MAY 2018

Plug & Play 2

Enabling distributed generation through effective grid connection standards

ClimateWorks AUSTRALIA

seed advisory

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Acknowledgment of Support

This project was funded in part by Energy Consumers Australia (www.energyconsumersaustralia.com.au) as part of its grants process for consumer advocacy projects and research projects for the benefits of consumers of electricity and natural gas.

ClimateWorks Australia and Seed Advisory would also like to acknowledge the openness and co-operation shown by the organisations interviewed. ClimateWorks Australia and Seed Advisory are responsible for the views expressed in this report: the views expressed in this document do not necessarily reflect the views of Energy Consumers Australia, or any other organisation consulted in the preparation of this report.

Plug and Play 2

Executive Summary

Plug and Play 2: Enabling distributed generation through effective grid connection standards is the second report for this project. It follows a consultation paper released in February 2017, titled *Plug and Play: Facilitating grid connection of low emissions technologies*.

For this report, we interviewed stakeholders from the gas, telecommunications and aviation industries about the characteristics of an effective process for developing industry standards and codes of practice. These discussions suggested two important features: regulatory oversight, and active and informed representation of different interests. Both of these features are helpful for the development of fair and effective standards, and at least one is necessary. These features are largely absent from the current process for developing distribution network access requirements, and this report suggests actions that could be taken to address this.

The Australian electricity market is at the forefront of the distributed electricity transition occurring internationally. This transition promises a move to customer-led markets located in distribution networks, providing a range of services to the network as a whole. To enable this transition, it is essential that customers can easily access the network by connecting their equipment. This will ensure customers can participate in the range of projected financial and energy security benefits produced through this evolving market.

Current arrangements do not always provide customers with easy access to the distribution network for their equipment. Connection is controlled by a complex array of laws, requirements and standards that vary between different networks. Under state laws, distributors are responsible for managing the safety and performance of the network, and have control over connection to the network. Distributors can base their access requirements on Australian Standards, International Standards and/or their own particular conditions. There is no regulatory oversight of distributors' network access requirements.

Customer access to the network may also be constrained by customers' absence from the process of developing access requirements. While networks are explicitly required to consider network safety and performance, they are not required to balance customer interests against these features. Some distributors include Australian Standards as part of their network access requirements. Although Standards Australia encourages the representation of a range of interests in the standards development process, broad stakeholder representation is not consistently achieved on Standards Australia committees. Across a range of industries, Standards Australia experiences difficulties in attracting appropriately skilled customer representatives, or customer proxies such as manufacturers, to sit on its panels. As a result, even the inclusion of Australian Standards in distributor access requirements may fail to provide balanced consideration of customer interests.

The development process for network access requirements therefore results in increased costs for customers wanting access to the grid by connecting their equipment. Our first report, *Plug and Play: Facilitating grid connection of low emissions technologies*, identified a range of situations where variations in distributor network requirements have increased customer costs or reduced customers' ability to achieve their objectives. This report influenced the Australian Energy Market Commission's discussion of the near-term enablers required for distributed

energy to flourish in the National Electricity Market (NEM). Energy Networks Australia (ENA) has also identified the importance of developing more consistent connection processes across the different distribution networks and is currently consulting stakeholders on principles for common distribution network connection processes. This new report is intended to feed into the current ENA process.

Improving the process

We have identified three actions that could improve the process for developing network access requirements.

Action 1 is intended to address the need for oversight and transparency of distribution network access requirements.

Actions 2 and 3 each address the need for better customer representation in the development of access requirements.

In order improve network access requirements, either Actions 1 and 2 or Actions 1 and 3 should be undertaken as a package.

Action 1: A framework for network access requirements

Across distribution networks, agreement is required to define the characteristics of a safe, secure network. A framework should be developed to provide guidance on the acceptable (and unacceptable) incidence of foreseeable events. In the first instance, this may mean codifying the 'rules of thumb' that networks are currently using to manage requests for access in specific locations. As the distributed electricity transition progresses, distribution networks should publish their findings from applying the framework, and the framework should be updated regularly to incorporate these learnings.

