer complaints. This affects both the identification of network constraints and solutions. The visibility of DER and LV networks is discussed in detail in the context of the NSW distributors in section 2.5.1.

2.2 Differences in distribution networks' capacity to connect DER

DER penetration affects different distribution networks differentially. This is due to different levels of:

- overall DER penetration, as discussed above; and
- hosting capacity – the capacity of a network to connect DER and continue to operate within its technical limits (eg, voltage and thermal limits) without augmentation.[13]

Table 2.2 sets out the primary factors that affect hosting capacity, which highlights why network hosting capacity is location specific.[14]

Table 2.2: Factors affecting DER hosting capacity

Impact	Description
Distributed generation installed	This depends upon: • the capability and settings of the generating unit's inverter – for example, whether the inverter is configured to comply with the relevant standards and the DNSP's connection requirements; and • whether the generating unit is: > active – proactively managed to respond to market signals and needs, usually via an aggregator (generally requires energy storage); or > passive – operating without intervention (eg, exporting when there is no load at the connection point, rather than in response to market signals).
Local load profile	Depends upon how the local load profile matches the generation behaviour of the distributed generators. For example, rooftop solar PV produces during the middle of the day. If there is a load to meet this generation, this may reduce the consequences of reverse flows that require management. However, if the local load profile is residential (ie, peak in the morning and evening), distributed generation is occurring during periods of low load and therefore exacerbates reverse flows.
Physical and electrical network characteristics	Networks differ in terms of their local network capacity and impedance. For example, 'central business district (CBD) and many suburban networks are more interconnected, span shorter distances with higher load density and lower impedance, and can accommodate more [distributed PV] generation than long radial rural feeders.'[15]

Source: AEMO, Renewable Integration Study | Stage 1 Report | Appendix A, April 2020, pp 16-17.

[13] Energy Transformation Taskforce, *Distributed Energy Resources Roadmap*, December 2019, p 33.

[14] AEMO, *Renewable Integration Study | Stage 1 Report | Appendix A*, April 2020, pp 16-17.

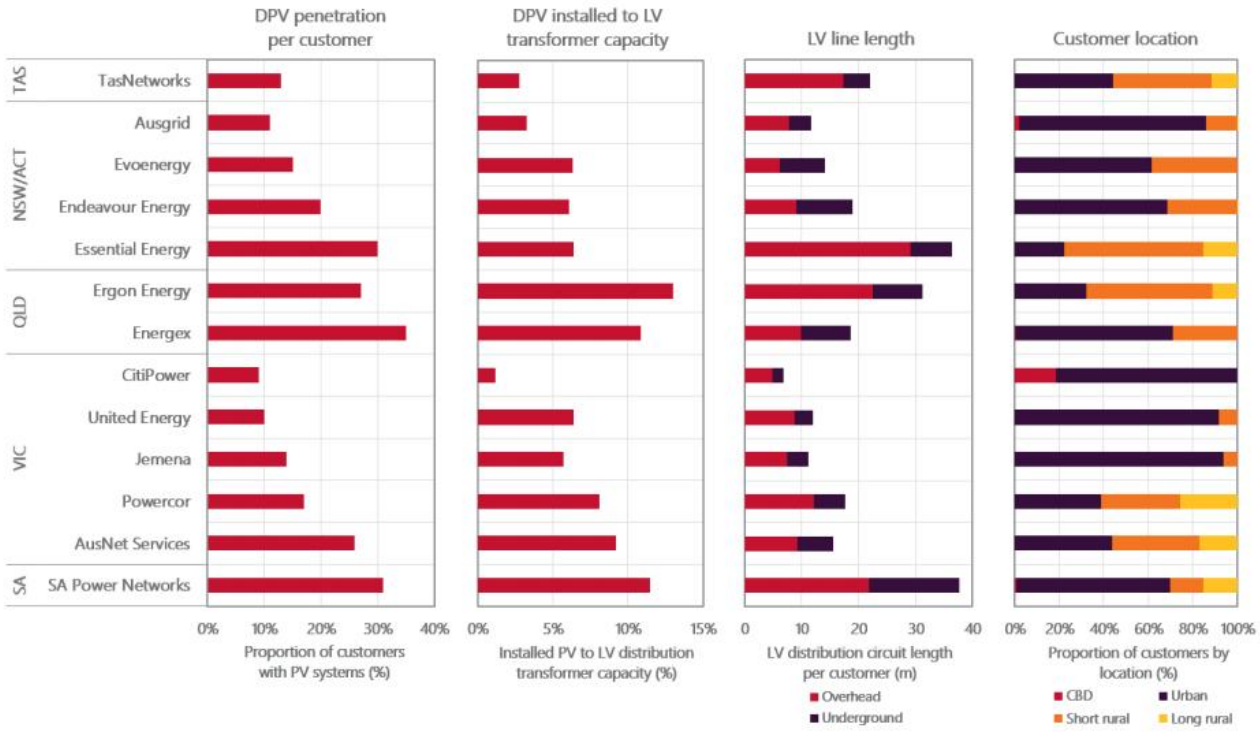
[15] AEMO, *Renewable Integration Study | Stage 1 Report | Appendix A*, April 2020, p 17.

As a result, the extent to which distribution networks are impacted by DER uptake and that DER customers experience network constraints differ both between jurisdictions and between networks in each jurisdiction (including the three NSW DNSPs).

2.2.1 Differences between jurisdictions

Figure 2.1 highlights differences in network characteristics between jurisdictions.

Figure 2.1: Characteristics that affect hosting capacity of NEM distribution networks



Source: AEMO, Renewable Integration Study | Stage 1 Report | Appendix A, April 2020, p 17.

For example:

- Queensland and South Australia have a higher degree of solar penetration per customer than NSW and Tasmania; and
- LV line length per customer is higher in South Australia than in NSW – both in terms of overhead (21m vs. 13m) and underground (15m vs. 6m) lines, respectively.

Differences in load profiles between states also impact hosting capacity. For example, in consultation Endeavour Energy noted that its network is able to host a higher degree of DER due to higher load when compared to networks such as SAPN.

These factors suggest that network constraints for DER are currently more prominent for jurisdictions such as South Australia and Queensland, and less problematic for NSW.

2.2.2 Differences between distribution networks within NSW

The different characteristic of the three distribution networks within NSW mean that the issues each DNSP is facing associated with DER export expenditure differs too. For example, Figure 2.1 shows that relative to Ausgrid and Endeavour Energy (Endeavour), Essential Energy (Essential) has:

- a higher penetration of solar PV per customer;
- a longer LV network line length per customer;
- proportionally more of their LV network overhead (per customer); and
- a higher proportion of rural customers.

These characteristics imply that DER is likely to pose more issues for Essential relative to the other NSW DNSPs.[16] This was confirmed in our discussions with the NSW DNSPs.

Differences between the NSW networks in terms of issues relating to DER constraints was further reflected in our consultation with the distributors, as summarised in Table 2.3.

[16] In fact, the network characteristics of Essential are more closely aligned to SAPN, which is at the forefront of DER penetration issues. However, there are factors that mitigate these challenges for Essential, relative to SAPN (for example, lower DER penetration and larger load).

Table 2.3: Key themes from our consultation with the NSW DNSPs

	Ausgrid	Endeavour	Essential
Awareness of DER connected	Awareness of connected DER across all three networks is limited to connection applications. This process has been streamlined under the new DER Register. Essential raised concern about the lack of audit: connection applications may differ to the amount actually installed and there is currently no verification.[17]		
Relative extent of DER export curtailment	Voltage is currently at the higher end of the allowed range. May need to consider curtailing exports in future. Currently addresses constraints reactively where customers complain through minor opex (eg, tap changes or phase alignment).	Endeavour's network has few constraint issues – the network is relatively new, largely underground and serves a customer base with relatively higher demand. Endeavour schedules minor works to boost hosting capacity (eg tap changes) alongside routine maintenance.	As a percentage of customers, Essential has the largest uptake of solar in NSW (~21,000 connections per year). DER export expenditure is increasingly problematic and a pivotal issue. Essential actively curtails DER exports to ensure the network maintains operation within physical limits (see below). Expects to seek regulatory funding at next AER determination for initiatives to improve network visibility.
Visibility of DER constraints	Visibility across all three networks is primarily reactive and reliant on customer complaints. Low voltage network modelling is in its infancy, however assists. Direct data on DER exports (from smart meters and DER inverters) would provide visibility on where DER is constrained, however this data is not owned by DNSPs and must be purchased.[18]		
	Noted that collecting information from 10-20 inverter manufactures is cumbersome with no standard process.	Estimated that approximately 0.6 per cent of DER exports are constrained. Typically receive 30 voltage complaints per month. Estimate that a few per cent of customers are heavily constrained.	Over 2018/19 experienced increasing levels of power quality and voltage complaints. Implementing a visibility strategy to identify constraint hotspots.
How are DER exports constrained?	Ausgrid and Endeavour do not actively constrain DER exports. Rather, when network voltage rises to a particular level, inverters progressively reduce output until they trip (default inverter safety standard). DNSPs have no visibility of inverters tripping.		Where required Essential is actively curtailing connections via static limits to ensure the network maintains operation within physical limits. Through customer complaints Essential becomes aware of connections where inverters are constraining/tripping but has no visibility.

[17] In NSW, the DNSPs have implemented a collaborative approach with AEMO, the solar and DER industry to collecting the equipment details for small generating systems when installed. This has involved making it a requirement as part of the connection application process for the connection applicant (or installers on their behalf) to update the AEMO DER Register with installed equipment details within 20 business days of commissioning. However, even going forward, the information collected for the AEMO DER Register for installed DER equipment at customers premises will only be as accurate as the information provided by installers to the AEMO DER Register portal or via smart device applications and compliance to this requirement.

[18] We note that Ausgrid's approach to identifying issues has been to increase visibility on the LV network by purchasing customer meter data from metering co-ordinators to identify problematic zones and other curtailment hotspots. This has been combined with modelling actual HV network to determine HV network (feeder) hosting capacity limitations and modelling typical LV networks to determine LV network hosting capacity limitations.

2.3 DER uptake is projected to increase

Australia's rapid uptake of DER, particularly rooftop solar PV, is projected to increase. This suggests that the prevalence of network constraints on DER exports is likely to increase too.

AEMO's Integrated System Plan (ISP) provides one source of future DER projections. AEMO's modelling of the NEM contains five scenarios:

- central scenario – used as the foundation for most ISP analysis;
- slow change;
- high DER;
- fast change; and
- step change – which predicts the most significant increase in DER of the five scenarios.

AEMO recently noted that its central scenario is likely understate the true growth potential of solar PV (and DER), with the step change scenario now considered to be the most reasonable estimate of future DER uptake, given current installation rates.[19]

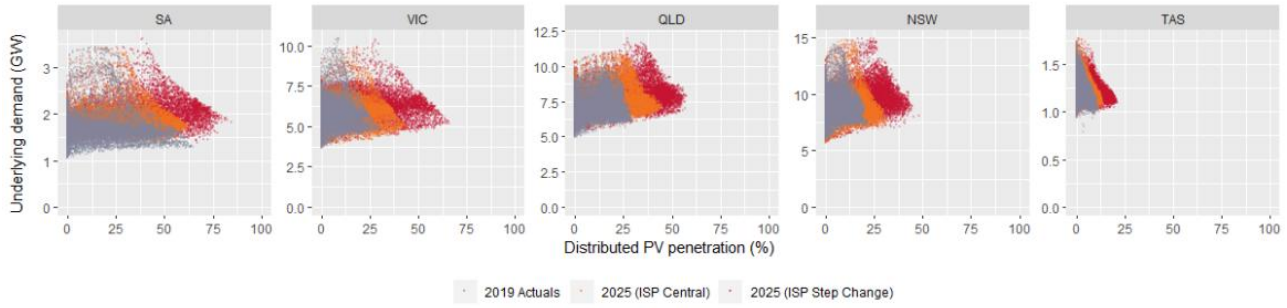
Below we discuss AEMO's ISP projections for:

- distributed solar PV; and
- embedded battery storage and electric vehicles.

2.3.1 Distributed solar PV

Comparing the historical and projected rates of distributed solar PV penetration in Figure 2.2 below, penetration of distributed solar PV is expected to increase across all NEM states.[20] However, for NSW (and Tasmania), the degree of penetration as a proportion of underlying demand is less when compared to other NEM states. Whilst this doesn't take into account differences in DER uptake between networks in each state, it does suggest that overall NSW is not at the forefront of DER export expenditure and network constraint issues.

Figure 2.2: Historical (2019) and projected (2025) half-hourly daytime instantaneous penetration of distributed solar PV generation and duration curves by NEM region [AEMO title]



Source: Source: AEMO, Renewable Integration Study | Stage 1 Report | Appendix A, April 2020, p 17.

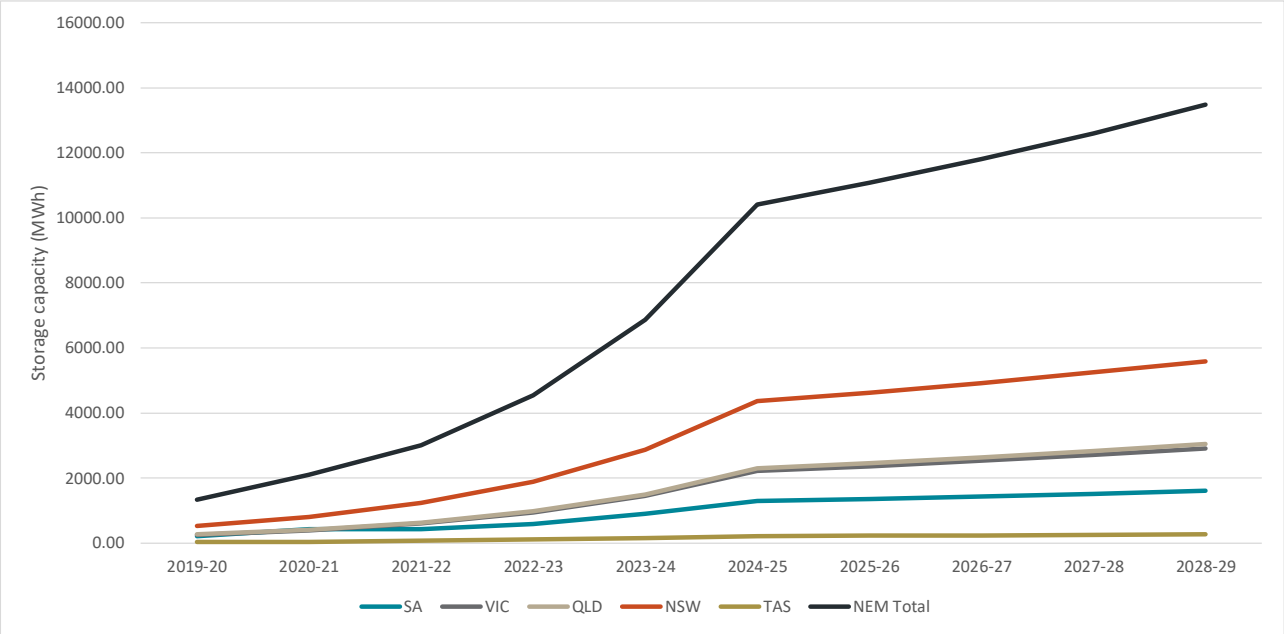
[19] AEMO, *Renewable Integration Study | Stage 1 Report | Appendix A*, April 2020, p 11.

