CEC Report

2014 Survey of Connection Experiences in National Energy Customer Framework Signatory Regions of the National Electricity Market

CLEAN ENERGY COUNCIL

2014 Negotiated Grid Connection Experiences Survey Results

8 October 2014

Contents

1 Executive Summary

This project collects the results of the largest and most comprehensive survey of the experiences of connecting generators to electricity distribution networks in Australia to date. The CEC undertook this survey in May 2014 in response to increasing concerns raised by member organisations which are involved in the development and connection of a diverse array of generation technologies.

The purpose of this survey is to enable industry stakeholders to develop a clearer picture of those aspects of the connection process which are the most challenging and which may attention to address inefficiencies. The CEC hopes that this information will enable these stakeholders to more effectively target issues to create more efficient outcomes with regards to market objectives.

This report is specifically presents the results of the survey from those regions of the National Electricity Market (NEM) which have adopted the National Energy Customer Framework (NECF).

The terms 'embedded generation' or 'distributed generation' have been used broadly to describe electrical generators which are not centrally located within our electricity supply systems. While the focus of the survey is on generators which are embedded within distribution networks (embedded generators[1]) there are numerous generation technologies, energy sources and generator sizes captured within this context.

Although generator sizes are diverse, the relevant rules, regulations and guidelines do make some distinction between different sizes. Generalisations can be made despite regional differences.

In order to analyse consistency of results across Australia's differing markets and regions, the CEC has relied on the Energy Networks Association's "typical classifications" of embedded generation (Figure 1). Although these general classifications may not align with the guidelines or rules applied in every Australian jurisdiction, they do provide a sound basis from which to design and analyse a survey such as this.

[1] As defined by the National Electricity Rules an 'embedded generator' is one which is embedded within a distribution network, not having access to the transmission network.

Classification Band	Technical Definition (*)	Typical Installations (**)
Micro	Less than 2kW; AS4777 compliant; installed within a (domestic) customer installation and connected to the low voltage (LV) network via the customer service connection)	Inverter connected plant; Domestic roof top PV, micro wind turbines
Mini	Having a nameplate greater than 2kW and up to 10kW single phase or 30kW three phase; connected to the LV distribution and generally installed within a customer installation; not necessarily AS4777 compliant All Inverter systems must be compliant with AS 4777 (ratings stated in kVA not kW)	Fuel cells; combined heat and power systems (CHP); mini hydro; mini wind turbines
Small	Having a name plate rating greater than 10kW single phase or 30kW three phase but no more than 1 MW and connected to the low voltage(LV)network; not AS4777 compliant	Induction machines - biomass, landfill, small hydro, individual wind turbines, gas & diesel fuelled engine, small hydro; fuel cells; dc storage/inverter feeds
Medium	Having a name plate rating greater than 1MW and less than 5 MW and connected to the high voltage(HV)network	Single or grouped large induction or smaller synchronous machines – biomass, landfill, hydro, wind, solar thermal, gas & diesel fuelled engine drives; Large scale storage plus inverter feeds
Large	Having a name plate rating of 5MW and greater	Single or grouped synchronous or power electronic controlled induction machines - wind farms, hydro, solar thermal, gas & diesel fuelled plant

(*) - Technical definitions of the classes modified by ENA to add a "mini" class to cover domestic type installations between from 2kW up to 10kW single phase and 30kW three phase rating.

(**) – Typical installations description added by ENA.

Figure 1: General classifications of embedded generator sizes and typical installations as set out by Energy Networks Association[2].

From Figure 1 it is clear that even generalised classes of embedded generation display some diversity. Although broad-based, the CEC's surveys considered the following classifications:

- *Mini embedded generators* which generally have a low impact on the distribution network and are expected to get connected through a very streamlined process;
- *Small embedded generators* which generally have a low, but locational specific, impact on the distribution network and are expected to connect through a streamlined process; and
- *Medium embedded generators* which are typically high-voltage-connected generating units that can have a large impact on the distribution network and are therefore

[2] Energy Networks Association, 2011, *ENA Guideline for the preparation of documentation for connection of Embedded Generation within Distribution Networks*, p. 8. available: www.ena.asn.au.

expected to connect through a negotiated process which fully accounts for this impact.

Although recent years have seen remarkable growth in renewable energy generation (primarily solar PV) the survey did not seek to segregate any particular technology. Rather, in keeping with the technology neutrality intent of the NEM's design, the surveys made no presumptions on generating technology.

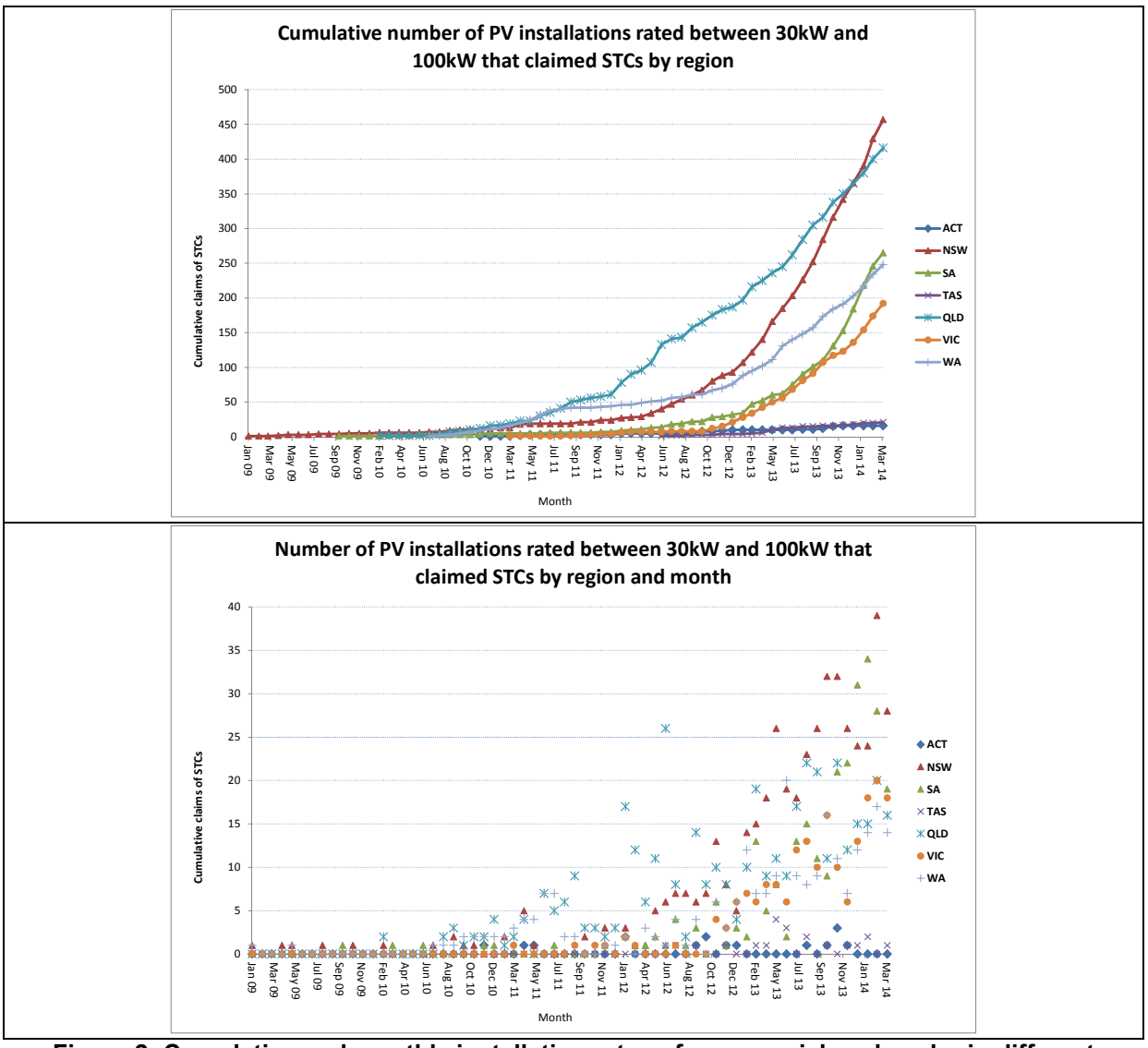

Figure 2: Cumulative and monthly installation rates of commercial scale solar in different regions as recorded by the Clean Energy Regulator[3].

[3] Courtesy of Warwick Johnston, Sunwiz, www.sunwiz.com.au.