To support the framework and provide transparency to a range of stakeholders, models and tools for testing key assumptions about the safety framework should become publically accessible. Manufacturers and customers could use the tool to better understand the risks and benefits of their product, or the potential impacts of their application for connection to the distribution network. It is our view that the ENA is best placed to undertake the role of developing the framework, models and tools. This process should be transparent and seek feedback from a broad range of stakeholders, including networks, manufacturers and customers.

Action 2: Representing customers in the development of Australian standards

The process of developing Australian Standards for grid-connected equipment could provide a valuable method for implementing the broad framework recommended as Action 1. However, better representation from a wider range of stakeholders is required. Increased funding may be needed to engage capable customer and industry representatives in the standards development process. We are yet to identify the most appropriate source for this funding.

The Australian Energy Market Operator (AEMO) could provide a potential alternative to Standards Australia for the development of network access requirements. This option should be considered further, to test its viability. This role would represent a significant departure from AEMO's current responsibilities.

Action 3: Adopting International Standards

In the absence of funding for improved participation in the development of Australian Standards, International Standards should be adopted, with only minimum amendments to account for specific Australian conditions. The rationale for this approach is that representation of a broad range of stakeholders is much stronger at the international level and this could provide a cheaper, more transparent, more adaptive alternative to the current model, both for Australian electricity customers and for the economy as a whole.

Effective distribution network connection requirements will be essential in enabling the distributed electricity transition to progress equitably and transparently. It is our view that implementation of the above actions would improve the balance of customer interests alongside network safety and performance in the requirements for distribution network access. The improved requirements would be evidence-based, consistent across different networks, and balance the interests of different energy market participants to create better outcomes for the economy and the grid.

Contents

1. Introduction

The Australian electricity market is at the forefront of the distributed electricity transition internationally. The distributed electricity transition promises customer-led markets located in distribution networks, providing a range of services to distribution networks, the wholesale electricity market and the ancillary services market.

For the distributed electricity transition to provide the greatest benefit to the maximum number of customers, access to the distribution network that minimises customer and network costs is necessary. Just as access to the incumbent's telecommunications network was critical for growth and innovation in the telecommunications market, access to the distribution network is critical to participation in the distributed energy transition. Unlike telecommunications, electricity market deregulation didn't coincide with a wave of innovation: that innovation is happening now. This history matters: because the current wave of innovation was not foreseen when deregulation occurred, access to distribution networks lacks the competitive safeguards that apply in other sectors or in the electricity transmission network, where the entry of new generators was anticipated.

There is a complex system of laws, standards, processes and requirements controlling connection to the distribution network. Current access to distribution networks is governed at a high level by state laws that local network policies give effect to. Access to local networks is controlled by connection processes, Australian and International Standards, and the local distributor's specific policies[1]. "Network access requirements" is used in this report to describe the combination of connection processes, Australian and International Standards, and any distributor-specific requirements governing network connections. The Distribution Service Operator (DSO) model supported by the Energy Networks Australia (ENA) proposes supplementing Australian and International Standards with ENA guidelines, potentially replacing distributor specific policies[2].

Our first report[3] and the Australian Energy Markets Commission's (AEMC) final report on the distributed generation transition, *Distribution Market Model*[4] argue that there are significant costs to potential market entrants from the lack of standardisation in network access requirements[5]. Our interviews and additional research suggest that there are two key elements absent in the electricity sector at least one of which characterises the processes for setting standards and safeguard access in other sectors. These key elements are:

- regulatory or technical oversight, and
- representation of a range of stakeholders and contending interests in the standards development process

As we identified in our first report, there is no oversight of the regulatory or technical principles behind or the decisions embedded in network access requirements at the individual level. There is also no explicit requirement for wide participation, stakeholder consultation or external review in the development of any element of networks' access requirements.

In this report, we discuss our analysis and observations of the possible ways in which the development of network access requirements could be improved.

[1] In this report, we distinguish between *Australian Standards* and *network access requirements*. When we refer to *network access requirements*, we mean the combination of connection processes, Australian and International Standards distribution network connections are obliged to meet, and any distributor specific requirements imposed on connection applications. Standards developed by or for Standards Australia are identified as *Australian Standards*.
[2] ENA and CSIRO 2017
[3] ClimateWorks Australia and Seed Advisory 2017
[4] AEMC 2017
[5] This issue also exists internationally, e.g. Ardani et al 2017

2. Background

ClimateWorks Australia and Seed Advisory published the first report for this project in February 2017, *Plug and Play: Facilitating grid connection of low emissions technologies*. The report, supported by the Australian Energy Council, influenced the Australian Energy Market Commission's (AEMC) discussion of "the near-term enablers that will need to underpin any future design of distribution system operations" for distributed energy to flourish in the National Electricity Market (NEM)[6].