[20] Note that distributed solar PV penetration is measured as the capacity of installed distributed solar PV relative to the underlying demand of a given state, rather than the proportion of customers that have distributed solar PV as in Figure 2.1.

2.3.2 Embedded battery storage and electric vehicles

Projections of embedded battery storage capacity exhibit a similar trend across all NEM states, increasing approximately 10 times across all states collectively between 2019-20 and 2028-29 under AEMO's 'step change' projections.[21] There are some slight deviations from this average between states, with South Australia and Tasmania increasing around 7 times over the same period, whilst the increase in NSW is projected to be on par with the NEM average.

Figure 2.3: Embedded battery storage capacity by NEM state- AEMO step change scenario



Source: AEMO, 2019 Inputs and Assumptions workbook v1, 3 December 2019.

Much of the concern associated with DER (particular solar PV) on the management of distribution networks results from passive installations injecting energy to the grid during periods of low load.[22] Whilst much of the discussion has focused on the potential issues of increasing DER penetration, the uptake of embedded storage devices could provide a potential solution. Storage devices can absorb excess PV generation in the middle of the day when load is low, and export this to the grid when load is high – avoiding the voltage rise and thermal issues currently appearing during the middle of the day. However, operation of storage devices in this way requires appropriate pricing reform such that DER owners are provided with signals of both the costs and benefits that they impose on the network. If battery storage is not managed actively, likely due to a lack of adequate price signals, the uptake of battery storage could exacerbate existing issues caused by DER (ie, if batteries also import and export energy from the grid passively).

Electric vehicles raise similar issues. The projected uptake of electric vehicles (EVs) in the NEM is even more striking, increasing from an estimated 16,703 vehicles in 2018-19, to 1,760,747 vehicles in 2028-29 across all NEM states (under AEMO's step change scenario).[23] EVs can be considered as mobile batteries – importing and potentially exporting energy to the grid throughout the day. EV charging timed to coincide with PV generation is a potential solution to the challenges networks currently face from passive DER. However,

[21] Note that embedded battery storage includes both non-aggregated and aggregated (ie, via a VPP) storage devices.

[22] For example, a solar PV system without a battery is considered passive DER. Such a system will export electricity to the grid when solar production exceeds self-consumption. This most commonly occurs during the middle of the day, when demand for electricity is low and solar production is high. Consequently, these are the periods when DER-related network issues (such as voltage rise) occur.

[23] AEMO, *2019 Inputs and Assumptions workbook v1*, 3 December 2019.

like embedded battery storage, appropriate pricing reform is necessary to provide EV owners with price signals that reflect the benefits and costs that they impose on the network.

Whilst we have not considered the uptake of batteries and EVs in detail in our analysis, we recognise that with appropriate price signals, these developments could provide a solution to some of the challenges distribution networks are facing in managing DER exports. However, network constraints on DER exports are present today, and there are actions that distributors could take to manage these constraints.

2.4 Materiality of DER export constraints for consumers

DER exports are currently being constrained in some locations across the NEM, and constraints are projected to increase as penetration of DER increases, particularly if the uptake of batteries and EVs is not actively managed in a way that offsets the impact of passive PV generation. A recent UNSW research article commissioned by the Energy Security Board analyses voltage levels using household-level solar data. In its analysis of 3,718 households in South Australia the authors concluded, given a number of assumptions, that:[24]

- 'the majority of consumers in the sample do not suffer significant PV curtailment, with approximately $3 - $12 per year per site on average in lost generation value'; however
- 'the consumers which are significantly impacted can experience considerable financial penalty. The most impacted consumer is estimated to lose approximately $225 - $900 per year.'

Endeavour have calculated their own estimate of the financial effect that DER constraints have on their average solar customer.[25] This high-level analysis indicates that the average solar system curtailment due to voltage is around 0.6%, with a likely financial impact of between $4-5 per average solar customer each year. Endeavour's methodology used a sample of smart meter voltage compliance data and made the assumptions that the average solar customer has a 5kW system and lost revenue is on the basis of a 70:30 split between feed in tariff and self-consumption.

Endeavour recognises that this estimate is not conclusive and suggests that further work in this area would be helpful. Whilst this estimate is preliminary, it is consistent with the findings from the UNSW analysis. Further, given lower levels of penetration and subsequently lower levels of constraints in NSW compared with South Australia, an estimate near the lower bound of the UNSW estimate appears reasonable. This supports the conclusion that the issue of DER constraints are in their infancy for the majority of NSW customers.[26]

These findings are consistent with the views expressed by consumer advocates during our consultation Whilst there are pockets of customers who are receiving very poor service and customers generally do not like PV exports being constrained, it was currently seen as generally not a material issue.

Customer advocates did raise concerns related to equity, namely that:

- customers should be provided with the optionality to pay for greater access; and
- customers are making investment decisions in DER without access to appropriate information, such as the extent to which exports will be constrained and the consequent impact on the pay-back period for their investment.

As part of their most recent regulatory proposals, the Victorian DNSPs engaged in detailed customer consultation. Collectively, this research found that customers:

[24] Heslop, S. et al. (UNSW), *Voltage Analysis of the LV Distribution Network in the Australian National Electricity Market*, May 2020, p 161. This estimate assumes that the sample of households and the 24 clear sky days used are representative.

[25] This reflects internal analysis by Endeavour, which was raised with us in our consultation. We appreciate Endeavour allowing us to include this estimate in our report.

[26] We note that network constraints are likely to be more material for the average Essential customer relative to Endeavour's customers.

- felt that they should have access to export energy to the grid;
- support expenditure on relieving export constraints where the benefits outweigh the costs; and
- disagree on who should bear the cost of reliving network constraints.

Box 2.1 provides further detail on the findings of this research.

Box 2.1: Victorian customer perspectives on DER expenditure

In preparation for their regulatory proposals for the 2021-26 regulatory period, Victorian distribution businesses engaged with customers to guide their expenditure over the next regulatory period.

Customers expressed a preference for the ability to export to the grid:[27]

> Most households with solar panels would be very unhappy if they were restricted in the time of day (79%) or amount of energy (85%) they could sell back to the grid. Close to 60% of household and business customers without solar were interested in installing solar panels.

However, customers recognised that such an ability to export requires investment:[28]

> There was support for sensible investment to allow solar exports so this valuable energy is not wasted and can reduce cost pressures for all customers, through expected reductions in wholesale market prices.

But there was disagreement over who should bear the costs of such investment, particularly regarding the effect that such investment may have on vulnerable customers:

> When asked about enabling more residential solar on our network, customers and stakeholders had a preference that the cost is paid for by those connecting solar (65%). This was also the view from consumer advocates representing financially vulnerable customers.[29]
>
> The majority of participants supported sharing costs among all customers, 54% supported an option to upgrade the network (at a cost of $10 annually for all customers) and 40% supported a smart control solution (at a cost of $5 annually).[30]
>
> Generally there was support for plans to invest to allow solar exports where the costs of this are outweighed by the benefits that all customers receive, but remaining concerns about imposing these costs on vulnerable customers.[31]

Citipower, United Energy and Powercor customers identified some further points, finding that:

> …customers can tolerate reasonable constraints (i.e. they supported dynamic control and affordable prices), but the network must be prepared to accommodate more solar and ensure these constraints are not excessive.[32]
>
> …customers also viewed a 'first-in, first-served' approach as unfair; rather, all customers should be able to export some solar.[33]
>
> Our customers, particularly local councils that have set local carbon reduction targets for themselves, were highly supportive of including the carbon price as a benefit from this program.[34]

[27] AusNet Services, *Electricity Distribution Price Review 2022-26 | Part I & II*, 31 January 2020, p 48.

[28] AusNet Services, *Electricity Distribution Price Review 2022-26 | Part I & II*, 31 January 2020, p 42.

[29] CitiPower, *Business case 6.02 | Enabling residential rooftop solar*, 31 January 2020, p 16.

[30] AusNet Services, *Electricity Distribution Price Review 2022-26 | Part I & II*, 31 January 2020, p 49.

[31] AusNet Services, *Electricity Distribution Price Review 2022-26 | Part I & II*, 31 January 2020, p 43.

[32] CitiPower, *Regulatory Proposal 2021 - 2026*, 31 January 2020, p 63.

[33] CitiPower, *Regulatory Proposal 2021 - 2026*, 31 January 2020, p 63.

[34] CitiPower, *Business case 6.02 | Enabling residential rooftop solar*, 31 January 2020, p 11.

2.5 Availability of information on DER and export constraints

Our stakeholder consultations provided insight into the limited visibility the NSW DNSPs have over DER and their LV networks, which affects both their ability to identify constrained parts of their network and identify the effect of potential solutions on other customers.

The remainder of this section discusses the visibility the NSW distributors have in relation to DER and their LV networks, and compares this visibility to other jurisdictions.

2.5.1 NSW distributor visibility of DER and their LV networks

A 2019 review by the AEMC found that distributors have limited visibility of their LV networks:[35]

- There is little direct monitoring of loads and voltages on LV transformers and circuits, and on individual phases of those circuits. Some of the monitoring that occurs is ad-hoc or alternatively measures only maximum load over a long period of time;
- With the exception of Victoria, where meters are still owned and controlled by DNSPs, there is little information beyond settlement and billing data that is directly available to DNSPs at the customer premises level; and
- There is very little direct monitoring of DER generation output. Net metering arrangements mean that only the total site is monitored.

Our consultation with the NSW DNSPs was consistent with these findings. Below we describe how the NSW DNSPs:

- identify the level and type of DER connected to their networks;
- identify network constraints;
- constrain DER output; and
- are improving visibility of LV networks.

Identifying the level and type of DER connected to the network

Visibility of DER connected to the NSW distribution networks is based on connection applications. Traditionally, DNSPs did not distinguish between intermittent and non-intermittent generation – for example, Ausgrid and Endeavour note that DER such as batteries were generally not recorded (and only recorded if an inverter was installed). With the recent introduction of the DER register, this process has become streamlined across all distributors in the NEM.[36] Under the new DER register, information such as the type of DER connected and its capacity are recorded (eg, DNSPs are required to distinguish between storage and other generation types).

However, the NSW distributors have previously suggested that the focus on connection applications may be unreliable.[37] This is since:

- there is no feedback loop to ensure the DER system applied for matches the system installed:[38]

[35] AEMC, *Economic Regulatory Framework Review | Integrating distributed energy resources for the grid of the future*, 26 September 2019, p xiv.

[36] The DER register was introduced following a Rule change on 13 September 2018 and came into effect on 1 March 2020.

[37] For example, see: Ausgrid, *National Electricity Amendment (Register of distributed energy resources) Rules 2018* | Submission, 20 April 2018, p 14.

[38] Ausgrid, *National Electricity Amendment (Register of distributed energy resources) Rules 2018* | Submission, 20 April 2018, p 10.

> …the fact that an application has been lodged does not necessarily mean that the device described in the documentation will be installed, and the detailed information on the device may be inaccurate; and

- there is no audit function to assess inverter compliance with the relevant standards or discrepancies between the application and installed capacities:[39]

> There is no audit of the DER data supplied from DER providers to DNSPs. While the implementation of an audit program could be a costly exercise, in the absence of such a program and an appropriate ongoing penalty regime there is a real risk that the data provided to DNSPs and onto AEMO is inaccurate. This may limit the visibility of both optimising and managing the risk of DER technologies.

Currently, Essential audit approximately 2 per cent of DER installations to assess inverter compliance.

Identification of network constraints

Due to poor visibility of LV networks, identification of network constraints is indirect and reactive, based primarily on customer complaints across all three NSW networks. Generally, customers complain if they experience export curtailment. Ausgrid noted that this relies on customers that aware of when their inverter trips or constrains exports, which is likely limited to those who proactively monitor their DER exports, either via their inverter or billing data.

LV network modelling provides some visibility of network constraints; however, this is still in its infancy for most distributors. For example, Endeavour noted that model results are at best indicative due to the need to make unsupported assumptions (eg, phase and connectivity identification) without inverter data.

The DNSPs also have access to billing data on a 15/30 minute basis. However such data only provides information on net exports.

There are some direct sources of constraint data available. For example, Reposit Power, whose offering provides households with visibility of their energy usage and access to aggregation (Virtual Power Plant) services, provides one such source of data. In our consultation, Reposit Power indicated that commercial arrangements do occur with distributors, although these are generally temporary.

Distributors recognise that access to third-party data is available, however this option often lacks process and was viewed as relatively costly. For example:

- Ausgrid noted that there is no common approach to accessing such data, with approximately 10-20 inverter manufacturers;
- Endeavour noted that the commercially negotiated cost of data per NMI is indicatively $7-14 per year. This cost would mean that:
  - customers are paying twice for providing this data (directly for the meter or through retail tariffs and through the cost of the data transfer); and
  - this cost may be prohibitive – given estimates of the benefits of relieving constraints, the net benefit may not be positive; and
- Essential note that voltage can be measured at only 0.3 per cent of connection points on Essential's LV network, even though they have approximately 120,000-150,000 smart meters within their network, as, they do not have commercial access to metering data.

Constraints on DER exports

Constraints on DER exports can be:

[39] Essential Energy, *Submission on the draft rule for the Register of Distributed Energy Resources*, 8 August 2018, p 1.

- passive – driven by network voltage and inverter safety responses curtailing output; or
- active – where the distributor actively limits the exports at a connection point.

Passive constraints are the primary constraint on DER exports and occur across all distribution networks in NSW. However, due to a lack of access to customer inverters and limited visibility of LV networks, passive constraints are primarily identified through customer complaints (as noted above). Endeavour noted that they receive approximately 30 solar-related voltage complaints per month. Essential observed that over the 2018-19 financial year, there was a material increase in both voltage and power quality customer complaints.

However, customer complaints do not provide a complete picture of which customers are constrained, nor by how much. By analysing a sample of inverter compliance data, Endeavour has estimated that approximately 0.6 per cent of DER exports are constrained, and that there are a few per cent of customers that are heavily constrained. Endeavour note that it will be a significant amount of time before networks can calculate and actively publish constraints to individual DER assets or their aggregators.

Essential is currently the only NSW network that actively limits the exports of DER within their network. Hard static limits are imposed at the time of connection. Any hard static limits are imposed at the time of connection, to ensure the network maintains operation within physical limits. The need to actively curtail DER exports reflects that Essential is at the forefront of DER penetration issues in NSW.

We note that active curtailment of DER exports by the other DNSPs is likely increase as penetration increases and DER poses a greater issue to the management of distribution networks. For example, Ausgrid note that actively curtailing DER exports may be an option as DER penetration increases, and network voltage issues become more widespread.