While it is difficult to fully capture the scale of the connections of embedded generators, those connected as a result of the small scale component of the Renewable Energy Target policy have created a readily accessible database of the installation rates of renewable embedded generation rated below 100 kW. This database is managed by the Clean Energy Regulator[4] and shows that by May 2014 some 3.6 GW of solar PV was installed across Australia on 1.2 million households and businesses.

There has been significant growth in commercial-scale solar in a very short timeframe. The same data shows that by May 2014 the installation of solar PV systems rated between 30 kW and 100 kW was increasing dramatically in some NEM regions (Figure 2). Looking closely at the data it can be seen that in those regions which have adopted the NECF and apply the Chapter 5A negotiated connection process a significant number of connections have been completed. Figure 3 shows that by singling out New South Wales and South Australia, and allowing a month after the introduction of NECF in these regions, 452 connections had taken place under the NECF regime up to the time the survey was conducted. Prior to NECF being introduced there was only 17 installations.

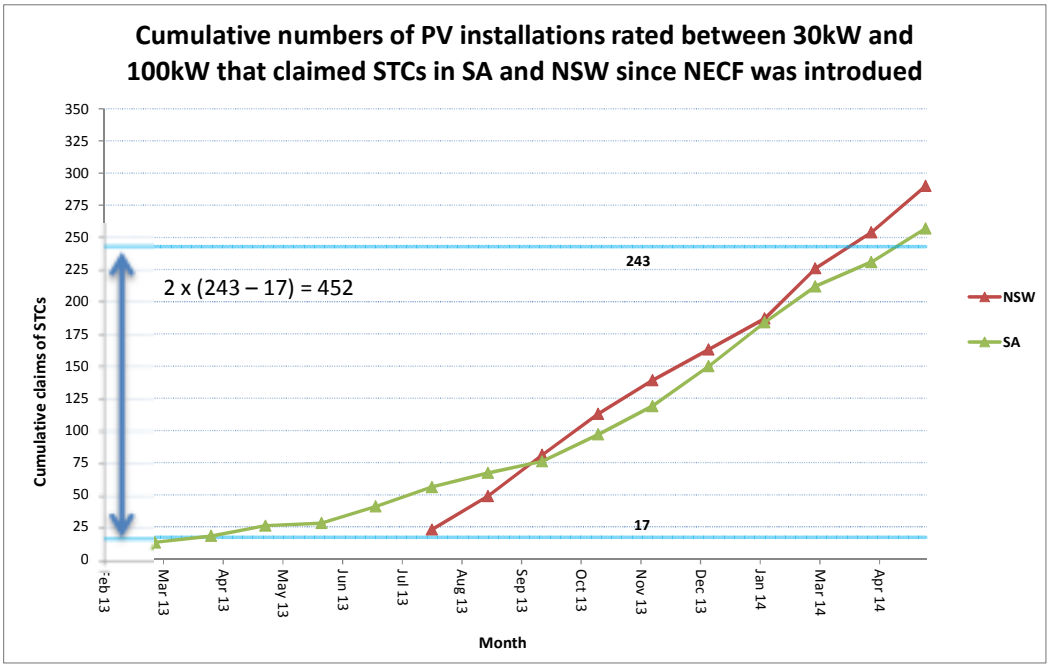

Figure 3: Cumulative installation rates of commercial scale solar in NSW and South Australia in the period since NECF was introduced up to the survey taking place[5], demonstrating the extent by this survey captures experiences under the NECF connection regime.

[4] http://ret.cleanenergyregulator.gov.au/REC-Registry/Data-reports
[5] Courtesy of Warwick Johnston, Sunwiz, www.sunwiz.com.au.

This survey clearly not only captures the experiences of generators connecting under the NECF negotiating framework, with regards to small and medium embedded generators, it is almost wholly focussed on experiences negotiating connections under the NECF regime.

The CEC's grid connection experience survey

This report summarises the outcomes of the CEC's 2014 survey of connection experiences. The survey was targeted at the CEC's membership base, which predominately consists of renewable energy project developers of all sizes and technology types.

The survey was conducted in May 2014 and targeted mini, small and medium embedded generators which had negotiated their connection with the relevant Distribution Network Service Provider (DNSP). This distinction was made in order to segregate those embedded generators who had connected under streamlined 'basic' connection processes (mainly mini and some small embedded generators). As these connecting parties would have connected without any issues or negotiated any complex aspects of connections with the DNSP it was assumed that there was no need to direct the survey towards basic connections for which no negotiation was required.

This survey was generalised and sought out experiences broadly with the connection process, rather than with specific projects. This survey was the largest survey of the experiences of connecting generators conducted in Australia to date.

1.1 Main findings

The inclusion of all Australian regions and mini, small and medium embedded generators has collected a clear snapshot of the status of the connection process at a point in time. Being the first comprehensive survey of its kind, the results have captured experiences garnered during a period of significant flux. It is easy to understand that the remarkable growth of embedded generation, particularly commercial scale solar photovoltaic (PV) generation, over a very short timeframe has caught an incumbent distribution network industry by surprise. Concurrently, new players entering the market have done so with low experience levels. Learning curves have been steep on all sides.

Although some connection processes have been subject to recent and impending reforms, this survey was conducted prior to those reforms taking effect. The survey results provide strong support for these reforms being introduced and progressed. In addition, they provide further support for a continual monitoring and improvement programme which should seek to achieve standardisation of connection processes to the greatest extent possible.

Key findings for mini embedded generators

Mini embedded generator proponents are generally smaller operators having less than 10 employees. Although these businesses generally have experiences with the connection of embedded generation below 30 kW, their strength is with projects rated less than 10 kW. These respondents were located in every Australian jurisdiction except Tasmania and the Northern and Australian Capital Territories.

Only a small portion of these survey respondents are content with the connection process. Over 50% of those with experience negotiating the connection of mini embedded generators do not believe that the connection process meets their needs in a fair and certain manner, or as quickly as reasonably possible.

Main areas of concern include:

- Connection process timeframes, with certainty of timing being a greater concern than expedition;
- Information exchanges, with certainty that information is complete and accurate from early on being the greater concern;
- Connection costs, with clarity of costs early in the process being the greater concern.
- Managing the expectations of their clients and their staff around the uncertainties associated with all of the above.
- Export limitations imposed or preferred by some DNSPs.

Many stakeholders who are involved in the connection of mini embedded generators have an expectation that the connection process should be simple, following defined parameters and timeframes. Although such connection processes are in place, issues arise when these generators cannot conform to the necessary requirements for them (for various reasons). It appears that these special cases, or negotiated connections, are occurring more frequently than the processes have envisaged. As these stakeholders are unprepared for this complexity, they feel that they are facing markedly increased risk for their businesses.

Key findings for small-medium embedded generators

Although those generator proponents operating in the small-medium classes are generally more equipped operators (with 50% of them having over 10 employees), this increased capacity does not necessarily lead to better experiences.

The vast majority (77%) of these respondents have gained experience with small scale solar installations and are now applying this experience to the installation of 30-100 kW solar PV

systems. Although 25% of respondents also had experience with larger generators, only 10% had experience with medium embedded generation.

These stakeholders are more aware of the rules around connection processes, yet only a small fraction believes that the negotiated connection processes are fair and reasonable. A large proportion of them cite unclear rules and connection processes as a concern.

Main areas of concern include:

- Connection process timeframes, with certainty of timing being a greater concern than expedition;
- Information exchanges, with incomplete information and changes to information during the process having a significant impact on these businesses;
- Connection costs, with uncertainty on costs until very late in the process and the cost of the connection process itself being a key concern;
- The lack of clear and uniform technical standards for connection; and
- Export limitations imposed or preferred by some DNSPs.

Priority areas for improvement

The CEC undertook these surveys on the basis that member organisations had notified it of concerns with connection processes. The results have identified that a large portion of embedded generator proponents have been experiencing issues with connection processes. All survey respondents generally supported continued improvement across a range of connection process parameters.

With regards to mini embedded generators, it is apparent that those who have negotiated aspects of the connection were not anticipating this outcome. There is a strong desire to continue the development of appropriate standardised connections for these generating systems. This should focus on the identification and standardisation of commonly negotiated aspects of these connections.

For small-medium embedded generators these results repeat those already identified as priorities elsewhere including:

- The maximisation of information available both publicly and, where connection specific, as early in the process as possible and in a timely manner.
- Clarity on connection costs as early in the connection process as possible.

- Clear and consistent technical standards for the connection of embedded generation are required at an Australian Standards level.