In our first report, we identified several possible alternative models to the existing arrangements, ranging from industry based, Australia wide models, such as have been developed in the gas industry to a national regulatory body like that governing technical standards and connection requirements in the telecommunications sector.

In this second report, we have proposed a program for shifting from the current process for developing network access requirements to a process which allows for greater transparency in the technical and regulatory conditions for network access, as well as wider representation in the development of Australian Standards underwriting network access requirements. In developing this program, we have explored the characteristics of alternatives to the current institutional arrangements identified in our first report. We tested the alternative models with a limited range of key sectoral and industry participants to identify issues. We also considered characteristics of the identified alternatives that could be replicated to improve customer representation in future development of standards and connection requirements. We have conducted a high-level literature search of the arrangements relating to connection requirements, standards and other network requirements in several other deregulated electricity markets.

[6] AEMC 2017

3. Network access requirements

3.1 The current Australian model – features and issues

As we outlined in our first report, state legislation confers on distributors the responsibility for managing the safety and performance of the network within local jurisdictional guidelines, and the powers to control customer connections in line with these responsibilities.

Distributors set network access requirements to allow them to meet their responsibilities to manage their network. The requirements fit within the National Electricity Rules (NER) which focusses on processes for connections to the distribution network. Network access requirements may be relevant Australian Standards, International Standards, requirements specific to the distributor, or a combination of these. Connected equipment must be certified as compliant with the relevant requirement(s).

The ENA is currently consulting stakeholders on principles for common distribution network connection processes for small to medium scale distributed generation. These internally developed principles may be adopted by its membership in the development of future connection processes and proposed guidelines.

There is no regulatory oversight or review of networks' access requirements. Individual connection applicants have some, limited rights to dispute decisions on individual connection applications, and the NER requires distributors publish their network access requirements, but there is no regulatory assessment of the requirements themselves. The responsibility of state safety regulators stops at the customer connection point, leaving the decision on the acceptability of customers' equipment and connection choices (the behind the meter market) to the distributor[7].

The absence of oversight is different from the approach in other jurisdictions and industries. For example:

- The European Union has both high level principles relating to network codes in the overarching electricity law, and an oversight process for network codes once developed[8];
- In the UK, the Office of Gas and Electricity Markets (Ofgem) is participating in the current review of the two Engineering Standards governing distributed generation connections to distribution networks. Given its responsibility for the Distribution Code, which will reference the Standards once completed, Ofgem also acts as a gate-keeper in deciding whether to incorporate the revised Standards into the Code[9]; and
- In the Australian telecommunications industry, the Australian Communications and Media Authority (ACMA) provides oversight of the development of industry codes and standards to ensure equipment and safety standards meet a minimum level consistent with customer safety and network integrity[10].

[7] The electricity market is different from the gas market, because equipment connected to the electricity network can, depending on the nature and performance of the protection equipment, affect the safety and performance of the wider electricity network. In contrast, connections to the gas distribution network have no potential impact on the network's performance; other than those issues included in the Distribution Code related to network performance, gas market safety regulators focus on customer safety in reviewing connected equipment.
[8] Black 2013
[9] Ofgem 2018
[10] Australian Government 1997

The absence of external oversight is consistent with the governance structure for access introduced during deregulation. Under this governance structure responsibility for the safety and performance of the network, and specifically the requirements governing equipment connected to the network, sits with the network operator. The network operator was regarded as the best placed and most incentivised party to safeguard the network's performance and to protect the network from the potentially adverse effects of connected equipment on customer safety. However, looking towards the distributed generation marketplace, the absence of oversight raises the possibility of unnecessary barriers to access.