How NSW DNSPs are improving their LV network visibility

In accordance with recommendations by the AEMC, DNSPs are currently investing in improving their LV network visibility.[40] For example:

- Ausgrid are currently in the process of developing their LV network modelling to assist in proactively identifying constraints on their network – initiating an innovation project to identify the degree of monitoring and testing required to inform a future business case for improving visibility;
- Endeavour has:
  - introduced a small volume of distribution transformer monitoring to enhance voltage visibility;
  - begun trials to commercially agree on data access with Metering Coordinators and customer monitoring vendors such as Solar Analytics, which amounts to approximately 1500 sites or 0.15 per cent of customers; and
  - developed capability to model the LV network within their planning load flow tools; and
- Essential is currently implementing their Network Visibility strategy with the purpose of improving visibility of the LV level of the network.
  - Part of this strategy includes a program to inform a business case to seek funding for at the next regulatory proposal by developing modelled heat maps to build visibility of where DER constraints (and subsequent customer complaints) may arise in the future. Essential is of the opinion that LV network visibility is critical to containing costs in the longer-term.

[40] 'The Commission encourages DNSPs to continue to develop business cases for improvement of modelling and monitoring of their LV networks, including the quantification of costs and benefits of their proposed approaches.' AEMC, *Economic Regulatory Framework Review | Integrating distributed energy resources for the grid of the future*, 26 September 2019, p xix.

2.5.2 Differences in visibility between NSW networks and distributors in other jurisdictions

There are differences in LV network visibility between distributors in different jurisdiction. As discussed above, distributors in NSW have limited visibility of their LV networks, where network constraints are identified reactively through customer complaints. Ausgrid has noted that a lack of visibility affects both the identification of constraints and feasible solutions.

On the other hand, in 2006 the Victorian government mandated the rollout of smart meters across that state – meaning that the Victorian distributors have visibility of nearly 2.4 million connection points on their LV networks.[41] Such visibility means that distributors are able to identify both constraints and solutions. This is reflected in the recent regulatory proposal by CitiPower, who justify their DER-related expenditure based on access to granular, connection point level data:[42]

> Our approach is also supported by extensive economic modelling. We have drawn on over 38 billion data points from our smart meters across our three networks (i.e. CitiPower, Powercor and United Energy), and considered the impact on each of our 4,200 distribution transformers.

Distributors in other jurisdictions have proposed projects to the AER to enhance visibility of their LV networks to enable their networks to be managed appropriately. For example, SAPN's 2020-2025 Regulatory Proposal proposed $112 million relating to DER transition and included the following programs:[43]

- LV management – primarily to improve visibility of DER and enable the implementation of dynamic export limits;
- LV transformer monitoring – which involves monitoring voltage on LV networks, 'driven by capacity (load),' to ensure that the network is operated according to its requirements; and
- Quality of Supply (business as usual) – which is a long-running capex line that funds reactive work completed to maintain the LV network.

Given SAPN is arguably at the forefront of DER issues in the NEM, their recent regulatory proposal highlights the importance of LV visibility as DER penetration increases. Moreover, excluding the LV management program, the remaining expenditure is associated with managing the network within requirements, rather than to facilitate additional exports from DER. This suggests that greater LV network visibility is required to ensure that networks are managed appropriately, as DER penetration increases. Improved visibility is also likely to be a threshold issue in facilitating for actions and incentives to relieve DER constraints.

[41] Victorian Auditor-General's Office, *Towards a 'smart grid' – The Roll-Out of Advanced Metering Infrastructure*, November 2009, p vii.

[42] CitiPower, *Regulatory Proposal 2021 - 2026*, 31 January 2020, p 64.

[43] Consultation with SAPN; SAPN, *Revised Regulatory Proposal 2020-2025 | Attachment 5*, 20 December 2019, pp 44-46.

3. National processes relating to DER export expenditure

There are a number of reform processes occurring currently at the national level relating to efficiently integrating DER into the energy market. Whilst this report is written in the context of IPART's review of NSW reliability standards and steps that could be taken to provide appropriate incentives to the NSW DNSPs to relieve DER export constraints, it is important that any recommendations made are cognisant of work in this space at the national level, and incorporate findings from this work where applicable.

Table 3.1 summarises current DER-related workstreams being undertaken at a national level. In this section, we provide a brief overview of these processes and note their importance for potential incentive mechanisms.

We have identified three national processes that are directly related to network regulation and that are influential for this project. These are the:

- **ARENA/AEMC DEIP program**, in particular the Access and Pricing (A&P) workstream – which resulted in a recommendation report concerned with access rights, the appropriateness of network pricing and the potential introduction of a DER incentive scheme:
  - The outcomes report was published 18 July 2020 and includes a number of findings including that the need to create additional obligations and/or incentives for networks to provide hosting capacity which will be the subject of a future AEMC-initiated study (see section 3.1);[44]
- **AER's Assessing DER integration expenditure consultation** – which is exploring the appropriate assessment framework for DER expenditure to inform an upcoming AER DER expenditure guidance paper; and
- **ARENA/AER Value of DER (VaDER) workstream** – to determine a methodology for valuing DER exports.

There are also a number of other workstreams currently underway, relating to standards and protocols; enhancing DER visibility; and the future framework and wholesale market design. We discuss each of these in turn at the end of this section.

[44] DEIP, *Access & Pricing Reform Package*, Outcomes Report, June 2020.

Table 3.1: National processes related to DER export expenditure

General Reform Processes	**Open Energy Networks Project (OpEN)**	**Post-2025 Market Design**	**DER Register**	**Distributed Energy Resources Roadmap**	**Electricity Network Transformation Roadmap**	**Renewable Integration Study (RIS)**	**DER Program**	**Technology Investment Roadmap**
	AEMO/ENA	ESB	AEMC/AEMO	WA Energy Transformation Taskforce	ENA/CSIRO	AEMO	AEMO	Federal government
	Future framework and design of the NEM.		Enhancing visibility of DER.	Modelling and recommendations to facilitate efficient integration of DER.		Recommendations to manage uptake of renewables (per ISP projections).	Several workstreams exploring DER export expenditure issues, eg, a standards and protocols workstream.	Develop recommendations for investment in low emissions technologies.
	Completed (mid-2020)	Final paper (late 2020)	Operational (March 2020)	Issues paper (Dec 2019) – implemented by 2023	Completed (July 2019) – Update forthcoming	Stage 1 (May 2020)	Various next steps	Low Emissions Technology Statement to Parliament (Q3 2020)
Directly Relevant Reform Processes	**DER export expenditure consultation paper**			**Distributed Energy Integration Program (DEIP)**			**Value of DER (VaDER)**	
	AER			ARENA/AEMC collaboration with a range of stakeholders			AER/ARENA	
	The AER is seeking stakeholder feedback on the appropriate assessment framework for DER integration expenditure to inform the upcoming guidance paper. This consultation paper recognises the importance of: • a consistent approach to assessing DER integration expenditure; • a consistent approach to valuing DER exports; and • avoiding inconsistency across jurisdictions.			The DEIP process is a collaboration of government agencies, market authorities, industry and consumer groups designed with the purpose of maximising the benefits of DER. The DER access and pricing workstream has explored: • whether consumers have a right to export; • what the appropriate pricing mechanism should be; and • if an incentive scheme is appropriate. A recommendation report was released in July 2020. This includes a recommendation that the AEMC initiate a study into the feasibility/practical implementation of introducing an incentive scheme for DER hosting capacity.			Only in its early stages, this program of work is to determine a common methodology for valuing DER.	
	DER expenditure guideline (June 2020)			Final report June 2020 Rule change expected to follow on DER incentives & export pricing			Upcoming	

3.1 ARENA/AEMC Distributed Energy Integration Program

The Distributed Energy Integration Program (DEIP) is a 'collaboration of government agencies, market authorities, industry and consumer associations aimed at maximising the value of DER for all energy users.'[45] DEIP is divided into four workstreams:[46]

- customer – capturing and sharing customers' preferences to inform the future;
- markets – enabling multi-party exchange of value in markets within physical network constraints;
- frameworks – optimising investment in and operation of network and DER infrastructure; and
- interoperability – standardising the physical operation, visibility and resilience of the distributed energy systems.'

These workstreams led to the creation of four work packages in 2020:[47]

- DER interoperability;
- DER market development;
- electric vehicles; and
- DER access and pricing.

The access and pricing (A&P) package has been the most active in 2020 to date, encompassing three consultation workshops with the aim of developing a suite of efficient network access and pricing solutions capable of generating broad support and informing future policy and regulatory changes..

The DEIP Access and pricing reform options report (prepared by CEPA) suggested six options for access and pricing reform:[48]

1. Universal firm access right with distribution use of system (DUoS) charges;
2. Option to purchase firm export capacity;
3. Open Access with Enhanced Incentives, with:
   - 3a – obligation and incentives for networks to achieve an efficient level of DER host capacity;
   - 3b – the addition of DUoS charges for DER exporters (together with 3a) to facilitate the allocation of costs to exporters;
4. Full two-way pricing, where short-run price signals are provided to retailers and aggregators such that retail customers purchase the level of import or export capacity; and
5. Aggregate retailer pricing, where the DNSPs price is based on retailers' or aggregators' customer base.

CEPA recognised that a lack of financial incentive may be a barrier to DER export expenditure:[49]

> Networks' incentives may not be sufficient to encourage the use of DER to support network services. This may mean they are not choosing the most efficient options.

[45] DEIP, *Distributed Energy Integration Program | Overview / DEIP at a glance*, February 2019, p 5.

[46] DEIP, *Distributed Energy Integration Program | Overview / DEIP at a glance*, February 2019, p 8.

[47] *What is DEIP?*, available at: *https://arena.gov.au/knowledge-innovation/distributed-energy-integration-program/#why-is-deip-important*, accessed 6 May 2020.

[48] CEPA, *Distributed Energy Resources Integration Program – Access and pricing | Reform options*, 9 April 2020, pp 11-12.

[49] CEPA, *Distributed Energy Resources Integration Program – Access and pricing | Reform options*, 9 April 2020, p 33.

This barrier is reflected in options three and four, where CEPA suggest that a legal obligation could be replaced by a financial incentive. CEPA suggest that a STPIS is one possible mechanism, and could include:[50]

- 'a financial reward (e.g., c/kV, c/kW, or c/kVA) to increase export capacity';
- 'a financial reward/ penalty around a target level of headroom'; or
- 'a financial reward/ penalty to ensure that export capacity is highly utilised.'

However, CEPA raised as a question for discussion:[51]

> Is the STPIS an appropriate mechanism for introducing DNSP export incentives? Are there other mechanisms that could be used?

An outcomes report was released on 18 July 2020 that suggested the following reform packages:

- review the regulatory framework to update service definitions and classifications to acknowledge the role of distributors as a platform to connect, manage and enable DER;
- introduce a requirement on distributors to optimise export capacity for system-wide net market benefits;
- create additional obligations on distributors and/or incentives for networks to promote hosting capacity to a level valued by customers;
- consider enabling networks export prices to send efficient price signals to allocate network hosting capacity costs;
- further reflect the value of the services DER could provide to networks;
- consider how access services, incentives, network planning and pricing interact and complement one another; and
- greater regulatory flexibility would allow regulators and the energy sector to maintain a focus on future options and enable continued innovation.

It was envisaged that these findings would be implemented through the following next steps:

- AEMC to initiate a study into the feasibility/practical implementation of CEPA options 3a and 3b, with a focus on the data requirements to measure and implement a possible incentive scheme and possible changes to the regulatory information notices and benchmarking;
- the DEIP Working Group, Total Environmental Centre (TEC) and Australian Council of Social Services (ACOSS), to submit a rule change request to the AEMC that reflects the findings of the DEIP outcomes report;
- AEMC to subsequently undertake a rule change process so that amendments to the rules can be implemented in time for the upcoming regulatory determinations for the NSW, ACT, NT, and Tasmanian distributors; and
- AER (with support from ARENA) to undertake a Value of DER study (see section 3.3, below) to inform the AER assessment of DER expenditure proposals.

We note that the AEMC has recently received three separate rule change requests relating to regulatory arrangements for DER:

- TEC and ACOSS (ERC0309) – request contains a range of incremental reforms, focused on network planning and access for DER;[52]

[50] CEPA, *Distributed Energy Resources Integration Program – Access and pricing | Reform options*, 9 April 2020, pp 87-88.

[51] CEPA, *Distributed Energy Resources Integration Program – Access and pricing | Reform options*, 9 April 2020, p 98.

[52] TEC and ACOSS, *More sun for everyone*, Rule change request (ERC0309), 7 July 2020.

- St Vincent de Paul Society (ERC0310) – proposes to completely remove the prohibition on DUoS charges for the export of energy;[53] and
- SA Power Networks (ERC0311) – proposes that the rules be modified to recognise the network services provided to DER exports, that would also facilitate the STPIS being modified to include DER export services and be subject to a separate GSL, and the removal of the prohibition on DUoS charges for the export of energy charged.[54]

In addition, the DEIP working group made the following observation that future reforms should consider the implementation of a full two-way/sided access and pricing model to enable customers to capture the multiple value streams of DER to networks and wholesale markets. Depending on the outcome of the rule change requests outlined above and the Energy Security Board's Post 2025 Review, the Working Group, TEC and ACOSS will consider submitting a rule change request to the AEMC to implement a full two-way/sided access and pricing model.

We note that the purpose of our current report is to explore what an appropriate incentive mechanism for DER exports could look like, with a particular emphasis on how the lack of visibility that the NSW DNSPs have over their LV networks will affect what mechanisms are feasible currently. The considerations in our report may also be relevant in the context of the AEMC's consideration of the Rule change proposals relating to the DEIP process.

3.2 AER DER export expenditure assessment framework

The AER is currently consulting on the appropriate assessment framework for DNSP's DER export expenditure, as a precursor to publishing a formal guidance paper. The guidance paper is intended to be published in June 2020.

The AER published a consultation paper In November 2019, that recognises the importance of:[55]

- a consistent approach to assessing DER export expenditure, particularly in light of recent proposals by DNSPs in South Australia and Victoria;
- a consistent methodology for valuing DER exports – which we note is now being progressed through the upcoming AER/ARENA VaDER workstream (see below); and
- avoiding inconsistency across jurisdictions.

Whilst this process will determine how DER-related expenditure will be assessed by the AER, we note that it will not assess the adequacy of the current incentive framework to deliver an optimal level of network hosting capacity for DER.

3.3 ARENA/AER Value of DER (VaDER)

Central to the assessment of DER expenditure is the question of what value should be placed on the benefits of DER expenditure. This is noted in the AER's consultation paper on assessing DER export expenditure and was also raised throughout the A&P workstream within DEIP.

A number of different approaches have been applied to measuring the value of additional DER exports (see Box 3.1), where the value has been determined according to the:

- avoided wholesale cost of generation – applied by SAPN;

[53] St Vincent de Paul Society, *Rule change request from St Vincent de Paul Society, Victoria - removal clause 6.1.4 in the National Energy Rules*, Rule change request (ERC0310), 30 June 2020.

[54] SA Power Networks, *Rule change proposal for access and pricing of distributed energy resources*, Rule change request (ERC0311), 7 July 2020.

[55] AER, *Assessing DER integration expenditure | Consultation paper*, November 2019, pp. 13 and 19.

- feed-in-tariff – as applied by AusNet Services; and
- range of services that DER provide – as applied in New York according to the 'value stack' approach.