- Connection process timeframes and response timeframes need to be more clearly committed and consistently adhered to in order to provide certainty for connecting parties.

- Early visibility of the commercial terms for connection is critical.

- Commercial terms for connection should also be standardised and determined by an independent body in order to ensure reasonable outcomes for both parties.

These findings serve to reinforce the need for continued improvement of connection processes while capturing the expectations of an industry which is growing and evolving very rapidly.

This survey has also led to a better understanding of a pressing need to strive for standardisation. The inefficiencies that are arising from what appear to be bespoke responses to many connections are unlikely to advance market objectives. A much stronger emphasis needs to be placed on working towards the standardisation of connection processes and technical and commercial outcomes on a national level. All parties should seek this outcome to maximise the efficiency of investment in embedded generation and the operation of DNSP businesses.

2 Grid Connection Processes in the NEM

The rules which guide the operation of the NEM, including the connection processes, are designed with the objective of meeting the National Electricity Objective (NEO). As enshrined in the National Electricity Law the NEO states:

> "*The objective of this Law is to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to:*
>
> *(a) price, quality, safety, reliability and security of supply of electricity; and*
>
> *(b) the reliability, safety and security of the national electricity system.*"[6]

The NEO is designed to ensure safe, reliable electricity supply to customers while capturing the three main dimensions of economic efficiency:

1. *Productive efficiency*: the provision of goods and services at lowest cost, including with the operation of networks and efficient use of electricity services.

2. *Allocative Efficiency*: the price of goods and services should reflect the cost of providing them, including efficient investment in embedded generation and distribution networks.

3. *Dynamic Efficiency*: arrangements should promote investment and innovation in the production of goods and services so that allocative and productive efficiency can be sustained over time, taking into account changes in technologies and the needs and preferences of consumers.

While the NEO sets out the overarching parameters of the National Electricity Rules (NER), they are more specifically designed such that where a generator connects to the grid they are generally required to negotiate the connection with the relevant DNSP. As of July 2012 the rules have contained two chapters which prescribe how embedded generators are expected to negotiate a connection:

- Chapter 5 applies to the connection of embedded generation that is generally rated above 5 MW[7] or is planning to sell energy in the wholesale market.

---

[6] National Electricity Law, 2013, *National Electricity (South Australia) Act 1996*, Section 7.

- Chapter 5A applies to the connection of generation rated below 5 MW, which are defined as '*non-registered embedded generators*' under this chapter. This chapter creates three divisions of connection:

    - *Basic Connection* applies to embedded generators which are compliant with the Australian Standard AS 4777[8] for inverter-based energy systems, and the associated retail customer connection.

    - *Standard Connection* which applies to retail customers, embedded generators or both together as determined and designed by individual DNSPs.

    - *Negotiated Connection* for embedded generators or retail customers which are not compliant with the basic or standard connection divisions, or where they may be compliant but may require augmentation to the network to connect.

    DNSPs are required to have their proposed Basic and Standard[9] Connection types approved by the Australian Energy Regulator prior to applying them. Both are intended to provide an avenue for streamlined connections within the relevant divisions.

Basic and Standard Connection type are designed to provide a lower cost and complexity basis for connection. As they cannot fully capture the diversity of network characteristics and the associated challenges in all cases, the DNSP reserves the right to determine that any generator will have to negotiate its connection (or any aspect of the connection).

Negotiated connections under Chapter 5 or Chapter 5A require that each party negotiate in good faith and that they provide the other party with sufficient information to negotiate effectively. The relevant chapters have set out the rules and expectations around each stage of the process.

Because neither state had signed onto the NECF reforms, Chapter 5A was not applied in Victoria or Queensland at the time of these surveys. Tasmania, South Australia, New South Wales and the Australian Capital Territory had signed on to the reforms at various timescales.

---

[7] As determined by AEMO's standing exemption for registration as a generator threshold.
[8] At the time of the survey the upper limit of the scope of AS 4777 was 10 kW per phase, or 30 kW.
[9] DNSPs can develop as many Standard Connection types as they feel necessary.

Recent reforms of the NER

The Chapter 5 connection process has recently been the subject of significant reform, largely driven by generator proponents[10]. These reforms were designed to enhance the transparency of the connection process and to allow connecting generators to make more informed investment decisions.

One of the more fundamental changes was to segregate distribution network connections and transmission network connections within the Chapter. Other changes include the introduction of a new two-stage enquiry process, which is designed to maximise the transfer of information and promote cooperation between the parties. The relevant parts of NER Chapter 5 were changed in early October 2014.

While this change was not at the time of the survey, it does provide a reasonable background of the challenges which have already been identified with connection processes. Many of these challenges are consistent with those identified by this survey.

[10] AEMC, 2014, Connecting Embedded Generators Rule Change (ERC0147), http://www.aemc.gov.au/Rule-Changes/Connecting-embedded-generators

4 Negotiated Connection in NECF Regions

The CEC's 2014 grid connection survey was targeted at embedded generators who had recently negotiated connections with a DNSP. The survey was restricted to generation rated below 5 MW. While the survey did not make any further division of sizes, it specifically noted that the focus was on embedded generators who had negotiated the connection. As generators who are required to negotiate their connection are generally rated above 5 kW, the survey relates to mini, small and medium scale embedded generators.

The survey did not focus on the connection of a single project, but drew on the experiences across multiple processes. It collected a substantial number of responses in regard to experiences in the NEM, which is unsurprising considering the heightened activity in commercial scale solar over more recent months.

In order to remain consistent with the current NER connection classes and established Australian standards, this analysis divides responses into generators rated above (small and medium embedded generators) and below (mini embedded generators) a size threshold of 30 kW or 10 kW per phase.

The latter is consistent with the scope of the current Australian Standard AS 4777 for the connection of inverter energy systems. In turn this is consistent with the threshold for a basic connection under Chapter 5A of the NER as applied in NECF regions. This survey is therefore is very strongly orientated towards experiences connecting under the Chapter 5A connection regime.

In order to capture the changing nature of connection processes, respondents were asked to consider only projects that had been connected in the last two years. Forty seven (47) respondents completed the survey. Figure 4 provides a summary of the number of connection experiences considered by the respondents.

The survey results did not provide an exact number of connections that experiences were built over. However, this can be *estimated* by assuming that the mid-point from each option in Figure 4 is the average number of installations for each response. Table 1 shows this data demonstrating the extent of the experience captured by the survey. The survey also identified that 30% of these projects were still in the connection process and had not yet received a connection agreement.