In addition to the absence of oversight, there is also no explicit requirement for wide participation, stakeholder consultation or external review in the development of any element of networks' access requirements:

- Local distributor's specific policies are developed at the discretion of the distributors.
- Australian Standards for the electricity sector are not heavily contested, regularly being developed without continuous informed participation by direct customer representatives or proxies (see "The role of Australian Standards" below).
- International Standards adopted for the Australian market also are considered by Standards Australia in a similar process to the development of domestic standards, and are also affected by the lack of customer representation.

The narrow pool of interests represented in the development of Australian Standards and the adoption of International Standards for the Australian market contrasts with the US electrical equipment market. In the US, the regulatory arrangements are similar to those in Australia, where state-based safety and performance regulation has no formal national standardisation and, in some cases, relatively little regulatory oversight of local utilities' policies. However, in the US market, manufacturers are significant participants in the standards development process, often, according to one utility peak body, "dragging the utilities behind them" in the development and refresh processes for industry wide standards.

In the Australian electricity market, the absence of either key element for managing customers' costs and access makes the electricity sector different from the other industries we have reviewed.

The role of Australian Standards

Australian Standards are a significant element in the development of network access requirements. As the process currently stands, the development and review of Australian Standards represent the main opportunity for customer input or, acting as a proxy for customer interests, manufacturer or retailer input into network access requirements. Participation in the development of relevant Australian Standards, however, does not guarantee customer input: other elements in networks' access requirements can significantly amend the application of the standard. For example, distributors also have the ability to adopt their own specific policies or restrict those areas of a network where connection applications consistent with the relevant Australian Standard apply.

Standards Australia's general policy is to aim to accept relevant International Standards or accept International Standards with modifications where required for Australian conditions. Where the Australian market is ahead of development of International Standards, a standard may be developed independently, as was the original intention for residential on-site battery storage standards, for example[11]. The electricity sector relies heavily on domestic standards, for example requiring inverters for small scale distributed generation equipment as the basis for network connection (AS 4777.2:2015). In other Australian industry sectors, like telecommunications and the aviation sector, the absence of a significant domestic industry has

[11] Standards Australia 2017a

driven the pragmatic adoption of International Standards with minimal amendments for the Australian environment[12,13].

The development of the residential on-site battery storage standards in Australia illustrates some of the issues that arise in the development and application of Australian Standards from a customer perspective. There was a significant adverse response by domestic and international industry to the draft installation standard developed by Standards Australia's technical committee. The draft standard proposed significantly more onerous installation standards on certain battery types than those required by similar International Standards or those applied to similar risks in a residential environment[14,15]. Standards Australia, industry and government have since agreed to work together to fast track the development and adoption of appropriate product safety standards for batteries, including the expected adoption of product standards from international battery standards developers, the International Electrochemical Commission and Underwriters Laboratories.

The absence of customer representatives or participants whose interests might coincide with customers' interests is a function of the small size of the Australian market place. The Australian electrical equipment manufacturing sector is small, the number of manufacturers of advanced distributed energy equipment even smaller. Particularly in new energy technologies, domestic and international manufacturers represented in the Australian market are focussed on international, not national standards, as accreditation to International Standards opens wider market access. While there are a number of industry groupings that bring together manufacturers, installers and developers in new energy technologies, their participation in the development of Australian Standards is typically low, lacking the resources to participate throughout the process. Depending on the topic, Energy Consumers Australia and/or the Australian Energy Council may be represented. However, in electricity as in other sectors of the economy active informed representation during the development of a draft standard is increasingly difficult to ensure[16], and significant amendments to draft standards once published are difficult to achieve.

The role of retailers in representing customer interests

In both telecommunications and aviation, carriers play a significant role internationally and domestically in the adaptation of International Standards for the Australian market. These carriers, some of which are international companies, are members of international and domestic industry organisations, and actively participate in the local processes adapting International Standards.

Are they the effective equivalent of retailers in the domestic electricity industry? And, if so, could the local retail participants be expected to take on the role of representing customers in the development of Australian Standards?

Arguably, no. Unlike telecommunications and aviation carriers, both of which industries have experienced very rapid growth with the deregulation and transformation of their sectors, Australian electricity retailers compete at the margin with distributed generation. Even those retailers that are planning for a distributed energy future face lower customer sales the higher the penetration of distributed generation. Realistically, not all retailers are planning a distributed energy future: smaller and niche retailers may lack the current ability to invest in

[12] Both industries are regulated nationally, an important difference from the responsibility for regulating the electricity market, which has been developed on a shared basis for those issues covered by the National Electricity Law and Rules, but which otherwise regulatory oversight defaults to the states.