Box 3.1: Alternative approaches to valuing DER

In South Australia, SAPN approached the value of DER by considering the avoided wholesale cost of generation.[56]

- When distributed generation is exported to the grid, this reduces the amount of generation required from grid-sourced generation.
- The benefit of DER exports is therefore the avoided costs of the marginal grid generator (since the marginal cost of distributed generation is essentially zero). Since the marginal generator displaced by distributed generation varies by location and time, the value of DER exports therefore varies with location and time.

In Victoria, the DNSPs have adopted the FiT as the appropriate approach to valuing DER, as this includes additional benefit categories provided by DER, over and above the avoided wholesale generation cost.[57]

- The FiT captures the avoided wholesale cost of generation, avoided network losses and environmental benefits which DER exports provide.
- However, the FiT is insensitive to location (defined at the state level) and time (the FiT does not vary over time) and therefore is at best a proxy for DER export value.

The 'value stack' approach in New York goes further than the FiT, capturing energy, capacity, environmental, demand reduction and locational system relief value.[58]

- The effectiveness of this valuation approach has been criticised by some parties for its complexity.[59]

The AER, with the support of ARENA, is in the process of commencing the VaDER workstream which will look at different DER valuation approaches. The objective of this workstream is to develop a common approach to valuing DER exports.

The AER's consultation paper on assessing DER export expenditure touched on the approach to DER valuation and sought stakeholder feedback.[60] In general, responses:

- support the development of a common approach to valuing DER;[61]
- highlight the importance that such a value is location specific and accounts for differences within and between networks;[62] and

[56] HoustonKemp, *Estimating avoided dispatch costs and the profile of VPP operation – a methodology report*, 9 January 2019, pp 6-7.

[57] Frontier Economics, *Value of relieving constraints on solar exports*, 16 October 2019, pp 16-17.

[58] State of New York Public Service Commission, *Order regarding Value Stack compensation | CASE 15-E-0751 – In the Matter of the Value of Distributed Energy Resources*, 18 April 2019, p 4.

[59] Kuiper, Dr Gabrielle, *The future of electricity distribution networks,* January 2019, p 46.

[60] See Question 7, AER, *Assessing DER integration expenditure*, Consultation paper, November 2019, p. 20.

[61] For example, see submissions by AGL Energy, Ausnet, Consumer Challenge Panel and SAPN. The submissions can be found here: https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/assessing-distributed-energy-resources-integration-expenditure/initiation.

[62] For example, see submissions by AGL Energy, Consumer Challenge Panel, Clean Energy Council and the Department of Environment, Land, Water and Planning – Victoria. The submissions can be found here: https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/assessing-distributed-energy-resources-integration-expenditure/initiation

- some responses touch on the variety of benefits DER may provide and that should be included.[63]

The value placed on DER exports is important to:

- correctly assess DER expenditure proposed by distributors; and
- ensure that any incentive mechanism incentivises efficient outcomes.

It appears that this national process will result in a common approach to valuing DER exports. To ensure consistency with the national framework, we recommend that any incentive mechanism implemented by IPART adopt the same VaDER approach to valuing DER.

3.4 Other national processes which impact DER development

There are a number of other current reform processes occurring at the national level relating to DER. Broadly, these can be categorised into three groups:[64]

- improving standards and protocols;
- enhancing DER visibility; and
- future framework and wholesale market design.

Improving standards and protocols

AEMO is currently managing a program of works, 'the DER program', in recognition of Australia's changing generation mix, as grid-scale generation is increasingly replaced by consumer DER and renewables. The purpose of this program is to facilitate a 'smooth transition' to Australia's future energy market.[65]

One stream under the DER program is AEMO's standards and protocols workstream, which is looking at firming up the relevant technical standards for DER. Supported by AEMO's Renewable Integration Study, AEMO submitted a rule change request to the AEMC on 5 May 2020 to set out 'DER Minimum Technical Standards' to enhance 'inverter performance and grid responsiveness, interoperability, and cyber security.'[66] An initial standard is anticipated to be published in October 2020.[67]

Whilst we recognise that this program is changing the operating environment of DER, these reforms will not address the imbalance of incentives for distributors to undertake expenditure to relieve DER constraints.

Enhancing DER visibility

The DER Register (which also falls under AEMO's DER program) was introduced in March 2020 to enhance visibility of DER across the NEM. This register contains information related to: [68]

- DER generation information – collected on small generating units, defined as those with a nameplate rating less than 30MW of generation capacity and for who has been exempted from the requirement of registering as a generator; and

[63] For example, see submissions by Tesla and the Department of Environment, Land, Water and Planning – Victoria. The submissions can be found here: https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/assessing-distributed-energy-resources-integration-expenditure/initiation

[64] Note that this categorisation is not exclusive. For example, AEMO's DER program fits under multiple of these categories, however, has been discussed under 'standards and protocols.'

[65] AEMO, Distributed Energy Resources Program, https://www.aemo.com.au/initiatives/major-programs/nem-distributed-energy-resources-der-program, 2020.

[66] AEMO, *AEMO Rule change request – Minimum DER Technical Standards*, 4 May 2020, p 1.

[67] AEMO, *AEMO Rule change request – Minimum DER Technical Standards*, 4 May 2020, p 2.

[68] AEMO, *DER Register Information Guidelines*, 2 September 2019, pp 5-6.

- demand side participation information – which includes 'contracted demand side participation; and the curtailment of non-scheduled load or the provision of unscheduled generation in response to the demand for, or price of, electricity.'

We note that distributors have expressed concern over the accuracy of data contained in the register, as installed capacity may differ from the connection application.

Further, the AEMC's 2019 Economic Regulatory Framework Review stated that:[69]

> The Commission encourages DNSPs to continue to develop business cases for improvement of modelling and monitoring of their LV networks, including the quantification of costs and benefits of their proposed approaches.

Our stakeholder consultations suggested that the NSW distributors were developing businesses cases for LV network modelling and monitoring.

Visibility of DER resources and network constraints on LV networks is an important prerequisite for the feasibility of incentive mechanisms, as discussed in section 2.5.

Future framework and wholesale market design

A number of projects are currently looking at the adequacy of the current NEM market design in ensuring that DER can be integrated in a way that maximises potential benefits. These processes include:

- AEMO/ENA's Open Energy Networks (OpEN) project, which is assessing different wholesale market design options to coordinate and optimise DER export expenditure – the final report is expected to be released in the near future;[70]
- the Energy Security Board's (ESB's) Post-2025 Market Design project, which aims to identify a long-term, fit-for-purpose market framework for the future of the NEM – a final paper is expected to be released in late 2020;[71]
- AEMO's Renewable Integration Study, which identifies the challenges associated with an increasing uptake of renewables and makes recommendations to facilitate the changing energy mix – the Stage 1 report was released in April 2020;[72]
- the Australian federal government's Technology Investment Roadmap, which aims to '…bring a strategic and system-wide view to future investments in low emissions technologies' through public consultation and expert reviews – a consultation paper was released in May 2020 to inform the upcoming Roadmap recommendations;[73] and
- Roadmaps developed for Western Australia by the WA Energy Transformation Taskforce and for the NEM by ENA and CSIRO, which provide projections for the future of the energy markets and recommend changes required to ensure (among a number of things) DER is effectively integrated – WA's Roadmap was published in December 2019, whilst the NEM Roadmap by ENA and CSIRO (originally published in 2017) is currently undergoing a refresh to be released in the coming months.[74]

The purpose of these projects is to shape the NEM in such a way that manages the transition of the energy market as effectively and efficiently as possible. The integration of DER is just one aspect of this transition.

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[69] AEMC, *Economic Regulatory Framework Review | Integrating distributed energy resources for the grid of the future*, 26 September 2019, p xv.

[70] AEMO and ENA, *Open Energy Networks | 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*, 15 June 2018, pp 29-33.

[71] Energy Security Board, *Post 2025 Market Design | Issues paper*, September 2019, p 3.

[72] *AEMO, Renewable Integration Study | Stage 1 Report | Appendix A, April 2020, p 4.*

[73] Department of Industry, Science, Energy and Resources, *Technology Investment Roadmap Discussion Paper | A framework to accelerate low emissions technologies*, May 2020, p 3.

[74] Energy Transformation Taskforce, *Distributed Energy Resources Roadmap*, December 2019; ENA and CSIRO, *Electricity Network Transformation Roadmap | Final Report*, April 2017.

Given the significant changes the energy market is facing, we support the need for a longer-term vision for the future.

Whilst there may be shortcomings in the current framework, and we are aware of the processes in place to address these for the future, ensuring efficient investments in and efficient operation of the network today will contribute to the necessary long term transformation of the electricity sector. Consequently, there is a need to ensure that the incentives provided by the current regulatory framework adequately encourage distributors to efficiently deliver sufficient network hosting capacity to enable DER exports.

3.5 Conclusion

With a number of processes underway at the national level, there are concerns regarding how this project fits within the national processes. For example:[75]

> Energy Networks Australia considers it appropriate for IPART to be cognisant of national processes that are currently underway when assessing the implications of two-way energy flows. Leveraging off outcomes from extensive national processes will avoid duplication and is in the best interests of customers.

it is important that the recommendations made in this report are cognisant of work that is occurring at the national level. However, our consultations and review of the current national processes suggest that although the issue of appropriate incentive arrangements on DNSPs to facilitate DER exports has been raised as an open question, this has not currently been explored as a level of detail in the national processes.

Further, while we acknowledge the desire for consistency in the incentive arrangements applying to DNSPs across the NEM, we also consider that flexibility is likely to be necessary to cater to the currently different circumstances of networks in different jurisdictions. From our consultation with the NSW distributors, we note that each of the NSW networks are at different stages of the DER export expenditure process, in terms of:

- the extent to which DER poses an issue for their networks;
- the extent to which they are actively managing issues that arise; and
- the extent to which they have visibility of DER and the associated constraints.

From a national perspective, these differences between become more apparent, as highlighted by the earlier discussion (section 2.5.2) on information differences between NSW and Victoria. Whilst cohesion and consistency across jurisdictions and networks is desirable, this may not be feasible – at least in the short term.

[75] ENA, *Energy Networks Australia submission to IPART Review of distribution reliability standards Issues Paper*, 24 April 2020, p 3. This was also raised as a key concern during our consultation with ENA.

4. Current incentives for distributors to incur expenditure to relieve DER export constraints

This section summarises the elements of the current regulatory framework that influence a distributor's incentive to incur expenditure to relieve constraints on DER exports ('DER export expenditure'), where it is efficient to do so. We conclude that currently the overall regulatory incentive framework is not sufficient to encourage distributors to deliver an optimal level of network hosting capacity.

4.1 Elements of the regulatory framework affecting distributors' incentives

There are a number of elements within the current regulatory framework that influence a distributor's incentive to incur DER export expenditure when it would be efficient to do so. We discuss these below in the context of those features associated with the revenue determination process and those features associated within the regulatory period.

4.1.1 Features associated with the revenue reset

There are a number of features within the regulatory determination process that will affect a distributor's incentive to efficiently incur DER export expenditure, including:

- the revenue proposal and AER determination; and
- network tariffs and the form of price control.

Each of these features are discussed in turn below.

Revenue proposal and determination

The regulatory revenue reset process establishes the maximum allowable revenue that a distributor is able to earn from DUoS charges over the forthcoming regulatory period. The regulatory determination will also establish the expenditure allowances and service quality targets against which the various incentive schemes are measured.

The regulatory framework establishes specific rules that must be applied by the AER in evaluating the total capex forecast submitted by a distributor. This includes an assessment as to whether the capex forecast reflects the efficient costs that a prudent distributor would incur to meet or manage expected demand for standard control services, maintain service quality, and ensure the reliability, security and safety of the network. In making this assessment, the AER must refer to a series of factors, such as the distributor's actual previous expenditure, and benchmark efficient expenditure. The regulatory framework applying to operating expenditure (opex) is very similar to that for capex.

We note that some stakeholders questioned whether the current expenditure criteria are sufficiently broad to enable distributors to include any DER expenditure. Specifically, whether DER export expenditure could be said to necessary to *meet or manage expected demand for standard control services*. That said , this issue was not raised by the AER in its Consultation Paper for Assessing DER integration expenditure, nor has it prevented the AER accepting proposed DER related expenditure by SA Power Networks. To the extent that this is an issue we would expect it to be addressed through the DEIP process.

The AER's assessment of DER related expenditure included in the distributor's proposal is being currently being formalised through additional guidance being developed by the AER (see section 3.2), and the ARENA/AER VaDER workstream (see section 3.3).

The indications from these processes is that distributors will likely be required to include a business case in their regulatory proposals demonstrating that expanding the hosting capacity of the network results in a positive net benefit, where the benefits of DER exports would need to valued consistent with the methodology developed by the VaDER workstream. Note that DER export expenditure, unlike demand management expenditure, will not include a positive incentive margin,[76] and so these projects are unlikely to be a priority for distributors in the same way as demand management projects.

Another feature of the revenue determination is that the AER is required to form a view on the total forecast capex and opex for the forthcoming regulatory control period, rather than on individual projects or programs.[77] It remains for the distributor to prioritise its expenditure within the approved overall regulatory allowance.

It follows that distributors are not required to undertake a project to expand the hosting capacity, even where that project is included in the regulated expenditure allowances. This is potentially an issue since under the current regulatory framework distributors are not penalised if they fail to deliver additional DER hosting capacity while they are rewarded for underspending their expenditure allowances (see section 4.1.2).

Network tariffs

A further component of the regulatory determination is the form of price control and the Tariff Structure Statement (TSS), that sets out the proposed tariffs in year one of the regulatory period and indicative tariffs for the remainder of the period.

The form of price control and network tariffs may also influence the incentives distributors have to efficiently optimise the hosting capacity of the network. For example:

- if the AER were to decide to change the regulatory control mechanism back to a price cap, allowing distributors to charge DUoS on DER exports would provide incentives for DNSPs to reduce DER export constraints by increasing the hosting capacity of the network because DER export expenditure would increase the distributor DER export sales and they would retain the benefits associated with any increase in sales. In contrast, under a revenue cap the benefits of any increase in sales are not retained by the distributor and are instead returned to customers; and
- if postage stamp network pricing was removed it could provide localised pricing signals reflecting network constraints (including hosting constraints) thereby providing a signal to DER customers of the costs they impose on the network. Localised pricing signals would encourage DER customers to efficiently locate within the network (ie, where the cost of provide hosting capacity is minimised), further, the efficient location of DER would also allow distributors to expand the hosting capacity of the network at least cost.

However, the following features mean that currently network tariffs do not provide distributors with either a financial incentive to efficiently incur DER export expenditure or provide a pricing signal to DER customers that reflects the costs they impose of the network:

- the adoption of postage stamp network pricing,[78] is incapable of providing a signal of local network constraints;
- the AER's imposition of a revenue cap means that distributors have no incentive to increase network utilisation and so do not retain the benefit of higher revenues through increased DER exports resulting from increased network hosting capacity;
- the prohibition on charging DUoS on exports mean that network tariffs are incapable to signalling to DER systems the costs that their exports impose on the system.[79]

[76] The incentive margin for demand management program arises from the DMIS – discussed below.

[77] Clauses 6.5.6(a) and 6.5.7(a) of the NER.

[78] We note that stakeholders have indicated broad customer support for the continuation of postage stamp pricing on equity ground.

[79] Clause 6.1.4 of the NER.