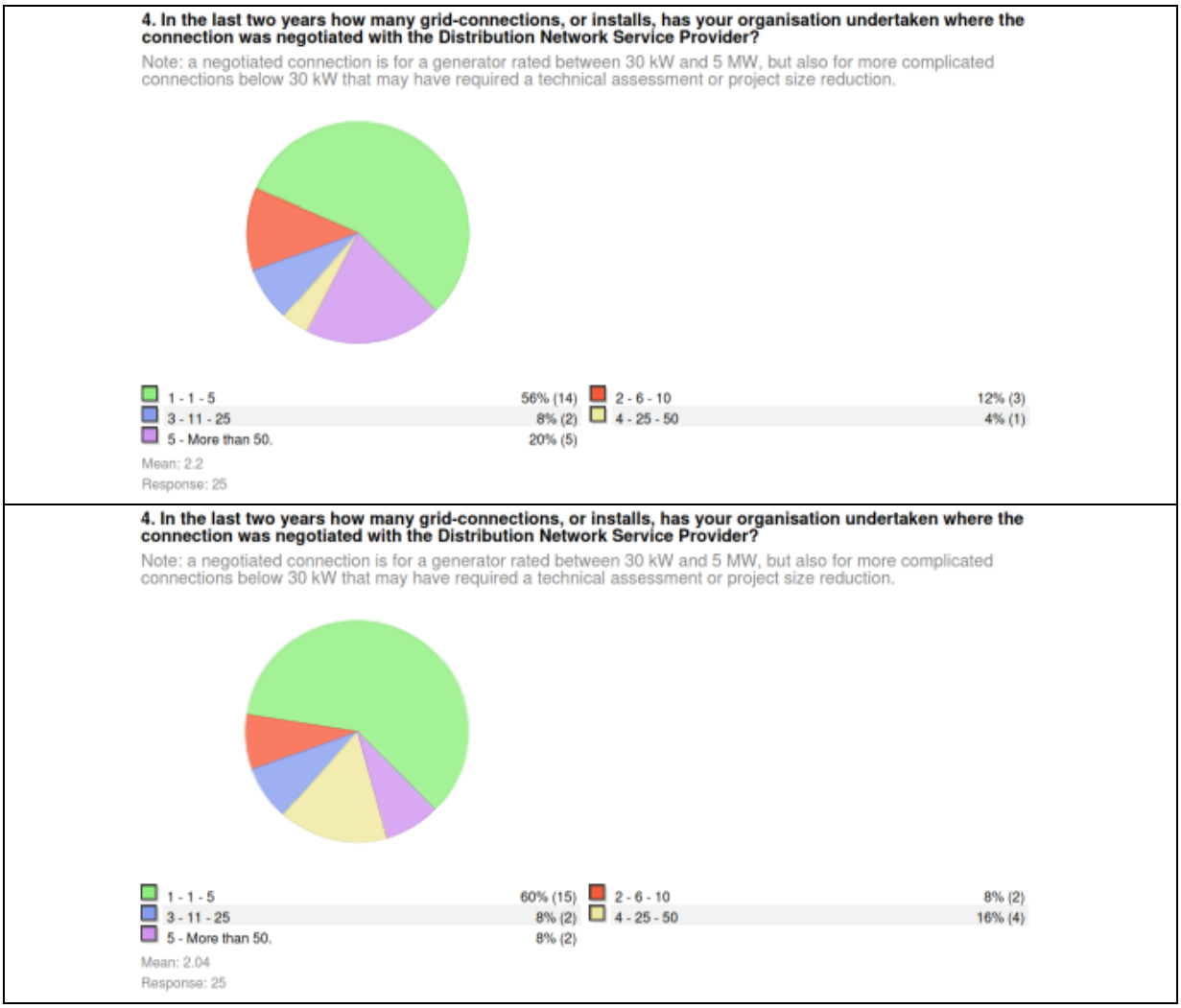

Figure 4: Survey results for Question 4 for NECF regions, which asked how many connections the respondent had negotiated in the preceding two years for mini (top) and small-medium (bottom) embedded generators. Note that as respondents were able to select multiple generator sizes the total respondents and the responses to Question 4 may not add equally.

Responses		NECF Regions
< 30 kW	Responses:	25
	Installations:	290
	Completed:	205
> 30 kW	Responses:	25
	Installations:	180
	Completed:	126

Table 1: Summary of responses received and estimated numbers of projects considered by the survey.

Table 2 provides insight into geographical spread of the responses received and generator size classes that the response related to. As respondents were allowed to select multiple generator sizes (relevant to their experience), the total numbers noted in Table 2 exceed the total number of responses.

Category	NECF Region		
	SA	Tas	NSW
Mini	6	0	13
Small	3	0	7
Medium	8	1	21

Table 2: Summary of responses for different generator classes (note: NSW includes the ACT).

In accordance to the technology-neutrality intent of the NERs, the survey did not inquire on the generation technology which the respondent's experiences related to, nor were any particular technologies sought to respond to the survey. However, from the qualitative responses received, it is clear that the vast majority of the respondents operate in the solar industry.

Overall, the survey provides a statistically significant spread of experience across NECF regions and generator classes. Tasmania is the clear outlier with only one response, which is likely to reflect a lower level of activity in commercial scale solar in that state.

The following sections look more closely at the survey results.

4.1 The connection process

The survey asked a series of specific questions regarding the respondent's understanding of the connection process. Nearly 87% of respondents indicated that they rely heavily on the DNSP for information relating to the connection process (Figure 5). This outcome was very consistent across generator classes and regions, demonstrating that the information provided by DNSPs, as compared to information from other sources, is critical to guiding the generator throughout the connection process.

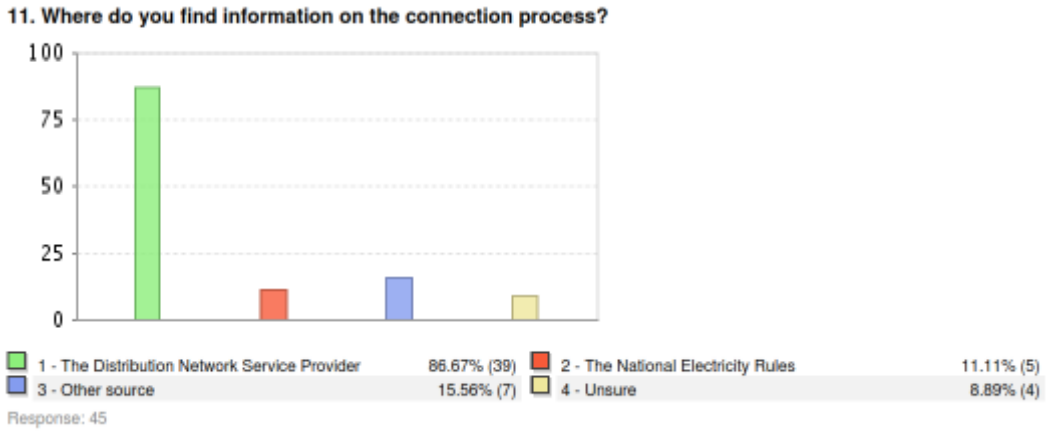

Figure 5: Survey results for Question 11 for the NEM demonstrating the importance of information provided by the DNSP, as compared to other sources.

The survey also sought information on some of the qualitative aspects of the connection process, including whether the process and rules around negotiating were clear and whether the process meets the reasonable needs of the generator.

Generator perspectives on the process

The survey did not make any special regional considerations. When asked whether the process for negotiating a connection was clear, responses from NECF regions were generally balanced across generator classes, with around 42% of all responses agreeing, and 42% disagreeing, that the process was clear (the remaining 16% were unsure).

When asked if the process was supported by clear rules, results were less consistent. In this case 29% of responses relating to mini embedded generators suggested that they were clear, 42% didn't agree and the remaining 29% were either unsure or unaware of the rules. Again, awareness of the rules increased for larger generators with 54% stating that they did not believe the rules were clear and 33% disagreeing (12% were unaware of the rules or unsure).

The survey asked if the connection process meets the needs of connecting generators in a fair and certain manner, and as quickly as reasonably possible. Where mini embedded generators were concerned 33% thought this was the case, 50% stated otherwise and the remaining 17% were unsure. From experiences with larger embedded generators, 75% stated that their needs were not met, while the remainder thought the process met their needs. One respondent noted that they had more positive outcomes once the DNSP had confidence that their preferred solution was able to be implemented:

> *"The "ground rules" were the implementation of controlled export capability which overcame the obstacle.* [The DNSP was] *proactive once trust was developed"*

It is difficult to see how these outcomes are positive. A large proportion of generators have expressed the view that the process is unclear, not properly supported by clear rules and does not meet their needs. A much smaller proportion is content with the process and it appears that satisfaction is inversely proportional to connection complexity or, alternatively, engagement with the DNSP.

The following sections look more closely at some of the specific characteristics of the connection process.

4.2 Connection process characteristics

The survey included a large number of ordinal questions in which respondents were asked to consider a broad range of typical connection process characteristics within three main areas. These areas were designed to allow the respondent to express their views on a number of aspects of the process and the impact that the process may have had on their businesses. Respondents were also encouraged to provide qualitative and quantitative information if possible.

The survey also tried to gain an understanding of the priorities of the respondents when they navigate the connection process. Understanding which aspects of the process are being prioritised can provide insight into those aspects which present the highest risk for connecting generators. For example, a respondent whom has been prioritising negotiating lower connection costs is likely to believe that these costs are unreasonable.

This section summarises the survey outcomes in terms of process timing, information exchange, cost and technical outcomes. Following that a further series of responses to questions that were designed to capture respondent's views on how the process could be improved are considered.

4.2.1 Process timing

As noted above, respondents were asked to consider a series of questions in relation to connection process timeframes.

Figure 6 shows these results for negotiated connection of mini embedded generators. During the connection process these respondents generally felt that achieving a connection agreement in a short and certain timeframe is of a very high priority. However, they also noted that the length of time to get connected and DNSP response timeframes have had a negative impact on their businesses, indicating that they do not believe this priority is being reasonably advanced. In support of these concerns two respondents noted

"Every job we do has some sort of lost time due to issues with network owners."

And

"They just delay the process longer and longer."