[13] In the telecommunications industry, the development of standards to apply in the Australian market, typically based on International Standards, happens outside the institutional umbrella of Standards Australia, being the responsibility of the Communications Alliance, accredited by Standards Australia, overseen by the Australian Communications and Media Authority (ACMA). In the aviation industry, responsibility for ensuring International Standards are appropriate for Australia sits with the Civil Aviation Safety Authority (CASA).

[14] Bloch, 2017 provides a summary of some of the criticisms of the draft standard.

[15] Of the 17 parties present at the meeting to agree the revised way forward, there were no direct consumer representatives, two electricity retailers, one international manufacturer, the networks' peak organisation, and two industry groups, one of which more directly represented affected parties, representing installers. The largest number of attendees were safety regulators. The regulators may have had no direct responsibility for electrical appliances behind the meter but were representing the potential safety issues of related trades and possible first responders in the event of a fire. (Standards Australia 2017a)

[16] Standards Australia 2017b

developing their capabilities in this space, even where they are a desirable partner for the technology vendors.

Given this, the current limited retailer interest in participating in Australian Standards committees is probably a realistic representation of the retail sector's likely participation, making the retailers an inadequate proxy for customers in the development of Australian Standards for the electricity sector.

3.2 The Distribution Service Operator: The Energy Networks Association's proposal

The ENA/CSIRO *Electricity Network Transformation Roadmap* envisages a future where " … connecting millions of customer owned generators and energy storage systems to each other, networks … act as platforms which help match supply and demand and reduce the need for inefficient duplication of energy investments"[17]. In this vision, the distribution network is a key building block, providing a platform where the network, now a Distribution Service Operator (DSO), co-ordinates and dispatches customer equipment to provide services to the network, to the electricity system, to the wholesale market and to local markets.

Regardless of the operator – whether the regulated Distribution Network Service Provider, an unregulated DSO or some other platform provider – the critical issue for customers in this marketplace will be access to the network. Without being able to connect her equipment, the customer can't participate. The barriers to potential participation can take several forms. The potential barriers considered in this report are those that result from:

- unnecessary customer costs, raising equity of access concerns; and
- overly conservative technical regulation, preventing customer participation, particularly in areas of lower network strength and/or where current levels of distributed generation participation are approaching or exceeding current network policies.

Unnecessary customer costs fall disproportionately on participation by lower income customers. As distributed energy penetration increases, the costs of participation will increasingly become an equity issue for customers and policy makers.

Where customers are unable to access similar benefits to those they see their neighbours benefitting from, then regardless of the technical case for the network's rule, transparency in network decision making is likely to become a more significant issue. Whatever role the distribution network is playing in the network of the future, being able to demonstrate to customers the even handedness of network access requirements and the relationship to network performance will be important components in networks' future customer relationships.

Australian electricity networks are positioned at the leading edge of distributed generation participation internationally. During the transition towards a distributed energy future, connection policies are inevitably going to be based on network studies, operator estimates and rules of thumb. However, at the leading edge, networks also have the potential to learn from each other, to provide a lesson for networks internationally, and to adjust network access requirements in the light of those learnings. Our proposed program, outlined in the next section, suggests ways in which we could combine higher levels of transparency and higher efficiencies for customers with the continuing safe and secure operation of the distribution networks.

[17] ENA and CSIRO 2017

4. Approaching a level playing field for customers: principles, possibilities and next steps

This section outlines a program that would address the issues we've identified in the research and interviews that have gone into this report and our earlier work. Those issues are:

1. The costs, measured in both higher installation costs and lower installations, of the current disparate network access requirements across the NEM and, considering Australia as a whole, across the country.
   The ENA's current project to begin the standardisation of connection processes is a welcome development, provided that it extends beyond process documentation standardisation to include both equipment standardisation and equipment standards that balance the network access cost to customers alongside maintaining network safety and performance.

2. The questions of equity and transparency in network decision making.
   While networks' connection processes have improved in response to earlier mandated reforms, in some cases more could still be done to improve the transparency of network access requirements. This is particularly relevant where networks are operating at the leading edge of distributed generation penetration. Equity and transparency are likely to become more significant issues for customers the higher the level of distributed generation: networks' processes and decision making need to anticipate these pressures as penetration increases.