4.1.2 Within regulatory period features

There are a number of regulatory features that operate during the regulatory control period that can potentially influence the incentives distributors have to deliver to efficiently incur DER export expenditure including:

- the expenditure incentive schemes, that reward distributors for underspending their capital and operating expenditure allowances and penalise them when they overspend;
- the service target performance incentive scheme that rewards the distributor for improvements in the quality of some aspects of network services, and penalises them for deteriorating service delivery; and
- the RIT-D/minimum project evaluation framework that mandates a process that distributors must follow in assessing potential capital projects to ensures that as range of credible options are considered, and that the option chosen has the highest net benefit.

Expenditure incentive schemes

Once the expenditure forecasts are set at the start of the regulatory period, distributors have the incentive to outperform these allowances and keep a portion of the difference. The amount retained by a distributor of any outperformance (or underperformance) is determined by the AER's two incentive schemes where:

- the efficiency benefit sharing scheme (EBSS) sets out how the benefits (costs) of any opex outperformance (underperformance) will be shared between the distributor and customers;[80] and
- the capital expenditure sharing scheme (CESS) sets out how the benefits (costs) of any capex outperformance (underperformance) will be shared between the distributor and customers.[81]

Both schemes target a share of any over(under) performance to retained by the distributor of 30 per cent while customers get 70 per cent of the benefit (penalty).[82] Each scheme achieves this through a different mechanism, with:

- the EBSS allowing the distributor to retain any incremental opex over(under) performance for a period of 6 years; and
- the CESS calculating a carry forward amount (to be included in the MAR for the following regulatory period) that ensures that the distributor retains 30 per cent of any capital over(under) performance on a net present value basis.

A feature of both these schemes is that they operate symmetrically, in that if a distributor spends less than its opex or capex allowance, it is rewarded with a portion of the financial benefit of the underspend. Where a distributor spends more than its opex or capex allowance, it receives a financial penalty equal to a portion of the financial loss of the overspend. Furthermore, the schemes both impose a constant incentive rate whereby the reward (penalty) for a given dollar of savings (overspend) does not change over time.

By ensuring that the regulatory arrangements impose a constant incentive to make savings, distributors have a strong incentive to reduce their expenditure since it will either increase the rewards, or reduce the penalties, provide by the EBSS and CESS.

A consequence of the AER's expenditure incentive framework is that distributors have a strong financial incentive to minimise their DER export expenditure. Consequently, (as highlighted in section 4.1.1) even if DER export expenditure is included in a distributor's expenditure allowances, a distributor has a financial incentive to defer or avoid this expenditure.

[80] AER, *Better Regulation | Efficiency Benefit Sharing Scheme for Electricity Network Service Providers*, November 2013.

[81] AER, *Better Regulation | Capital Expenditure Incentive Guideline for Electricity Network Service Providers*, November 2013.

[82] AER, *Better Regulation factsheet | Expenditure incentive guideline*, November 2013.

Counterbalancing these expenditure incentives would be the following the incentives/obligations for distributors to undertake DER export expenditure.

- any rewards (penalties) provided under a quality of service incentive scheme (this is discussed in the following section);
- any applicable regulatory obligations or requirements for distributors to undertake DER export expenditure; and
- the desire to generate good customer relations to be seen to address customer complaints.

In our consultation, the NSW DNSPs indicated that the primary reason that they undertook DER export expenditure was to maintain good customer relations.

Quality of service incentives

The AER's distribution service target performance incentive scheme (STPIS) provides a financial incentive linked to the overall quality of service experienced by customers.

In general, the STPIS is designed to balance the incentive to reduce expenditure with the need to maintain or improve service quality. It achieves this by providing financial incentives to distributors to maintain and improve service performance when customers are willing to pay for these improvements. That is, while the regulatory regime as a whole encourages distributors to improve operating and capital efficiency, the STPIS is designed to ensure that this increase in efficiency is not at the expense of an inefficient deterioration in service performance for customers.

Under the scheme, the AER establishes service-based targets for each distributor and provides financial rewards for distributors that exceed the targets and financial penalties for distributors that fail to meet the targets. The scheme currently consists of four components – the reliability of supply component, the quality of supply component, the customer service component (which are collectively referred to the 's-factor components'), and the GSL component. The s-factor components reward (penalise) a distributor by providing annual revenue increments (decrements) depending on the distributor's performance against pre-determined performance targets. The GSL scheme sets threshold levels of service for distributors to achieve and requires direct payment to customers who experience service levels below the threshold level (however this component does not apply to the NSW DNSPs, as discussed below).

The incentive rates provided through the reliability of supply component are calibrated with how willing customers are to pay for improved service, consistent with the requirements in the NER.[83] That is, the distributor is able retain the value customers place on improvements in network reliability for a period of five years which is designed to balance the expenditure incentives provided under the CESS and EBSS.

Consequently, the AER's incentive framework aligns the distributor's financial incentives to deliver an optimal level of network reliability, ie, a level of reliability where the incremental cost of improving reliability equals the value that customers place on the incremental improving reliability.

The GSL component of the STPIS does not apply to the NSW distributors because the NSW licence conditions imposes an obligation on a distributor to operate a GSL scheme.[84] The NSW distribution licences currently impose the following two GSLs[85] with the licence holder required to pay $80 to a customer:[86]

- on each occasion that the customer's premise exceeds the interruption duration standard (ie, 12 hours in a metropolitan and 18 hours in a non-metropolitan area); and

[83] Clause 6.6.2(b)(3) of the NER.

[84] AER, *Final decision Electricity distribution network service providers Service target performance incentive scheme*, June 2008, p 8.

[85] In NSW a GSL is called a guaranteed customer service standard.

[86] IPART, Review of distribution reliability standards, March 2020, pp 29 & 49.

- when the supply at a customer's premise over a financial year exceeds the interruption frequency supply standards (ie, 4 interruptions of greater than or equal to 4 hours).

Under the NSW scheme customers are required to claim the GSL from the distributor and payments are capped at a maximum of $320 per customer per year.[87]

The current service quality incentive framework for NSW distributors does not define the provision of hosting capacity for DER customers as a dimension of network service quality. Consequently, neither the STPIS nor the NSW GSL arrangements provide any financial rewards or penalties associated with the level of hosting capacity for DER customers. In the absence of any offsetting penalty for providing insufficient host capacity, the distributors have a strong financial incentive to defer or avoid DER export expenditure.

4.2 Assessment of current framework

To summarise, the incentives for efficient DER export expenditure under the current regulatory arrangements are:

- efficient DER export expenditure can be included in a distributor's expenditure allowances, with the details of how a distributor would demonstrate efficiency the subject of a currently open AER consultation process;
- the inclusion of DER export expenditure in a distributor's total expenditure allowances does not require the distributor to undertake the project, instead it remains for the distributor to prioritise its expenditure within its approved opex and capex expenditure budgets;
- unlike demand management, a distributor is not provided with an additional positive incentive for DER export expenditure that allows the business to recover more than its costs whilst also delivering a net benefit to customers;
- distributors have a strong financial incentive to minimise DER export expenditure over the regulatory period without any counterbalancing service quality incentives to provide DER hosting capacity to allow greater DER exports; and
- there no minimum service standard for DER customers that requires distributors to pay an amount to customers who experience service levels below the threshold level network hosting capacity.

With respect to DER export expenditure, the current incentive framework applied to the NSW distributors is weighted towards minimising expenditure and so would promote a less than efficient level of DER exports due to limited network hosting capacity.

We understand from stakeholder meetings that to date the issue of insufficient DER hosting capacity has generally not been a major issue in NSW, although it is an emerging issue for Essential.[88] Further, we understand that distributors are undertaking DER export expenditure in response to customer complaints. However, projections of future DER growth in NSW, together with the experience in other Australian jurisdictions suggest that the need to ensure that the regulatory arrangements provide an efficient level of DER hosting capacity will become an important issue.

[87] Customers are required to identify the date that of the duration event occurred, or the financial year for a frequency claim together with the customers NMI. The customer is also able to attach supporting documents.

[88] See section 2.2 of this report that that outlines the experience of DER by the NSW distributors.

5. Framework for assessing incentive options

This section outlines how we have assessed different potential options to incentivise distributors to optimise network export capacity. The terms of reference for the reliability review directs IPART to make recommendations that could be:

> …implemented by distributors (within the current regulatory framework) that would be likely to reduce network prices and are consistent with the National Electricity Objective.

Our discussions with IPART clarified that options should be capable of being implemented by 1 July 2024 (the start of the NSW distributors next regulatory control period), and that options that may not reduce network prices may also considered, where they are expected to provide customer benefits.

Consequently, each of the options have been assessed on the basis of whether the option:

- improves incentives to efficiently relieve DER export constraints and addresses the concerns identified in the previous section;
- provides efficient network price signals which reflect the long run marginal costs incurred by networks to facilitate DER exports;
- addresses concerns that limitations in hosting capacity can give rise to equity issues in that:
  - some DER exporters are disproportionally impacted by network constraints; and
  - investments in DER are being undertaken by customers without easy visibility of the local area network constraints that may impact their DER generation; and
- can be implemented in time for the NSW distributors next regulatory control period starting 1 July 2024.

We discuss each of these elements of our assessment framework further below.

5.1 Financial incentives to efficiently relieve DER export constraints

The previous section concluded that the incentives under the current regulatory framework applying to the NSW distributors is not fit for purpose with respect to providing financial inducements to efficiently expand the DER hosting capacity of the networks. Any new incentive mechanism should induce distributors to expand the hosting capacity of their network, where it is efficient to do so.

An efficient expansion of DER hosting capacity would be where the value of additional DER exports enabled by the additional capacity outweighs the incremental costs of providing the additional capacity. We note that investments in the distribution may have multiple benefits, such as expanding both network and DER hosting capacity, or the safe operation of the network and DER hosting capacity, in these circumstances the efficiency is options results in the greatest net benefits.

An optimal financial incentive mechanism would ensure that a distributor's profit maximising position would be to deliver a level of DER hosting capacity where the incremental cost of network capacity equals the incremental value of DER exports. That said, any incentive mechanism that rewards a distributor for an efficient expansion or reduction in the DER hosting capacity of its network would be an improvement on the current regulatory framework.

The incentive mechanism should not simply focus on increasing network hosting capacity but should instead focus on the services that this additional capacity allows, ie, increased DER exports. An increase in network hosting capacity has no value unless it increases the amount of DER that can be exported.

As discussed earlier, the AER has initiated a process (with ARENA) to determine a methodology for valuing DER exports (ie, the VaDER project). Any incentive mechanisms should seek to align with the use of this VaDER value for DER exports.

5.2 Efficient network prices

The network pricing objective in the NER requires that network tariffs should reflect the efficient costs of providing network services.[89] This objective is subject to the limitations imposed by the prohibition of network charges for the export of energy.[90]

A consequence of the prohibition on exports, the costs imposed on the network by DER exports cannot be recovered from only those customers with DER systems. Instead these costs must be recovered from all customers.

Options that allow networks to adopt more cost reflective network tariffs, by allowing networks to recover from DER customers the additional costs they impose on the network, would promote the efficient use of the network consistent the NEO. In contrast, options that exacerbate current pricing efficiencies, by recovering additional DER costs from all customers, would lead to a less efficient use of the network and be inconsistent with the NEO.

5.3 Equity issues

Equity issues arise because the network's hosting capacity experience by DER customers is highly location-specific and will depend on a number of factors including: the level and type of DER installed; the local load profile and physical and electrical network characteristics.[91]

The variability in the level of network access received by DER exporters is reflected in the following equity issues raised by stakeholders:

- some DER exporters are disproportionally impacted by network constraints; and
- investments in DER are being undertaken by customers without visibility of the local area network constraints to DER generation.

The disproportional impact of network constraints on some DER customers was perceived unfair or inequitable because the level of network access provided was substantially below that received by the average DER customer. This concern is consistent with the analysis reported by University of NSW that:[92]

> - The majority of consumers in the sample do not suffer significant PV curtailment, with approximately $3 - $12 per year per site on average in lost generation value …
> - However, the consumers which are significantly impacted can experience considerable financial penalty. The most impacted consumer is estimated to lose approximately $225 - $900 per year.

The second equity issue raised by stakeholders was the concern that customers are currently investing significant amounts in DER with little or no information on the impact that constraints on the local distribution network may have on the DER system's capacity to generate electricity. Information about whether a DER system installed in a specific NMI location may be constrained was seen as necessary for consumers to make an informed decision to invest in a DER system.

[89] Clause 6.18.5 of the NER.

[90] Clause 6.1.4(a) of the NER.

[91] See AEMO, *Renewable Integration Study Stage 1 | Appendix A: High Penetration of Distributed Solar PV*, April 2020, pp 16-17

[92] Heslop, S. et al. (UNSW), *Voltage Analysis of the LV Distribution Network in the Australian National Electricity Market*, May 2020, p 161.

5.4 Practicality of implementation

IPART's focus in on options that can be implemented for the start the NSW distributors' next regulatory control period, ie, by 1 July 2024.

There are two principal barriers to implementing an incentive mechanism for the NSW distributors:

- the lack of necessary information to implement a scheme; and
- the need to operate within the national regulatory framework.

As discussed in section 2.5.1, the level of visibility that NSW distributors currently have of DER systems installed in their network and the constraints experienced by DER exports on their low voltage network is extremely limited. This means that:

- options that require limited information may be more feasible to implement in the short term; and
- options that are more information intensive may only be able to be implemented in the longer term, once more sophisticated information systems are developed.

A further implementation issue is that the NSW distributors are subject to the national regulatory framework. Consequently, options that:

- can be unilaterally implemented, such as those that only require changes to the NSW distribution licences, would be easier to be implemented in the short term; while
- options that require changes to the national regulatory framework may be more appropriately supported through advocacy as part of national processes.

6. Mechanisms to incentivise reducing constraints on DER exports

This section considers six potential options for providing incentives for the NSW distributors to relieve constraints on DER exports, when efficient to do.