What do you prioritise during the connection process?	Very Low	Low	Neutral	High	Very High
Acheiving a Connection Agreement in the shortest possible timeframe (5.% N/A)	0%	5%	17%	29%	41%
Acheiving a Connection Agreement in a certian timeframe (5.% N/A)	0%	11%	11%	29%	41%
What kind of influence has these aspects of the process had on your business?	**Very Negative**	**Negative**	**Neutral**	**Positive**	**Very Positive**
Timeframe for the whole connection process (0% N/A)	35%	45%	5%	10%	5%
Timeframes for DNSP responses to queries (0% N/A)	35%	40%	10%	10%	5%
Timeframe for DNSP to respond to Connection Applications (0% N/A)	25%	55%	10%	10%	0%
Indicate your perspective on the statements below	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
The timing of the connection process is uncertain (0% N/A)	10%	5%	21%	42%	21%
The connection process can take too long (5.% N/A)	10%	5%	15%	42%	21%
The DNSP sticks to a defined process (5.% N/A)	10%	5%	47%	15%	15%

Figure 6: Survey results from questions on negotiated connection process timing for mini embedded generators in NECF regions.

The results for small-medium embedded generators (Figure 7) reflect typically longer connection timeframes with increased complexity. These stakeholders prioritise certainty of the timeframe over a rapid resolution, although the latter is still a high priority. Timeframes for the connection process and DNSP responses have clearly had a negative impact on respondents' businesses.

What do you prioritise during the connection process?	Very Low	Low	Neutral	High	Very High
Acheiving a Connection Agreement in the shortest possible timeframe (0% N/A)	0%	5%	20%	35%	40%
Acheiving a Connection Agreement in a certian timeframe (0% N/A)	0%	0%	10%	20%	70%
What kind of influence has these aspects of the process had on your business?	**Very Negative**	**Negative**	**Neutral**	**Positive**	**Very Positive**
Timeframe for the whole connection process (0% N/A)	45%	22%	22%	4%	4%
Timeframes for DNSP responses to queries (4.% N/A)	22%	40%	18%	9%	4%
Timeframe for DNSP to respond to Connection Applications (0% N/A)	22%	36%	31%	4%	4%
Indicate your perspective on the statements below	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
The timing of the connection process is uncertain (0% N/A)	5%	5%	20%	45%	25%
The connection process can take too long (0% N/A)	5%	10%	15%	25%	45%
The DNSP sticks to a defined process (0% N/A)	5%	30%	25%	30%	10%

Figure 7: Survey results from questions on negotiated connection process timing for small-medium embedded generators in NECF regions.

Experiences show general agreement that the connection process is uncertain and takes too long in NECF regions. One respondent noted that

> "*while the upfront costs* [of the connection process] *are known in advance, significant delays are sometimes experienced which can cause a significant increase in operating costs on a per job basis*".

In summary, there is strong agreement across the survey results that the connection process is uncertain and takes too long. Stakeholders generally agreed that connection process and DNSP response timeframes have generally negatively impacted on their businesses.

4.2.2 Information exchange

Survey responses in regard to the exchange of information are set out in Figure 8. These outcomes generally indicate that information availability and changes to information are having a negative impact on stakeholders' businesses. One respondent noted:

> *"Guidelines for connection are conflicting and written around size of PV panels rather than max continuous output of inverter and created confusion over the terms 'generator', 'generating unit' and 'micro-generator'. Response to email questions was very slow - I felt that the distributor was stone walling me, as I was not an ex-employee or consultant."*

What do you prioritise during the connection process?	Very Low	Low	Neutral	High	Very High
Managing your staff around DNSP responses or requirements (17% N/A)	0%	11%	5%	47%	17%
What kind of influence has these aspects of the process had on your business?	**Very Negative**	**Negative**	**Neutral**	**Positive**	**Very Positive**
Level of publicly available information (0% N/A)	25%	40%	30%	5%	0%
Level of technical information provided by the DNSP (0% N/A)	25%	30%	30%	10%	5%
Changes to information (0% N/A)	25%	25%	40%	0%	10%
Indicate your perspective on the statements below	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Information available to the generator is limited (0% N/A)	10%	5%	21%	57%	5%
DNSPs frequently request more information (5.% N/A)	10%	5%	26%	52%	0%
Informaton is not forthcoming from DNSPs (5.% N/A)	10%	5%	47%	15%	15%

Figure 8: Survey results from questions on the exchange of information during the negotiated connection process for mini embedded generators in NECF regions.

Mini embedded generators generally agreed that information availability is limited, that DNSPs make many requests for more information and that information is not as forthcoming from DNSPs. One respondent noted frustration that connection applications for mini embedded generators have been rejected without clear explanation:

"For systems [5 kW] *it costs to get a connection approval with* [the DNSP] *in the vain hope that you will get approved. If rejected there is no explanation."*

Mini embedded generators are placing weight on managing their staff around DNSP responses, supporting the case that information exchange is underperforming expectations.

Considering small-medium embedded generators, Figure 9 shows that the vast majority of respondents have experienced negative outcomes from the exchange of information. Some respondents noted that changes to information have had a significant impact:

"Changes in requirements mid project have caused significant additional costs to us on some previous projects, as has the uncertainty around the connection process within the DNSPs themselves."

"As a consultant, we are relied upon by our clients to assist them through the connection process. Changes by the DNSP and unclear requirements mean more risk to us and our clients."

Figure 9 shows that larger embedded generators are also of the view that limited information availability and requests for additional information were contributing to challenges during the connection process.

Some of the written responses received reinforced this finding. One respondent, with experience across the NEM, noted that "*the goal posts shift depending on the time of year and the person spoken with"*. Another stated that the DNSP requested that the generator gather data on the DNSP's existing network assets:

"[the DNSP] *wanted me to check their transformers etc (not qualified) wanted me to write a letter and be liable if it was the wrong transformer".*

What do you prioritise during the connection process?	Very Low	Low	Neutral	High	Very High
Managing your staff around DNSP responses or requirements (0% N/A)	5%	0%	25%	50%	20%
What kind of influence has these aspects of the process had on your business?	**Very Negative**	**Negative**	**Neutral**	**Positive**	**Very Positive**
Level of publicly available information (0% N/A)	4%	22%	59%	9%	4%
Level of technical information provided by the DNSP (0% N/A)	18%	27%	36%	4%	13%
Changes to information (9.% N/A)	18%	27%	31%	4%	9%
Indicate your perspective on the statements below	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Information available to the generator is limited (0% N/A)	5%	0%	35%	40%	20%
DNSPs frequently request more information (0% N/A)	5%	10%	15%	25%	45%
Informaton is not forthcoming from DNSPs (0% N/A)	5%	5%	20%	40%	30%

Figure 9: Survey results from questions on the exchange of information during the negotiated connection process for small-medium embedded generators in NECF regions.

4.2.3 Commercial matters

The survey results captured two main commercial components, including connection costs and the commercial outcomes of the process. The NECF region results are discussed below.

Connection costs

The price paid by generators to connect is determined by the costs that the DNSP faces to facilitate the connection and any augmentation of the network required to connect the generator while maintaining the same level of reliability, quality and safety of supply that customers expect.

A fairly strong correlation across generator classes is evident from questions regarding connection costs. Reasonable technical outcomes are generally a high priority, with a majority of respondents agreeing that there is no clarity of connection costs until very late in the process (presumably because the technical outcomes are unconfirmed until late in the process).

What do you prioritise during the connection process?	Very Low	Low	Neutral	High	Very High
Negotiating lower connection costs with the DNSP (18% N/A)	6%	18%	18%	37%	0%
Ensuring technical outcomes are reasonably meeting your needs (5.% N/A)	0%	11%	11%	41%	29%
What kind of influence has these aspects of the process had on your business?	**Very Negative**	**Negative**	**Neutral**	**Positive**	**Very Positive**
Costs of the connection process (DNSP charges) (10% N/A)	15%	20%	50%	5%	0%
Costs of the physical connection assets (20% N/A)	10%	25%	40%	5%	0%
Changes to costs during the process (10% N/A)	15%	35%	35%	0%	5%
Indicate your perspective on the statements below	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Connection costs are unclear until very late in the process (0% N/A)	5%	5%	21%	47%	21%

What do you prioritise during the connection process?	Very Low	Low	Neutral	High	Very High
Negotiating lower connection costs with the DNSP (5% N/A)	0%	25%	30%	30%	10%
Ensuring technical outcomes are reasonably meeting your needs (0% N/A)	0%	0%	5%	52%	42%
What kind of influence has these aspects of the process had on your business?	**Very Negative**	**Negative**	**Neutral**	**Positive**	**Very Positive**
Costs of the connection process (DNSP charges) (13% N/A)	13%	36%	31%	4%	0%
Costs of the physical connection assets (13% N/A)	22%	31%	27%	4%	0%
Changes to costs during the process (9.% N/A)	27%	45%	13%	0%	4%
Indicate your perspective on the statements below	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Connection costs are unclear until very late in the process (0% N/A)	5%	10%	30%	30%	25%

Figure 10: Survey results from questions on connection costs for the connection of mini scale embedded generation (top) and small-medium scale embedded generation (bottom) across NECF regions.