3. The absence of either external oversight of distributors' network access requirements or direct/ proxy customer representation in the development of Australian Standards for the electricity sector.
   Australian Standards for the electricity sector are the only element of distributors' access requirements customers may be able to influence in the current environment. As with other sectors that rely on Australian Standards, the electricity industry is suffering from difficulties in representation, skills, consistency and participation. However, while the proposed introduction of Distributor Guidelines as part of the Roadmap implementation could remedy some of these issues, to the extent Guidelines replace Australian Standards and are developed by the distribution networks with limited external participation or oversight, they have the potential to reduce customer representation.

Appendix A provides an overview of our investigation of different models of network access governance internationally. Our program draws on this research without replicating any of the individual models we've looked at.

- Our first and possibly most important learning was the observation that Australian electricity distribution networks had neither external oversight of their access requirements, nor a forum where access requirements could be and were actively contested by other industry participants.

- The Australian environment for the development of electricity network access requirements differs significantly from the environment in which International Standards are developed in the telecommunications, aviation and electricity sectors.

Given the Australian manufacturing sector's make-up and the issues confronting Australian Standards Technical Committees more generally, the Australian environment is unlikely to support the wide participation experienced in developing International Standards. The decisions of International Standards organisations are actively contested by a wide group of stakeholders, particularly by the manufacturing sector. While customers may not be directly represented, the presence of retailers and manufacturers provides some proxy for customers' interests.

- Without stipulating specific technical targets or requirements, it's possible for an industry-led process to agree to regulation and industry codes consistent with the lowest possible standard consistent with network safety and resilience[18].

We have not proposed an institutional response, as based on our assessment there is currently no appetite for such a measure in the Australian electricity industry[19].

4.1 Our program

A framework for network access requirements

We need an agreed framework for establishing what a safe, secure network looks like. State regulation specifies the over-riding requirements for network performance. Below this level, at the relevant local network level, we need to identify the principles and rules that should underlie networks' access requirements to provide better transparency to customers seeking access to the network. These rules and principles should govern network access requirements whether the source for those requirements is Australian Standards, International Standards, ENA guidelines or distributors' own local requirements. Desirably, the framework would be national; state safety regulators' responsibilities, as now, could be limited to all those activities up to the connection to the premise, but with a higher level of insight into, and confidence in networks' approach to the safety issues behind the meter. The framework should include critical examination of the acceptable (and the unacceptable) incidence of foreseeable events, whether likely or remote, as well as those events the framework is not intended to address.

In the first instance, this may mean codifying the "rules of thumb" networks are using to manage requests for access in specific locations. In the future, we anticipate that individual network's studies, operator estimates and rules of thumb should be replaced by the systematic application of the learnings from networks' experiences in refining current access requirements as well as international learnings. Australian networks should also publish their findings as distributed energy penetration grows – this could provide a learning opportunity for networks internationally[20].

In the interests of both transparency and in encouraging constructive debate about the appropriate level for network access requirements, we think any framework could be supported by widely accessible, if simplified, models and tools for testing key assumptions and outcomes for changing technologies, equipment use and customer behaviours. Manufacturers, potential connection applicants and other interested parties could use the tool for thinking about the benefits of proposed technologies, or the likelihood of a connection application succeeding in a stylised environment with key relevant network characteristics.

The ENA, with appropriate stakeholder representation, is the best placed sponsor for the development of the framework. To address issues of inefficient costs and to provide transparency, trade-offs between customers' and other stakeholders' interests need to be

[18] Energy Safe Victoria 2017. The draft Review of Energy Safe Victoria's network safety framework (December 2017) provides a useful discussion of the disadvantages of specific technical targets or requirements given the rate of technical changes, and the trend towards performance-based regulation in safety and performance regulation.
[19] The AEMC acknowledged the issue of network access requirements in their *Distribution Market Model* report, and assigned responsibility to the ENA rather than a regulatory body.
[20] A range of network studies are receiving support from state and national innovation programs. Where this is the case, dissemination of the findings is a typical condition of grant funding.

explicitly identified, the benefits and costs of the available alternatives considered in the context of the framework, and the justification provided for any decisions.