These options are:

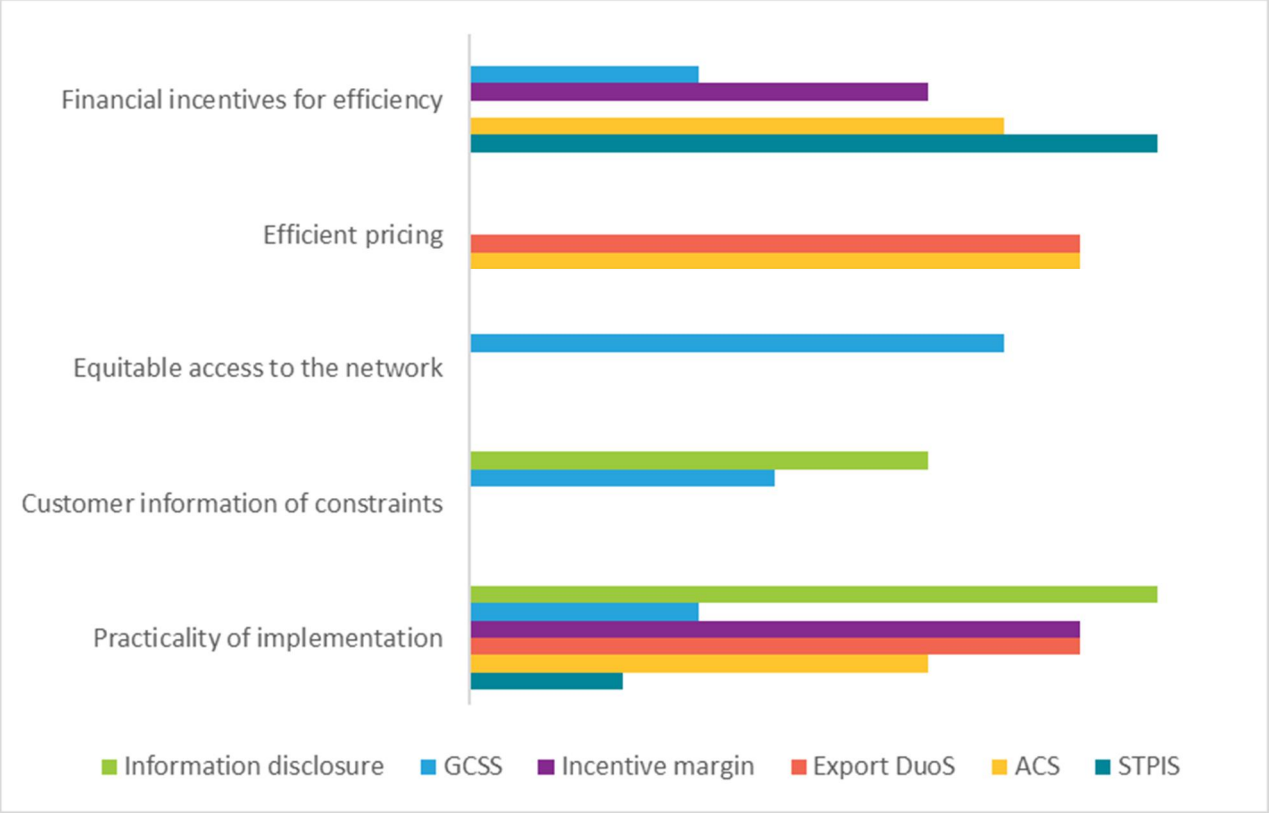
- two options that could be unilaterally introduced by IPART/NSW Government:
  - information disclosure; and
  - a guaranteed customer service standard targeted at customers experiencing the most severe export constraints.
- four options, that would need to be implemented through the national regulatory framework:
  - allowing distributors to earn an additional margin on expenditure that efficiently increased DER export hosting capacity (analogous to the Demand Management Incentive Scheme (DMIS)),
  - allowing distributors to levy a charge on exports, as part of their DOUS tariffs;
  - classifying DER hosting capacity as an alternative control service; and
  - incorporating a measure of hosting capacity as part of the STPIS incentive scheme.

We assess each of these options against the criteria discussed in the previous section, ie, the impact the option has on:

- the distributors financial incentive to invest in relieving constraints on DER exports, when efficient;
- the efficiency of network tariffs in signalling to DER customers the costs they impose on the network;
- equitable access by DER customers to the export hosting capacity of the distribution network;
- the information available to customers on potential local network constraints; and
- the practicality of implementing the option for the NSW distributors by 1 July 2024.

Figure 6.1 summarises our assessment of the six options against these criteria.

Figure 6.1: Overview of the identified options



6.1 DER information disclosure regime

Mandatory information disclosure regimes can be an effective means of achieving policy goals and have been applied to a number of problems such as restaurant quality and health outcomes, the quality and price of childcare services, and competition in petrol markets.

There are several reasons why information disclosure regimes can be capable of achieving desired policy outcomes. Delmas, Shimshack and Sancho in a working paper (2010) described a number of reasons why an information disclosure regime can influence the fuel mix of US utilities, including:[93]

- the presence of information can result in community coercion, with community activists using the information to harm the firm's reputation with the public; and
- disclosure programs can also signal the state's willingness to impose future regulations on the industry unless firms self-regulate.

We have considered an option in which a new obligation is imposed on distributors to periodically report on available metrics relating to their networks' DER export performance.

[93] M. Delmas, J. Shimshack, M. Montes, *Mandatory Information Disclosure Policies: Evidence from the Electricity Industry*, Working Paper , 2010.

6.1.1 Description of the option

A DER information disclosure regime would seek to encourage NSW distributors to efficiently minimise the impact of insufficient network hosting capacity on the ability of DER customers to export electricity. To achieve this objective the disclosure regime could seek to information on:

- the number of DER systems exporting electricity in the distributor's network over the reporting period;
- the quantum of electricity (MWh) of DER electricity exported to the distributor's network over the reporting period;
- the quantum and value of DER generation that could not be produced due to insufficient hosting capacity of the distributors network, although as set out in section 2.5.1 NSW distributors do not currently capture this information;
- a record of customer complaints relating to the distributor constraining DER exports, including the date and the customer NMI over the reporting period;
- the number of customers that are actively being curtailed from exporting any electricity via a total static limit over the reporting period;
- number of customers that are actively being curtailed from exporting some electricity via a partial static limit over the reporting period;
- the number of DER systems that were denied connection to the network over the reporting period; and
- level of operating and capital expenditure by the distributor that is primarily for the purpose of addressing network constraints on DER exports.

The above list illustrates the types of information that could be included in an information disclosure regime. However, the development of the information to be disclosed should be subject to a consultation process to ensure both that the information is available and that does not give rise to any unintended incentives.[94]

The information disclosed by the NSW distributors could then be used by IPART to:

- publish trend analysis on each network's historical performance on each of these metrics;
- benchmark performance across each of the distributors – we note that any benchmarking would be more effective if it also included distributors elsewhere in the NEM, however, the development of a national disclosure regime would be outside of the purview of IPART; and
- inform customers with DER (and those who may be contemplating in investing in DER) as to the presence and location of DER complaints (in the short term) and DER constraints (in the longer term) as more information becomes available on the DER hosting capacity of localised network.

The obligation on the NSW distributors to disclose this information could be achieved by extending current performance monitoring and reporting requirements contained in the NSW distribution licences.

6.1.2 Assessment of the DER information disclosure regime

The introduction of a requirement on the NSW distributors to disclose DER-related information provides a non-monetary incentive for distributors to optimise export hosting capacity through a combination of moral suasion and the implicit threat of future regulatory intervention. The obligation to disclosure could illuminate:

- the services that networks provide to DER exporters, through the disclose of increasing penetration of DER systems and output within the distributor's network;

[94] For example, an unintended consequence might be if the information disclosure regime requires a disclose of the number of static limits placed on DER systems, a distributor might respond by refusing to connect DER systems.

- the impact that networks have on the ability to export, initially via information on the number of customers that are subject to static limits or who are refused connection, and in the longer term the quantum and value of DER generation that could not be produced;
- the level of customer satisfaction regarding the services provided by the distributor to DER customers, through publishing data on customer complaints; and
- the response by distributors to DER issues, via the requirement to provide information on expenditure to address network constraints on DER exports.

An information disclosure regime would highlight situations where distributors have either not responded to DER concerns of customers or where their response is not consistent with the observed practice of other distributors.

However, this option does not change the current balance of financial incentives for distributors to optimise the network's DER export capacity. Consequently, distributors will continue to have no financial incentive to invest in DER export capacity.

An information disclosure regime also does not improve the efficiency of network prices for DER. However, an information disclosure regime could exist and complement any distribution pricing reforms. Similarly, an information disclosure regime would not address issues of inequal network access by individual DER customers, although the publishing of the location of DER complaints could provide information for investors in DER of the presence and location of constraints within the distributor's network.[95]

This option could be implemented by IPART/NSW Minister to start by 1 July 2024 through changes to the NSW distributors' licence conditions. Initially this would only provide information that is currently retained by the three NSW distributors. Over time, however, more information could be captured by the disclosure regime as each distributor improves its LV network visibility and/or gains access to individual customer DER output.

We note that an information disclosure regime that only includes information from the three NSW distributors would only provide a limited capacity to carry out meaningful benchmarking of distributors' performance. A national information disclosure regime could therefore be more effective. However, this could only be introduced by the AER through changes to its distribution information disclosure requirements.

6.1.3 Recommendations and further steps

In our opinion, IPART/NSW Government should consider establishing a new requirement to disclose information relevant to the quality of service provided by each distributor to DER customers.

The introduction of an information disclosure regime would deliver the following benefits:

- create a non-financial incentive for distributors to address network constraints experienced by DER customers; and
- the information of the location of DER-related complaints could be published, so that customers considering investing in DER systems have an indication of where networks are currently needing to constrain DER customers.

It is an option that can be independently established by IPART/NSW Government through unilateral changes to the licences of NSW distributors, and is capable of being implemented by 1 July 2024.

An information disclosure regime does not change the existing financial incentives, and so distributors will continue to have no financial incentive to invest in DER export capacity. However, an information disclosure regime could coexist with options that introduce financial incentives for DER and/or reforms to network tariffs.

[95] We note that the publishing of DER complaints would need to be done in a manner consistent with IPART's privacy obligations.

For this option to be implemented we recommend that IPART undertake a consultation process that seeks to identify:

- the specific information to be required by the information disclosure regime, which should only include data distributors already retain;
- the specific information that should be provided on a "best endeavours basis", which would include data that distributors can reasonably expect to collect in the medium term;
- the completeness of the information required, to ensure that the disclosure regime is effective and does not give rise to any unintended adverse incentives; and
- development of a visualisation tool for DER complaints that could be provide to the public and would be periodically updated as new information becomes available.

6.2 Guaranteed customer service standard

Guaranteed customer service standards (GCSS) establish a measure of the minimum quality of service standard beyond which a customers can apply for a compensatory payment from the NSW distributors. In NSW the distributors' licences currently impose the following two GCSS with the licence holder required to pay $80 to a customer:[96]

- on each occasion that the customer's premise exceeds the interruption duration standard (ie, 12 hours in a metropolitan and 18 hours in a non-metropolitan area); and
- when the supply at a customer's premise over a financial year exceeds the interruption frequency supply standards (ie, 4 interruptions of greater than or equal to 4 hours).

Under the NSW scheme customers are required to claim the GCSS from the distributor and payments are capped at a maximum of $320 per customer per year.[97] This licence obligation to pay GCSS means that the expected cost of the scheme is recovered in the distributor's total operating expenditure allowance.[98] Distributors then have an incentive to improve the reliability experienced by worst served customers to outperform the expected cost of the GCSS.[99]

We have considered an option in which a new GCSS (a 'DER export GCSS') is created covering the ability of customers with standard DER systems to access the network to export electricity. The objective of this option would be to target standard DER customers that experience very poor DER network hosting capacity, to provide an incentive for distributors to improve their hosting capacity, where efficient, or to provide that customer with a level of compensation. We note that the purpose would not be to create a financial right to export all electricity produced by DER.[100]

[96] IPART, Review of distribution reliability standards, March 2020, p. 29 & 49.

[97] Customers are required to identify the date the duration event occurred, or the financial year for a frequency claim, together with the customers NMI. The customer is also able to attach supporting documents.

[98] Clause 6.5.6 (2) of the NER requires a distributor's total forecast operating expenditure allowance to include the expected cost of complying with regulatory obligations.

[99] Under the AER's current opex incentive framework, the actual costs of GCSS in the base year is incorporated in the distributor's base year total opex costs and projected forward over the forthcoming regulatory period. This, combined with the EBSS, means that the distributor retains any reduction (or increase) in GCSS payments for a period of 6 years.

[100] As discussed below the introduction of GCSS involves a transfer from all electricity customers to DER customers. Consequently, a GCSS that creates a financial right to export DER would result in a substantial new cost to all electricity customers that would grow as the number of DER systems increase. Further, with the current restriction on charging network tariffs on electricity exports the creation of a financial right to export DER would lead to inefficient network tariffs that would be incapable of signalling to DER customers the locational costs of hosting DER within the network.

6.2.1 Description of the option

The DER export GCSS would have the following characteristics:

- a threshold level of DER export interruption duration that, if exceeded, would result in a fixed GCSS payment; and
- the DER export GCSS threshold would be targeted at the worst served DER systems (for example, the two per cent of standard DER customers that are most disrupted by insufficient network hosting capacity).

The features of the DER export GCSS would need to be shaped by the available information. For example, depending on the information available the GCSS could have the following characteristics:

- a threshold could be established as either:
  - the dollar value of DER that could not be generated due to network constraints, which has regard to both the quantum and time that DER exports were constrained; or
  - the quantum of electricity (kWh) that the DER could not generate over a year due to insufficient network hosting capacity; or
  - a set number of minutes that the DER system is unable to generate due to network constraints. The time that a DER systems is partially constrained would be apportioned, ie, a system that is limited to 50 per cent of its capacity for 10 minutes, would be equivalent to being fully constrained for 5 minutes;
    - We note that DER GCSS could adopt a single threshold or the threshold could vary by network types, ie, different thresholds for urban, regional and rural; and
    - Our understanding from distributors is that it would be theoretically possible to estimate a threshold, however, with poor levels of statistical confidence. Distributors would require access to data from customer inverters to provide accurate data to estimate thresholds.
- evidence of a breach of the GCSS threshold could be sourced from either:
  - distributors' internal systems, with the customer's claim only required to identify the affected NMI and the financial year. This is similar to the current GCSS frequency claim.
    - Note that this option would allow for the establishment of an automatic GCSS payment to individuals. However. our understanding is that distributors do not currently have the capability to identify when a DER system has been constrained; or
  - individual DER customers as part of their GCSS claim. We note that customers are currently required to provide evidence where claiming the cost of any damaged or destroyed equipment caused by the distributor;
    - Distributors have indicated that independent verification would be required. However, verifying customer claims under a DER export GCSS would be very difficult without broad scale visibility of voltage and gross solar exports. Distributors would also need to determine whether the curtailment was caused by the customer installation.
- the quantum of GCSS payment could be based on either:
  - the value of DER production that was constrained from generating due to insufficient network hosting capacity for example, using the AER's VaDER approach; or
  - a fixed dollar payment to individual customers (for example, other GCSS payments are set at $80); and
- an explicit statement that there is no requirement to maintain current levels of GCSS payments.

The statement that there is no requirement to maintain current levels of GCSS payments is to ensure that this option does not create an implicit network planning standard. We expect that a distributor's regulatory proposal would include:

- a cost benefit analysis, consistent with the AER's DER export expenditure guideline, with any plan to increase the hosting capacity of the network;[101] and
- the expected cost of the DER export GCSS that factors in both the expected increase in DER installation over the regulatory period and any proposed expenditure to increase the hosting capacity of the network.
  - Distributors will need a period of time to collect reliable data to estimate the cost of the DER export GCSS.

6.2.2 Assessment of the GCSS mechanism

The creation of a GCSS for individual DER exporters, would create an incentive for distributors to maintain or improve the network hosting capacity of its worst affected DER customers. However, the primary benefit of GCSS is that its provides compensation DER customers, that due to the operation of the network, have limited ability to generate electricity, and so provide some redress for inequal access to the network.

A GCSS would also provide a limited incentive to improve network hosting capacity. However, a GCSS would only target DER customers experiencing the worst network access and so would not in itself incentivise a distributor to efficiently optimise network hosting capacity for all customers. This is because the GCSS provides no financial incentive for networks to improve the network hosting capacity for DER customers that have average or above average network access.