Respondent experience is generally that the cost of the connection process, physical connection, and changes to connection costs have had a negative impact on their businesses, although this impact appears to be subdued for mini embedded generators.

Some respondents provided some anecdotal details of their experiences. One noted that

> "*the network protection costs are also prohibitive due to sometimes unnecessary requirements, particularly for systems under 200 kW*".

Commercial terms

The survey requested that respondents consider the commercial implications of some aspects of the process, including the commercial terms and how they interact with the technical outcomes of the connection (Figure 11).

There was general agreement from around half of the respondents that the commercial terms of connection agreements had not had a significant impact on their businesses. With regards to larger embedded generators, 54% of responses noted that these terms have had a neutral impact, while 27% noted negative or very negative impacts. The relatively high proportion of negative responses to this question is further supported by 65% of respondents agreeing that the commercial terms for connection are risky. One respondent stated the view that

> "*There is a clear conflict of interest in negotiating a supply / feed in agreement where the approving and governing body (distributors) also have a financial interest"*.

A very large proportion of respondents noted that export limitations requested by the DNSP have had a negative impact on their business, while 65% of respondents expressed the view that such limitations were unjustified. This outcome was heavily skewed by those states in which this is more practiced, with around 70% of the respondents from South Australia expressing this view.

A number of written comments were also received, generally expressing frustration that explanations for limiting export have been unreasonable, especially for mini embedded generators. With regards to technical outcomes, one respondent provided a detailed description of their experiences with determining reasonable technical outcomes for a specific mini embedded generator:

> *"Despite my presenting detailed voltage rise calculations, I was not allowed to talk to technical staff, always stopped at admin level …* [the DNSP] *refused my request to change inverter to 5 kW three phase inverter to reduce voltage rise on a rural property, and imposed 3.6 kW three phase max output, or 700 W single phase. I had to install three x 1200 W inverters instead … Voltage rise of actual installation vindicated my calculations that 5 kW over three phases would not have been any problem" … "The whole process with network agreements, was totally frustration" …*

"There was never a name we could ever contact to get clarification of any result. The goal posts were constantly changing. Every time [the DNSP] *would give an inverter option – which was not available at the time. Then when inverter manufacturers made changes to meet the DNSP's needs, they were still rejected. The most annoying part was that they never gave any clarification of results, and no one could be contacted … There was no dispute resolution process and no ability to discuss issues with technical staff - just take it or leave it!".*

What kind of influence has these aspects of the process had on your business?	Very Negative	Negative	Neutral	Positive	Very Positive
Export limitations imposed by the DNSP (5% N/A)	40%	30%	20%	0%	5%
The commercial terms of Connection Agreements (10% N/A)	15%	35%	35%	5%	0%
Indicate your perspective on the statements below	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
The connection process should treat generation differently to load (0% N/A)	5%	5%	42%	26%	21%
Dispute resolution processes are not clear (0% N/A)	5%	5%	21%	36%	31%
DNSPs are unjustifiably preventing export to the grid (0% N/A)	0%	5%	31%	15%	47%
The commercial terms of Connection Agreements are risky (10% N/A)	0%	10%	42%	26%	10%

What kind of influence has these aspects of the process had on your business?	Very Negative	Negative	Neutral	Positive	Very Positive
Export limitations imposed by the DNSP (18% N/A)	36%	4%	36%	4%	0%
The commercial terms of Connection Agreements (13% N/A)	18%	9%	54%	4%	0%
Indicate your perspective on the statements below	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
The connection process should treat generation differently to load (0% N/A)	5%	5%	10%	20%	60%
Dispute resolution processes are not clear (5% N/A)	5%	10%	35%	25%	20%
DNSPs are unjustifiably preventing export to the grid (0% N/A)	5%	10%	15%	30%	40%
The commercial terms of Connection Agreements are risky (10% N/A)	0%	0%	25%	35%	30%

Figure 11: Survey results from questions on the commercial terms for the connection of mini-scale embedded generation (top) and small-medium scale embedded generation (bottom) across NECF regions.

Respondents agreed that the connection of load and generation should not follow the same process. While this is likely to reflect the negotiated nature of the connection of generation as relative to load, it can also be seen that the way generator connections are treated by DNSPs varies significantly to a load connection.

4.3 General connection process characteristics in NECF regions

Building on the previous discussion, the respondent data can be used to further compare outcomes with regards to the general performance of the connection process.

What do you prioritise during the connection process?	Very Low	Low	Neutral	High	Very High
Sticking to a defined connection process (5.% N/A)	0%	5%	17%	35%	35%
Fostering a constructive relationship with the DNSP (5.% N/A)	5%	0%	23%	41%	23%
Managing a problematic relationship with the DNSP (5.% N/A)	5%	0%	29%	47%	11%
Following up with the DNSP to ensure they are doing their part (5.% N/A)	0%	11%	11%	47%	23%
What kind of influence has these aspects of the process had on your business?	**Very Negative**	**Negative**	**Neutral**	**Positive**	**Very Positive**
Negotiating with the DNSP (0% N/A)	30%	20%	45%	0%	5%
Assistance recieved from the DNSP (0% N/A)	35%	15%	35%	15%	0%
Indicate your perspective on the statements below	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
The obligatons on DNSPs are vague (5.% N/A)	15%	5%	21%	42%	10%
The obligatons on generators are vague (10% N/A)	15%	10%	26%	31%	5%

Figure 12: Survey results from questions related to the connection process for mini embedded generators in NECF regions.

Consistent with previous results, Figure 12 shows that negotiations with DNSPs and the assistance they have provided appear to have had a negative impact on respondents' businesses. In general, connecting generators are unsure of the obligations on DNSPs in the process. Similar conclusions can be made when considering small-medium embedded generators. Figure 13 provides an indication of the generator's priorities during the connection process, demonstrating that all embedded generators have to focus on keeping the process on track and managing their relationship with the DNSP.

What do you prioritise during the connection process?	Very Low	Low	Neutral	High	Very High
Sticking to a defined connection process (5% N/A)	0%	5%	5%	50%	35%
Fostering a constructive relationship with the DNSP (0% N/A)	0%	5%	10%	30%	55%
Managing a problematic relationship with the DNSP (0% N/A)	5%	5%	20%	40%	30%
Following up with the DNSP to ensure they are doing their part (0% N/A)	0%	0%	26%	36%	36%
What kind of influence has these aspects of the process had on your business?	**Very Negative**	**Negative**	**Neutral**	**Positive**	**Very Positive**
Negotiating with the DNSP (0% N/A)	22%	18%	45%	0%	13%
Assistance recieved from the DNSP (4.% N/A)	22%	9%	45%	9%	9%
Indicate your perspective on the statements below	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
The obligatons on DNSPs are vague (0% N/A)	0%	5%	30%	35%	30%
The obligatons on generators are vague (5% N/A)	5%	5%	35%	40%	10%

Figure 13: Survey results from questions related to the connection process for small-medium embedded generators in and NECF regions.

Further questions assessed respondents' capacity to manage their clients' expectations and whether respondents were able to manage their risks and costs during the connection process. Figure 14 and Figure 15 show that generator proponents have to prioritise management of their clients' expectations during the connection process. Although good

business practice would normally lead to the prioritisation of client expectations in most cases, this result indicates that a degree of uncertainty associated with the connection process outcomes leads to a heightened need to prioritise client expectations.

A large number or responses indicated that the inability to manage risks and costs arising from the connection process creates a big challenge for all embedded generators.

What do you prioritise during the connection process?	Very Low	Low	Neutral	High	Very High
Managing client expectations during the process (5.% N/A)	0%	5%	17%	17%	52%
Indicate your perspective on the statements below	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
You are unable to manage your risk and costs effectively (5.% N/A)	5%	5%	31%	31%	21%

Figure 14: Survey results from questions related to management of risk mini embedded generators NECF regions.

What do you prioritise during the connection process?	Very Low	Low	Neutral	High	Very High
Managing client expectations during the process (0% N/A)	0%	0%	20%	20%	60%
Indicate your perspective on the statements below	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
You are unable to manage your risk and costs effectively (0% N/A)	0%	10%	25%	25%	40%

Figure 15: Survey results from questions related to management of risk for small-medium embedded generators in NECF regions.