The strength of the incentive that the network has to invest in improving network DER hosting capacity under this option will depend on the expected cost of the GCSS it will otherwise have to pay and so:

- a lower GCSS threshold (ie, with more DER customers being entitled to a GCSS payment) gives rise to a greater incentive;
- a setting of a higher individual GCSS payment creates a greater incentive;[102] and
- an automatic payment framework would create a greater incentive compared to customer-initiated claims.

In other words, the GCSS with a greater expected cost would create a bigger incentive for distributors to efficiently expand the DER hosting capacity of its network. However, it would also, by definition, have the biggest impact on the costs of providing distribution services.

Where networks are prohibited from introducing a tariff on exports, the introduction of a DER export GCSS would result in less efficient network prices. The inefficiency arises because the cost of the new GCSS would be borne by all network customers (through its inclusion in the overall regulatory allowance), for the benefit of a limited number of DER customers. In effect, introducing a DER export GCSS would mean that the effective network tariff paid by DER customers as a group would be lower than the effective tariff paid by non-DER customers. This outcome is less efficient since costs on the distribution network associated with GCSS payments is imposed by DER customers rather than non-DER customers.

Further, a DER export GCSS may distort the signal to DER customers to efficiently locate DER systems within the network. That is, a GCSS increases the return for customers installing DER systems in parts of the network with insufficient hosting capacity. The materiality of this distortion depends on the level of the DER export GCSS payment, a modest payment that only partially compensates the customer for lost export revenues is unlikely to distort the locational signals to not install DER on the constrained parts of the network. However, where a GCSS created a financial right to export electricity (ie, the GCSS fully compensated DER customers for all lost exports) the return from installing a DER system would be the same

[101] This option does not address the concern discussed in section 4 that there is no requirement to actually spend the amounts included in a network's expenditure allowances on increasing network hosting capacity.

[102] Note that if the DER export GCSS payment was set above the value of lost DER exports by the individual there it would create an incentive to inefficiently expand the hosting capacity of the network.

irrespective of the hosting capacity of the local network. In this extreme example, the GCSS would result in customers having no incentive to avoid installing DER in constrained parts of the network.

Further, the information collected on the payment of GCSSs could be provided to customers to inform them before they invest in DER systems as to the presence of network constraints within the distribution network. This information could potentially complement the information provided by distributors under any information disclosure regime.

However, we do not consider that a DER export GCSS would be capable of being implemented in practice for the 2024-29 regulatory period, . In particular it would face the following implementation issues:

- difficulties with estimating a GCSS threshold with any statistical confidence;
- potentially insufficient time for distributors to collect data to estimate the cost of a DER export GCSS for their revenue proposals to the AER, due in January 2023; and

developing sufficient systems to independently verify DER export GCSS claims. NSW distributors do not currently have the capabilities to independently verify breaches of the GCSS, which would require distributors to have greater visibility of customer DER production and to ensure that any curtailment was due to insufficient network hosting capacity.

6.2.3 Recommendations and further steps

In our opinion, a new GCSS that compensates individual DER customers experiencing very poor network hosting capacity has a number of good properties, however, to be implemented would require information systems that could measure individual DER generation. The information NSW distributors do not have access to generation of individual DER systems (and do not have plans to have this information) and so cannot in practice be implemented for the 2024-29 regulatory control period.

When introduced a DER export GCSS would deliver the following benefits:

- create a financial incentive for distributors to reduce the level of network constraints experienced by those DER customers with the worst network access;
- mitigate stakeholder concerns that a small number of DER customers experience very poor levels of network access; and
- it is an option that can be independently established by IPART/NSW Government through unilateral changes to the licences of NSW distributors.

These benefits would need to be assessed against the following weaknesses of a DER export GCSS:

- less efficient network prices with:
  - all customers paying the cost of the GCSS, with the benefits disbursed to affected DER customers only; and
  - muted locational signals for DER systems not to be installed in parts of the network with significant hosting constraints;
- a GCSS targeting worst served DER customers will not provide an effective incentive for distributors to efficiently optimise network hosting capacity for all customers; and
- the practical issues with implementing a DER export GCSS.

In our opinion, IPART should keep this option under review for future regulatory periods. However, at this stage there is little value in detailed development of this option.

6.3 Incentive margin on efficient DER export expenditure

The national regulatory framework currently provides for an additional margin to be earned by distributors for efficient demand management expenditure, via the DMIS. [103]

In the AER in its reasoning for the DMIS stated that:[104]

> The Scheme and [Demand Management Innovation] Mechanism are targeted, achievable solutions that form a bridge between the current regulatory framework and a framework more focussed on efficient pricing of network services. While we have already taken steps towards the new framework, the transition to more efficient tariff structures is likely to take some time.

Similar reasoning could justify the introduction of analogous arrangements to incentivise efficient expenditure on increasing DER hosting capacity, which would not currently fall under the definitions of expenditure which are eligible for the DMIS.

6.3.1 Description of the option

Similar to the DMIS,[105] a DER incentive margin would have the following features:

- distributors identify via a RIT-D/project business case, efficient DER export expenditure projects and commit to the deliverables for the project. Consequently, this option does not require any additional information from what distributors would already need provide the AER to justify DER export expenditure;[106]
- the distributor determines the project incentive margin, up to 50 per cent of the DER export project's cost, subject to the constraint that the project costs plus the incentive margin cannot be greater than the project benefits;
- the distributor produces an annual compliance report that includes data on each DER export project, including the costs, benefits and outputs of the projects; and
- the AER reviews the compliance reports and approves the payment of the financial incentive, which could potentially include a cap on the total incentive payment. For example, for the DMIS the cap is 1.0 per cent of the distributor's annual smoothed revenue requirement.

This option could not be unilaterally imposed by IPART/NSW government, and would instead need to be implemented through changes to the national regulatory framework. There would need to be a rule change to allow for the introduction of a DER incentive margin and to establish key principles, which would most likely provide for the AER to develop the details of the incentive arrangement.

An outcome of the AEMC/ARENA DEIP process is for the DEIP Working Group, TEC and ACOSS to submit a rule change proposal that would require the AER to develop an incentive mechanism for efficient DER export expenditure.

In our opinion, such a rule change should provide the AER with the flexibility to develop more than one incentive mechanism for DER export expenditure. This would allow the AER to tailor the incentive mechanism for the particular circumstances of each distributor, having regards to:

- the materiality of the issue, ie, DER currently creates very different issues for different distributors due to differing levels of DER penetration, load profiles, and physical and electrical network characteristics,

[103] The DMIS replaced the earlier Demand Management and Embedded Generation Incentive Scheme, and was introduced in 2017.

[104] AER, *Explanatory statement | Demand management incentive scheme | Electricity distribution network service providers*, December 2017, p 15.

[105] AER, *Explanatory statement | Demand management incentive scheme | Electricity distribution network service providers*, December 2017, pp 7-9.

[106] We would expect that the evaluation of these projects would adopt the methodology set out that the AER is currently developing for assessing DER export expenditure.

noting that these issues are generally less pressing for the NSW distributors (particularly Ausgrid and Endeavour) compared with distributors in South Australia and Queensland; and

- the current differing level of visibility of DER systems and LV networks, which may make some incentive mechanisms impractical for some distributors (eg, a STPIS-style approach, as discussed below).

Although this represents a departure from the NEM-wide arrangements typically reflected in the rules, the different current status of each of the distributors with respect to DER warrants consideration of whether in the short-term different incentive approaches are warranted.

6.3.2 Assessment of an incentive margin on efficient DER export expenditure

This option addresses a number of the incentive problems we identified with the current incentive framework, specifically:

- it would provide distributors with a positive incentive to propose efficient DER export projects, and to deliver those projects;
- requires no additional information than that already required of distributors to propose DER export expenditure in their capex and opex allowances; and
- an incentive margin of 50 per cent would be greater than the incentives that distributors have to reduce expenditure during the period (under the CESS and EBSS).

The one drawback with this option is that distributors would not have to propose projects with the greatest net benefits. Rather, this option encourages distributors to propose DER export projects that maximise incentive payments, which will be likely be higher cost projects. Notwithstanding this drawback, all DER export projects would still need to demonstrate a positive net benefit to customers (where the costs include the incentive margin on an ex-ante basis).

This option would not improve the efficiency of pricing signals to DER customers. Instead since the costs incurred to relieve DER export constraints plus the incentive margin would be borne by all customers this option has the capacity to lead to less efficient price signals for DER customers. However, this option could be introduced alongside reforms to network tariffs, such as the removal of the current prohibition on charging DUoS to exports.

This option would also not address the issues of inequal network access between DER customers, nor provide potential DER investors with information on the location of network constraints. However, this option could again operate alongside other mechanisms targeted at addressing these concerns, such as an information disclosure regime.

As noted above, this option does not require the distributor to have access to any more information than it would currently need to propose DER export expenditure in its regulatory proposal. Obviously, distributors with better visibility of their LV network and individual customer DER systems would be better placed to identify and substantiate efficient DER export projects. It follows that providing an incentive margin for DER export projects would provide distributors with a further reason to improve visibility of their LV network and DER systems.

6.3.3 Recommendation

In our opinion, this option represents a credible solution to the imbalances of the current incentive framework for efficient DER export expenditure. Further, this option could be realistically be implemented to apply to the NSW distributors by 1 July 2024, as it does not require comprehensive visibility of either the distributors' LV networks or the operation DER systems within their network. However, as noted above, this option would need to be implemented by the AEMC and the AER through changes to the national framework.

In our opinion this option appears to be proportional response to the problem of insufficient network hosting capacity. UNSW has estimated that the cost of insufficient hosting capacity resulted in a cost to DER

customers in South Australia (where the DER related issue are most prominent) in the order of $3 - $12 per year per site on average in lost generation value.[107]

In our opinion, this option would be an achievable solution that forms a bridge between the current regulatory framework and a framework more focussed on efficient pricing of network services.

6.4 Reforming distribution tariffs

An efficient distribution network tariff would signal to customers the costs their export from DER imposes on the distribution network. Currently, the regulatory requirements and assessment of network tariffs focuses on the costs that a customer's electricity demand imposes on the distributor, because of the prohibition in the rules on distributors charging DUoS charges for the export of electricity generated by customers.[108]

6.4.1 Description of the option

Under this option the prohibition on distributors charging DUoS for the export of electricity by DER would be removed. We note that more fundamental changes in electricity markets will be necessary to realise the full benefits of new technology, including DER, and this is currently being assessed in the AEMO/ENA Open Energy Networks (OpEN) project and ARENA/AEMC DEIP process. That said, the introduction of network tariffs for DER export would be a step towards more efficient network tariffs.

Under this option the prohibition on charging DUoS on the export of electricity by DER would be removed, and the pricing principles in the NER would be updated to reflect this change. Distributors would then be able to introduce DUoS tariffs for DER exporters, and the revenues generated from these tariffs would be included in the distributor's revenue cap.

DER export tariffs would then be included in the distributor's Tariff Structure Statements which requires all DUOS tariffs to be consistent with the pricing principles and the network pricing objective.

This option would require distributors to develop forecasts of:

- DER exports over each year of the regulatory period, noting that these forecasts would be updated annually under the revenue cap; and
- the allocation of network stand-alone, incremental and LRMC costs of DER exports, where required by the Tariff Structure Statements.

This option could not be unilaterally imposed by IPART/NSW government, and would instead need to be implemented through changes to the national regulatory framework. We note that an outcome of the DEIP process is a Rule change proposal from TEC and ACOSS that would allow distributors to impose DER export tariffs.

6.4.2 Assessment of reforms to network tariffs

This option would not provide any financial incentive for distributors to efficiently increase DER export capacity, if standard control services continue to be regulated using a revenue cap. An implication of a revenue cap form of control is that the distributor does not assume demand risk. In other words, the distributor's revenues are insensitive to changes in the quantum of DER exports. It follows that distributors would not receive any revenue benefit from increased DER exports to offset the cost of DER export expenditure.

If the form of control were to be changed back to a price cap, introducing DER export tariffs would create an financial incentive to reduce DER export constraints, as it would then increase the revenues of the

[107] UNSW, *Voltage Analysis in the Australian National Electricity Market Distribution Network*, March 2020, p.70.

[108] Clause 6.1.4 of the NER.

distributor. The decision on the form of control lies with the AER at the time of each regulatory determination, and we note that the AER has shown a preference for adopting revenue cap price controls.

The primary advantage of this option would be to allow distributors to develop efficient network tariffs for DER exporters. Providing DER customers with an efficient price signal would promote the efficient use of the network by DER customers. Further, recovering revenue from DER exports under a revenue cap form of control would result in lower network costs for all other customers.

This option would not address issues of inequal network access between DER customers, nor would this option provide DER investors with information on the location of network constraints. However, this option could complement other approaches that address these concerns, such as an information disclosure regime.

This option would require distributors to develop DER export tariffs and ensure that they are consistent with the pricing principles and the network pricing objective set out in the NER. This should be capable of being implemented in the short term.

6.4.3 Recommendation

In our opinion, IPART/NSW Government should support reforms to allow distributors to charge DUoS to exporters to address concerns that the current tariffs do not appropriately signal to DER customers the costs their use of the network imposes on the distributor. However, allowing distributors to charge DUoS to DER exporters is potentially only a first step to more fundamental reforms to network tariffs necessary to realise the full benefits of new technologies, such as local use of system, full two-way, or aggregate retailer pricing.[109]

6.5 Classifying DER exports as an alternative control service

As discussed above, an option that allows distributors to charge DUoS on DER exports, whilst still being regulated by way of a revenue cap, does not create a financial incentive for distributors to increase DER exports by increasing the hosting capacity of the network.

We have considered a further option that would provide distributors with an incentive to increase DER exports, while retaining a revenue cap for other standard control services.

6.5.1 Description of the option

Under this option, the AER would classify DER exports as an alternative control service (ACS), and:

- this service would be subject to a price cap over the regulatory period;
- the expected revenue from DER exports would be removed from the distributor's revenue requirement for standard control services;
- differences between forecast and actual levels of DER export revenue would be retained by the distributor;
- all DER export capex would continue to be included in the RAB and would be subject to the CESS;
- DER export opex would be subject to the EBSS;
- an export adjustment mechanism would need to be developed to allow the distributor to retain any incremental increases (decreases) in revenue from higher (lower) throughput due to increased hosting capacity for a period of six years, so that the distributor retains a 30 per cent share of the benefits (costs) of changes in exports of DER; and

[109] See CEPA, *Distributed Energy Resources Integration Program – Access and pricing Reform options | Australian Energy Market Commission*, 9 April 2020, pp 99-111.

- the network tariff for DER exports would be set at the start of each regulatory control period based on an estimate of the incremental cost to the distributor to provide DER exports, subject to a cap that the tariff cannot be greater than the value of DER exports.

Note that unlike other ACS services, the costs of DER export services would be included in the calculation of standard control services. However, a portion of building block costs would be allocated to the DER export ACS and recovered from expected DER export revenue. The reasons for keeping DER export costs within standard control services is our understanding that these costs cannot generally be separated between those relating to the network delivery of energy and that that allow DER exports of electricity.[110]

This option could not be unilaterally imposed by IPART/NSW government, and would instead need to be implemented through changes to the national regulatory framework.