4.4 Priority areas for improvement

Considering the above results it is apparent that many results are trending negatively, indicating there is much work to be done to improve connection processes.

In order to capture the changing nature of connection processes, the survey sought respondent views on whether the connection process has improved over the last two years. Figure 16 shows these results. While the survey outcomes are indicative of an industry which has been undergoing rapid growth, some concerning issues are clearly evident.

The negotiated connection of mini embedded generators appears to be increasing in difficulty. While having over 50% of these respondents claim that the process has become more difficult is worrying, a low ‘unsure’ response could imply a better understanding of the evolution of the process, thus giving confidence that the process is improving.

A stronger consensus that the process is improving can be seen for larger embedded generators. Two respondents noted:

> *"There has been some improvement recently in terms of clarity if connection rules for some DNSPs but it is still very much a case by case basis for many DNSPs."*

> *"While criticisms are valid, it is also early days for the installation of bigger systems and the process may become smoother for the networks as they go through them more often."*

Although there are some positive outcomes from Figure 16 are also some worrying signs. A large portion of embedded generator proponents believe they are facing more difficulties, despite recent reforms informing of the issues faced by generators. The conflicting message this sends is difficult to interpret.

It could be suggesting that increasing penetration of embedded generation is leading DNSPs to become increasingly cautious. This increased caution could be creating a more challenging process for the connecting party as technical requirements have become more stringent. Alternatively, it could be a result of increased activity in commercial scale solar stretching DNSP resources, leading to negative experiences for some connecting generators. A further conclusion could be that DNSP business priorities are not as focussed on the connection of generation as they are on servicing customers and maintaining reliability. This outcome could possibly be expected as it is consistent with the regulation applied to these businesses.

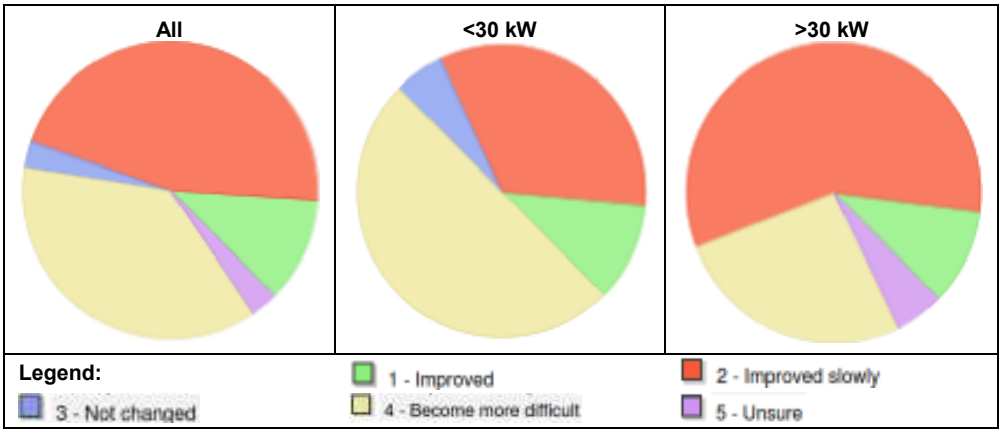

Figure 16: Comparison of respondent perspectives on whether the connection process has improved over the last two years in NECF regions.

It is likely that the outcomes in Figure 16 are a combination of all of the above.

One would reasonably expect that as embedded generation proponents build experience with connection processes, connection experiences would become more positive. Lessons

learned during previous processes continually feed into industry capability as subsequent connection processes include this built knowledge.

However, the results in Figure 16 appear to indicate that this is not necessarily the case and connection processes create uncertainties that cannot be managed by the connecting party. This outcome was also evident in the previous discussion in Section 4.3 which identified that a large number of respondents are unable to manage their risk in the connection process.

Respondents were asked to provide their opinion on the priority of a range of activates which may improve connection processes. These results are discussed below and should provide steerage to all stakeholders for future actions to improve connection processes.

Connection process

Clarity within the rules around the connection process and the standardisation of the process to the greatest degree are very high priority improvements for all embedded generators, and an increasing priority with generator size. A lower ranking was placed on the provision of sufficient time for the generator to analyse the technical limits of the connection and provide solutions to the DNSP.

What would you prioritise to improve the connection process?	Very Low	Low	Neutral	High	Very High
Allowing the generator time to analyse the connection's technical limits and provide solutions to the DNSP (15% N/A)	0%	5%	42%	31%	5%
Standardised approaches for generator connection where appropriate (15% N/A)	0%	5%	10%	57%	10%
Clear obligations on DNSPs and generators in the rules (10% N/A)	0%	5%	15%	42%	26%

What would you prioritise to improve the connection process?	Very Low	Low	Neutral	High	Very High
Allowing the generator time to analyse the connection's technical limits and provide solutions to the DNSP (5% N/A)	0%	0%	45%	45%	5%
Standardised approaches for generator connection where appropriate (0% N/A)	0%	10%	0%	40%	50%
Clear obligations on DNSPs and generators in the rules (0% N/A)	0%	0%	20%	30%	50%

Figure 17: Survey respondent perspectives on process-related priorities to improve the connection process for mini (top) and small-medium (bottom) embedded generators in NECF regions.

The outcome in Figure 17 is unsurprising as the negotiating process has generally had a negative impact on these businesses and a certain connection timeframe was previously noted as a high priority (Sections 4.3 and 4.2.1 respectively).

While agreeing that clear obligations are a high priority, one respondent also provided the view that they may not necessarily be effective:

> *"Clear obligations can exist - it does not mean an NSP is following them, acknowledging them or doing them."*

Information

There was strong agreement across all generators that DNSPs should be obliged to provide complete information early in the connection process. Again, the priority of this information increased with generator size, reflecting the increased complexity when connecting larger embedded generators. It increased even further for larger generators operating, where 80% of these respondents placed these obligations at a very high priority in Figure 18.

One generator with experience connecting small embedded generation across the NEM provided the following supporting commentary:

> *"The main concerns we have are generally related to the uncertainty of the requirements and hence the costs associated with connections up front. By the time the requirements are clear it is often too late to account for these costs, or conversely it can be very difficult for clients to commit to a proposal for a renewable generator when the costs they face are uncertain."*

Another noted that

> "*the connection requirements need to be publicly clear to ensure that competitors for a project are all factoring in the same connection process and associated costs*".

What would you prioritise to improve the connection process?	Very Low	Low	Neutral	High	Very High
Obligations on DNSPs to provide complete information early in the process (10% N/A)	5%	0%	21%	31%	31%

What would you prioritise to improve the connection process?	Very Low	Low	Neutral	High	Very High
Obligations on DNSPs to provide complete information early in the process (0% N/A)	0%	0%	20%	45%	35%

Figure 18: Survey respondent perspectives on information exchange priorities to improve the connection process for mini (top) and small-medium (bottom) embedded generators in NECF regions.

Connection costs

As with previous results increased clarity of connection costs was seen as a priority for many respondents. Again this increased in priority with generator size (Figure 19) with 80% of these respondents ranking this as a very high priority.

One of the respondents stated that their "*biggest concern is about knowing the costs and process up front rather than the actual magnitude of that cost (within reason)".*

What would you prioritise to improve the connection process?	Very Low	Low	Neutral	High	Very High
Clear connection cost breakdowns (10% N/A)	0%	0%	26%	36%	26%

What would you prioritise to improve the connection process?	Very Low	Low	Neutral	High	Very High
Clear connection cost breakdowns (5% N/A)	0%	0%	15%	25%	55%

Figure 19: Survey respondent perspectives on connection cost priorities to improve the connection process for mini (top) and small-medium (bottom) embedded generators in NECF regions.

Commercial terms and technical requirements

Looking closely at the views of respondents on options to improve commercial and technical aspects of the connection, it is evident that clear technical standards and visibility of commercial terms early on are critical improvements, especially for larger embedded generators (Figure 20). There was also strong support for the allowance of export, again, increasingly so for larger embedded generators.

A lower ranking was placed on enhanced support for the negotiation of outcomes via legal channels and dispute resolution. Interestingly this support was marginally higher for smaller embedded generators.