6.5.2 Assessment of classifying DER exports as an ACS

The implications of this option are similar to those for the previous option of reforming network tariffs, except that this option would also provide distributors with an incentive to efficiently increase the hosting capacity of the network. The incentive to increase hosting capacity arises because it facilitates higher DER export volumes thereby increasing the distributor's ACS revenues.

Furthermore, the export adjustment mechanism allows the distributor to retain increases in revenues associated with higher DER export volumes for a period of 6 years. This would offset the expenditure incentives to minimise opex and capex. Under this scenario, the distributor's expenditure allowances would not include any explicit budget for increasing the hosting capacity of the network and would allow the overall incentive regime to drive efficient DER export expenditure.

When the level of the network tariff for DER exports equals the value DER exports, then distributors would have an incentive to efficiently optimise DER exports. That is, a distributor would invest in network hosting capacity to the point where the value of an incremental increase in DER exports equals the cost of providing the incremental increase. This incentive mechanisms would result in the distributor retaining the benefits of increasing DER export expenditure for a period of 6 years which would the act as a counterbalance to the expenditure incentive mechanisms.

This option includes a cap on the network tariff for DER exports so that the tariff cannot be greater than the value of DER exports. This safeguard ensures that distributors would not have an incentive to invest in inefficient DER export projects.

6.5.3 Recommendation

IPART/NSW Government could advocate for this option to be applied in the national regulatory framework for the NSW distributors if it believes that a more expansive option to address DER export incentives is warranted. The primary advantage of this approach is that it provides both a financial incentive for distributors to efficiently increase DER export capacity as well as providing DER customers with an efficient price signal that promotes the efficient use of the network by DER customers.

[110] For example, distributors indicated that they minimise customer disruptions by scheduling necessary adjustments to distribution transformer tap positions to increase DER hosting capacity at the same time that periodic maintenance is carried out on the transformer.

6.6 Incorporating an export capability in the STPIS

The STPIS is designed to balance the incentive to reduce expenditure with the need to maintain or improve aspects of customer service quality. It achieves this by providing financial incentives to distributors to maintain and improve service performance when customers are willing to pay for these improvements.

This option would modify the STPIS to incorporate a factor that rewards a distributor for reducing DER export constraints by increasing the hosting capacity of the network.

6.6.1 Description of the option

This option would involve the AER adding an additional aspect of service quality to its STPIS framework. Specifically, the STPIS would define an aspect of service quality to reduce the amount of DER exports constrained by insufficient hosting capacity of the network.

Other definitions of service quality for DER exports would be problematic because:

- the **amount of DER exported** depends on actions that are outside the control of the distributor including:
  - the amount invested in DER systems;
  - the quantum of generation by installed DER systems;
  - the location where new DER is installed; and
  - the amount of electricity self-consumed by customers with DER systems; and
- the **amount of DER system headroom** (ie, the unutilised hosting capacity), would incentivise the distributor to add hosting capacity at least cost irrespective whether that additional hosting capacity has an impact on DER exports.

The incentive rate for the DER STPIS would be set by reference to the value of DER exports. We note that ARENA/AER is currently undertaking a consultation process (VaDER program) to establish a methodology for valuing DER generation.

Unlike the other STPIS parameters, the target for a DER component of the STPIS could not be set by reference to past performance, because the level of DER constraint on the existing network will change as new DER is installed. Consequently, the DER STPIS target would need to be modelled for each period based on expectations of:

- the amount invested in DER systems;
- the quantum of generation by installed DER systems;
- the location where new DER is installed; and
- the amount of electricity self-consumed by customers with DER systems.

Distributors would also be required monitor DER generation output to determine the performance against the benchmark. As a component of the STPIS, the incentive would be symmetric, ie, the scheme would reward reductions in DER export constraints through increased network hosting capacity and penalise increases in DER export constraints.

This option could not be unilaterally imposed by IPART/NSW government, and would instead need to be implemented through changes to the national regulatory framework. We note that an outcome of the ARENA/AEMC DEIP process is a plan to submit a Rule change proposal that would require the AER to develop a distribution DER incentive scheme, such as the STPIS.

6.6.2 Assessment of including DER in the STPIS

The objective of incorporating an additional DER factor in the existing AER STPIS scheme would be to counterbalance the incentives created by the CESS and EBSS. Where the incentive rate is set by reference the system wide value of increased DER exports, then the distributor would retain 30 per cent of the value of the improvement in the service. Consequently, distributors would have a financial incentive to deliver an efficient level and location of network hosting capacity, ie, where the costs of an incremental increase in network hosting capacity equals the value of an incremental increase in DER exports.

This option would not improve the efficiency of pricing signals to DER customers. Instead since the STPIS penalties and rewards would be borne by all customers, this option has the capacity to lead to less efficient price signals for DER customers. However, this option could complement reforms to network tariffs, such as the removal of the current prohibition on charging DUoS to exports, targeted at addressing deficiencies with the current pricing signals to DER customers.

This option would also not address the issues of inequal network access between DER customers or provide DER investors with information on the location of network constraints. However, this option could complement other mechanisms targeted at these concerns, such as the introduction of an information disclosure regime.

Implementing this option would require distributors to have full visibility of the operation of DER systems within their network. The information collection system would need to be auditable to ensure credible incentive reward/penalty payments. Information would be need to be collected to understand when DER generation is constrained by:

- static export limits;
- dynamic export limits; and
- inverter settings that limit the production of DER.

NSW distributors do not currently have visibility of the operation of DER systems within their network, nor will they have systems in place by 1 July 2024. This limitation of the NSW distributors' information collection systems makes the introduction of a STPIS incentive mechanism impractical to apply to the NSW distributors by 1 July 2024. This option may be possible to implement in other jurisdictions or could be applied in NSW in the longer term if investments are made by the distributors to directly monitor DER generation within their networks.

This option could also not be unilaterally imposed by IPART/NSW government, and would instead need to be implemented through changes to the national regulatory framework.

6.6.3 Recommendation

This option would provide distributors with a balanced incentive framework that would provide a financial incentive to deliver an efficient level and location of network hosting capacity. However, the adoption of a DER component in the STPIS would be impracticable to adopt in NSW by 1 July 2024, due to limitations in the current information on DER systems available to the NSW distributors.

This may be a viable option in the longer term when the NSW information systems are able to effectively monitor when DER generation is constrained. However, these information collection systems are not costless and so we would advise that, before this option is recommended, that the AER undertake an assessment of the materiality of this issue. Potentially, a more targeted incentive mechanism that is less costly to implement may be a more appropriate solution.

7. Conclusions

The penetration of DER is increasingly posing challenges to the management of distribution networks. DER penetration is projected to increase across the NEM, which means that the challenges DER penetration poses to the networks are expected to become more widespread and material.

While all distributors will be challenged by DER growth within their networks, there are a number of factors that suggest the impact of DER will be relatively modest and delayed for NSW distributors compared to other states (except Tasmania), including:

- Queensland and South Australian distributors have a higher degree of solar penetration per customer than all of the NSW distributors;
- NSW distributors have a lower ratio of solar installed to LV transformer capacity than distributors in Queensland, South Australia and Victoria (except CitiPower); and
- distributors in Queensland and South Australia also have a longer average LV line length per customer compared to Ausgrid and Endeavour Energy, although Essential Energy's average line length is second only to SA Power Networks.

There are two additional aspects of DER that effect the development of incentives for distributors, specifically:

- the materiality of the cost to DER customers of insufficient network hosting capacity. This cost has been estimated by UNSW to be in the order of $3 - $12 per year in South Australia (where customers experience more substantial constraints on their exports than in NSW), and by Endeavour to be around $4 - $5 per year. While these estimates are inexact, they suggest that the magnitude of the issue is low, a conclusion that was supported by our conversations with customer representatives; and
- that distributors have differing levels of visibility of DER and their LV networks, with NSW networks having limited visibility of the impact that their network has on the operation of DER.

Our assessment of current incentives for distributors to efficiently incur DER export expenditure concluded that the inclusion of DER export expenditure in a distributor's total expenditure allowances does not require the distributor to undertake the project. Instead it remains for the distributor to prioritise its expenditure within its approved opex and capex expenditure budgets. Distributors have a strong financial incentive to minimise DER export expenditure over the regulatory period without any counterbalancing service quality incentives to provide DER hosting capacity to allow greater DER exports.

With respect to DER export expenditure, the current incentive framework applied to the NSW distributors is weighted towards minimising expenditure and so would promote a less than efficient level of DER exports due to limited network hosting capacity.

The inadequacy of the current incentive framework for efficient DER export expenditure leads to us assessing options for reform against the following criteria:

- whether the option improves incentives to efficiently relieve efficiently incur DER export expenditure and addresses the concerns identified in section 4.2 regarding the current incentives to efficiently invest in DER export capacity;
- whether the option provides efficient network prices which signal the future cost incurred by networks to facilitate DER exports;
- does the option address concerns that network limitations on the production of DER can give rise to equity issues in that:
  - some DER customers are disproportionally impacted by network constraints; and

  - investments in DER are being undertaken by customers without easy visibility of the local area network constraints to DER generation; and
- can the option be implemented for the NSW distributors next regulatory control period starting 1 July 2024.

We assessed the following six DER reform options:

- an information disclosure option that required distributors to publish DER-related information;
- a new guaranteed customer service standard that would compensate individual DER customers that receive below a minimum threshold of network access to export electricity;
- a DER expenditure incentive margin option (similar to the DMIS applied to demand management expenditure) that allows distributors to recover more than their efficient DER export costs so long as the costs (including the margin) is less than the total system wide benefits of the increased DER hosting capacity;
- a removal of the prohibition on distributors charging DUoS on DER exports within the current standard control revenue cap;
- classifying DER exports as an alternative control service and removing these services from the standard control revenue cap and instead making them subject to a price cap; and
- the introduction of a DER component to the AER's STPIS mechanism that would provide explicit financial incentives for distributors to undertake efficient DER export expenditure.

We concluded that IPART/NSW Government should consider establishing a new requirement to disclose information relevant to the quality of service provided by each distributor to DER customers. We believe that there are no practical impediments to this option being implemented by IPART/NSW Government through a change to the NSW distributor licences by 1 July 2024. This option would:

- provide a non-monetary incentive for distributors to optimise export capacity through a combination of moral suasion and the implicit threat of future regulatory intervention; and
- provide information on the location of DER-related complaints, so that customers considering investing in DER systems have an indication of where networks are constraining DER customers; however
- this option does not improve the efficiency of network prices for DER nor address concerns about inequal access to the network for some DER customers, although this option could complement other measures more specifically targeted at these concerns.

A NSW guaranteed customer service standards (GCSS) targeted at DER would compensate individual DER customers experiencing very poor network hosting capacity which would:

- create a financial incentive for distributors to reduce the level of network constraints experienced by DER customers with the worst network access although it would not provide an effective incentive for distributors to efficiently optimise network hosting capacity for all customers;
- mitigate stakeholder concerns that a small number of DER customers experience very poor levels of network access; and
- however, option would lead to less efficient network prices, since all customers paying the cost of the GCSS with the benefits disbursed to affected DER customers.

We recommended that IPART/NSW Government remain open to implementing this option in the future when NSW distributors have systems capable of validating curtailment of individual customer DER systems.

The final four options will need to be introduced through changes to the national regulatory framework, although IPART/NSW Government could provide support through the consultation process for the adoption of one or more of these options by the AEMC and AER. If a national DER incentive mechanism is introduced, we recommend that NSW advocate that it be sufficiently flexible so that it different incentive

mechanisms could be applied to different distributors. That is, the Rules should allow the AER to determine and apply an incentive mechanism that is proportionate to the materiality of the issue for that network as well as the capabilities of the network's information collection systems.

The first of the four national reform options assessed was a DER incentive margin mechanism that would allow distributors to recover more than their efficient DER export costs so long as the costs (including the margin) is less than the total system wide benefits of the increased DER hosting capacity. This option would therefore:

- provide distributors with a positive incentive to propose and deliver efficient DER export projects; and
- requires no additional information than that already required of distributors to propose DER export expenditure as part of their regulatory proposals.

However, this option encourages distributors to propose efficient DER export projects that maximise incentive payments, rather than projects that have the largest net benefits. Further this option, would not:

- improve the efficiency of pricing signals to DER customers;
- address the issues of inequal network access between DER customers; or
- provide DER investors with information on the location of network constraints.

This option represents a targeted and credible solution to the imbalances in the current incentive framework for DER export expenditure. In our opinion, this option would be appropriate to apply to the NSW distributors from 1 July 2024.

The second reform to the national regulatory framework assessed was removing the restriction on distributors charging DUoS on DER exports. This option would allow distributors to appropriately signal to DER customers the costs they impose on the network. More efficient DER network tariffs would promote the efficient use of the network by DER customers. However, while distribution standard control services remain regulated using a revenue cap, this option would not provide any financial incentive for distributors to efficiently increase DER export capacity. Further this option, would not:

- address the issues of inequal network access by between DER customers; or
- provide DER investors with information on the location of network constraints.

In our opinion, reforms that allow distribution tariffs to be more efficient should be supported, including those that allow distributors to charge DUoS to DER exporters. That said, more fundamental reforms to network tariffs may be necessary to realise the full benefits of new technologies, such as local use of system, full two-way, or aggregate retailer pricing.[111]

The third potential reform to the national regulatory framework is similar to the option above in that it would allow distributors to charge DER customers for the export of electricity. However, under this option DER exports would be classified as ACS rather than a standard control service, which would allow this service to be regulated by way of a price cap. A price cap on DER exports would incentivise distributors to reduce the network constraints on DER generation to benefit from increased DER export revenues.

To balance the expenditure incentives this option would include a mechanism that would allow the distributor to retain any incremental increases (decreases) in throughput due to increased (decreased) hosting capacity for a period of six years. However, this option would not address issues of inequal network access or provide DER investors with information on the location of network constraints.

[111] See CEPA, *Distributed Energy Resources Integration Program – Access and pricing Reform options | Australian Energy Market Commission*, 9 April 2020, pp 99-111.

Consequently, classifying DER exports as ACS provides additional advantages compared with just removing the prohibition on charging DUoS on DER exports. In our opinion, this option should be supported for the NSW distributors if a more expansive option to address DER export incentives is warranted.

The final option assessed would be to expand the AER's existing STPIS mechanism to include a DER component. Under this option the distributor would be rewarded (penalised) when the quantum of DER exports constrained by insufficient hosting capacity of the network is less (more) than the STPIS target. Where the incentive rate is set by reference to the value of DER exports, the STPIS would internalise the costs and benefits of DER export expenditure and foster efficient levels and locations of DER export expenditure. However, this option would not:

- improve the efficiency of the pricing signals to DER customers;
- address the issues of inequal network access by between DER customers; or
- provide DER investors with information on the location of network constraints.

While this option provides superior incentives for efficient DER export expenditure, NSW distributors do not currently have visibility on the extent that their networks constrain DER exports. Consequently, it is not currently possible for NSW distributors to either estimate the DER STPIS targets or measure DER outcomes. This option may be possible to implement in other jurisdictions which have superior information systems or could be applied in NSW in the longer term, if investments are made to directly monitor DER generation within their networks.

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