What would you prioritise to improve the connection process?	Very Low	Low	Neutral	High	Very High
Clear technical standards for connection available from an early stage (10% N/A)	5%	5%	10%	36%	31%
Visibility of the commercial terms of a Connection Agreement from an early stage (10% N/A)	0%	5%	15%	47%	21%
Allowing generators to export to the grid where desired (10% N/A)	0%	0%	31%	26%	31%
Enhanced access to dispute resolution processes (10% N/A)	0%	10%	21%	31%	26%
Enhanced access to a DNSPs legal team to negotaite commercial matters (10% N/A)	0%	5%	31%	31%	21%

What would you prioritise to improve the connection process?	Very Low	Low	Neutral	High	Very High
Clear technical standards for connection available from an early stage (0% N/A)	0%	0%	5%	45%	50%
Visibility of the commercial terms of a Connection Agreement from an early stage (0% N/A)	0%	10%	15%	35%	40%
Allowing generators to export to the grid where desired (15% N/A)	0%	0%	25%	20%	40%
Enhanced access to dispute resolution processes (5% N/A)	5%	5%	35%	25%	25%
Enhanced access to a DNSPs legal team to negotaite commercial matters (5% N/A)	5%	10%	40%	30%	10%

Figure 20: Survey respondent perspectives on commercial terms and technical priorities to improve the connection process for mini (top) and small-medium (bottom) embedded generators in NECF regions.

In summary, survey respondents have clearly shown strong support for continued improvement of a diverse array of connection process characteristics.

Of note from this analysis is the large number of mini embedded generator proponents who did not feel that the suggested improvements were of benefit (as indicated by the high number of “N/A” responses) is of particular note. This outcome is likely to stem from a desire to have these smaller generators connected in a rapid simple way, rather than having to negotiate the connection with the DNSP.

4.5 Summary

This survey was the largest survey of the experiences of connecting generators conducted to date. The inclusion of mini, small and medium class embedded generators has captured a clear snapshot of the status of the connection process at a point in time in NECF regions.

Being the first comprehensive survey of its kind, the results have captured experiences garnered during a period of significant flux. It is easy to understand that the remarkable growth of embedded generation, particularly commercial scale solar PV, over a very short timeframe has caught an incumbent distribution network industry by surprise. Concurrently, new players entering the development of embedded generation have done so with low experience levels. All sides have had to work through steep learning curves and these combined conditions are reflected in the survey results.

The survey has captured the experiences of over 45 organisations with experience negotiating the connection of hundreds of embedded generation projects across NECF regions. Looking specifically at the connection process parameters considered by the survey, it is clear that the experiences of many connection applicants have been less than ideal. Many do not appear to be consistent with the intent of market objectives.

Outcomes for mini embedded generators

Mini embedded generator proponents are generally smaller operators. While their businesses focus on higher turnover of generator installations, they generally do not have the time or capacity to engage on detailed matters with DNSPs. They are much more likely to seek the easiest connection process and rely solely on the DNSP for guidance during the process. A large proportion of these proponents is struggling to comprehend negotiated connection process, apparently due to a lack of clarity, or understanding of the negotiating process and the rules which underpin it.

Only a small portion of these survey respondents are content with the connection process. Across NECF regions 33% of those with experience in negotiating the connection of mini embedded generators believe that the connection process meets their needs in a fair and certain manner, or as quickly as reasonably possible. Some 50% believe that this is not the case.

Connection process timeframes are of considerable concern for these stakeholders, many of which noted that delayed timeframes for responses from DNSPs and for the overall process have negatively impacted on their businesses. The majority of these stakeholders prioritise certainty of timing over a rapid connection process, indicating that uncertainty on timing has the greatest impact.

The exchange of information creates further uncertainty for mini embedded generators. Many survey respondents noted that information availability and unexpected changes to information are having a negative impact on their businesses. A further uncertainty is caused by frequently unresponsive DNSPs when requests for information are made, while DNSPs make frequent and repeated requests for additional information from these stakeholders. For example, there have been many cases of connection applications simply being rejected without clear explanation.

The poor performance of information exchange is leading to these stakeholders having to exhaust effort in managing their staff around above-average uncertainty. Further uncertainty is created by these stakeholders having no vision of connection costs until very late in the process, making this an extremely difficult environment within which to manage their own risk and the expectations of their clients.

Mini embedded generator proponents have expressed concern about the imposition of a preference to limit export from these generators, with many suggesting that this has had a negative impact on their businesses. A large proportion of (70%) of respondents from the region in which this is more frequently practiced noted that they did not believe that this preference was justified.

Many stakeholders who are involved in the connection of mini embedded generators have an expectation that the connection process should be simple, following defined parameters and timeframes. While this is the intent of Chapter 5A for these generators, there will always be special cases which require closer attention to ensure the DNSP can maintain supply reliability and security.

The results of this survey indicate that these special cases, or negotiated connections, are occurring more frequently than the rules have envisaged. There is less preparedness for these connections. Those who are expecting a simple process are increasingly being funnelled into less defined and more uncertain negotiated connection processes, creating unexpected and markedly increased risk for these businesses.

Outcomes for small and medium embedded generators

Although those generator proponents in the small-medium class ranges are generally more equipped operators (increasingly so for medium embedded generators) this does not necessarily lead to better connection process experiences. This is demonstrated by a larger proportion of definitive responses to the survey questions (i.e. a lower proportion of ‘unsure’ or ‘unaware’ responses as compared to mini embedded generators).

These stakeholders are more aware of the connection process rules. Although this awareness leads a majority to state that they don't believe the connection process or the associated rules are clear. The 25 respondents in these classes have had experiences connecting approximately 180 embedded generators. Yet only 6 of them believe that connection processes meet their needs in a fair and certain manner, or as quickly as reasonably possible.

There were a few NECF region respondents who were content with the process. However, the much larger proportion of views is that the process is unclear, not supported by clear rules and does not meet their needs is concerning. Comparing this outcome to mini embedded generators it appears that satisfaction is inversely proportional to connection complexity or, alternatively, engagement with the DNSP during the connection process.

A longer connection timeframe to connect these generators generally reflects the increased complexity of doing so. However, connection process timing and DNSP response timeframes are clearly having a negative impact on the businesses involved in the installation of generators in this class. Overall these stakeholders prioritise certainty of the timeframe over a rapid resolution, although the latter is still a high priority.

Limited information availability and requests for additional information from the DNSP were contributing to challenges during the connection process. Changes to information already provided have also had a significant impact. It appears that every DNSP has a vastly different approach to the provision of information, which creates a challenging environment in which to operate a business.

There was strong agreement that the lack of clarity of connection costs until very late in the process creates challenges. So too does the cost of the connection process, the physical connection and changes to costs. A large proportion of respondents noted that export limitations requested by the DNSP have had a negative impact on their business as this has increased costs.

Although many of these respondents had not experienced negative impacts from the commercial terms of connection, a majority expressed concern that these terms are high risk for their businesses.

Priority areas for improvement

As noted previously, the CEC undertook this survey on the basis that member organisations had notified it of concerns with connection processes. The survey results have also identified that a large portion of embedded generator proponents believe they have been facing increasing difficulties with the connection process.

In order to round-out the survey it asked which aspects of the process should be prioritised to make improvements. These responses generally supported continued improvements across a range of connection process parameters.

With regards to mini embedded generators it is apparent that those who have negotiated aspects of the connection were not anticipating this outcome. There is a strong desire to continue the development of standardised connection for these generating systems. This should focus on the identification and standardisation of commonly negotiated aspects of these connections, with the general aim of standardisation on a National level.

For larger embedded generators these results repeat those already identified as priorities elsewhere including:

- The maximisation of information available, both publicly and, where connection-specific, as early in the process as possible and in a timely manner.
- Clarity on connection costs as early in the connection process as possible.
- Clear and consistent technical standards for the connection of embedded generation are required at an Australian Standards level.
- Connection process timeframes and response timeframes need to be more clearly committed and consistently adhered to in order to provide certainty for connecting parties.
- Early visibility of the commercial terms for connection is critical.
- Commercial terms for connection should also be standardised and determined by an independent body in order to ensure reasonable outcomes for both parties.

It is worth noting that many of these opportunities for improvement have been previously identified and are already being progressed through avenues such as recent rule changes via the Australian Energy Market Commission. However, these findings serve to reinforce the need for those actions while capturing experiences of an industry which is growing and developing very rapidly.

This survey has also led to a better understanding of a pressing need to strive for standardisation. The inefficiencies that are arising from what appear to be bespoke responses to many connections are unlikely to advance market objectives.

A much stronger emphasis needs to be placed on working towards the standardisation of connection processes and technical and commercial outcomes on a national level. All parties require this outcome to maximise the efficiency of investment in embedded generation, and the operation of DNSP businesses.