Representing customers in the development of Australian Standards

Assuming a role is retained for Australian Standards in network access requirements, can Australian Standards be made to work better for Australian electricity customers? What we've learnt from telecommunications regulation is that Standards Australia's standards development process is compatible with an external framework governing the objective of any standard adopted, so there's no inconsistency between the overarching framework proposed and the continuing use of Australian Standards. What is needed is better representation from a wider range of stakeholders in the development of future Australian Standards.

There's an argument that there's a market failure in representing Australian customers' interests. The Australian manufacturing sector, the local industry peak organisations and the electricity retailers are unlikely candidates to act as customer proxies, even where the sector has the organisational scale to support participation in Standards development. If we could fund appropriate representation, then it should be possible to find appropriate resources to participate on customers' behalf, even if by extending Energy Consumers Australia's current participation. Identifying a funding source, however, may be an issue. Discussing this issue with regulators and industry participants outside the electricity industry threw up some possibilities, but even peak industry bodies are under resourced in this area and challenged to respond across a range of policy initiatives at present.

The Australian Energy Market Operator, AEMO, has been suggested as a candidate for the role of developing network access requirements. Certainly, AEMO has a very strong interest in the network requirements applied, both in relation to the interaction of any requirements with the wider performance of the electricity system under stress, and given its interest in the prospective development of the DSO model and the interface of that model with the wholesale and ancillary service markets. On the other hand, AEMO's current responsibilities in relation to connections are restricted to technical considerations of large scale connections. The required balancing of networks', customers' and the system's requirements is something which the codification of AEMO's responsibilities was originally designed to avoid.

Adopting International Standards

If we can't identify how to fund better customer representation – and given the issues the electricity industry faces in the Standards Australia process are shared with other industries, we're pessimistic about this - then we should consider, in combination with the framework for network access requirements, moving to adopt International Standards, with only the minimum amendments for significant Australian departures from international electricity industry engineering practices. This is the pragmatic decision taken by other sectors of the Australian economy faced with similar challenges to the electricity sector; it could represent a better alternative – less expensive, more transparent, more adaptive – than the current model for Australian customers and the economy as a whole.

4.2 Our objective: National network access requirements, limited exceptions

As we argued in our earlier report, consistent, clear and transparent national network access requirements would reduce the cost and market impacts of the current arrangements, provide benefits to customers and the economy, and unblock uptake of new technologies.

National network access requirements must explicitly balance risks to safety and network performance, costs and wider policy objectives: There is a cost to both inappropriately high and inappropriately low network access requirements, and the process used to access

requirements needs to recognise these costs[21]. The performance of the electricity system as a whole needs to be considered, in addition to local distributor requirements.

The distributor may have specific requirements in particular areas characterised by poorly performing, vulnerable or old infrastructure: these characteristics should be addressed at a local level, not through distributor-wide network access requirements. Network access requirements should reflect conditions in the networks where there are a large number of connections and where the major economic activity is, that is, in highly meshed urban networks, high performing by international standards. Setting network access requirements based on the performance of the least well performing areas of the network would result in network access requirements 'levelling up' to meet the most onerous current requirements. The opposite should be the case: national network access requirements should be set at the minimum consistent with the safety and performance of networks, and areas where exceptions to those standards are appropriate should either be explicitly excised (for a period) from the coverage of the network access requirements or dealt with on an exceptions basis.

[21] In the course of the debate surrounding the changes to connection processes in Chapter 5 of the NER, a stakeholder representative claimed it was a matter of some pride that the automatic connection threshold in the NER Schedules was as onerous as it is. To an economist, of course, a standard set so high it can never profitably be implemented is ineffective and expensive regulation, not a desirable outcome.

Appendix 1: International models for governance of network access requirements

	Australia	California	Texas	United Kingdom	New Zealand
Responsibility for network access requirements	Distributors set network access requirements to allow them to meet their responsibilities under the National Electricity Rules. The National Electricity Rules require distributors to publish their network access requirements, and provide individual connection applicants with some rights to dispute decisions on their connection application.	The California Public Utilities Commission's (CPUC) Electric Rule 21 describes the interconnection, operating and metering requirements for generation facilities to be connected to a utility's distribution system. Each investor-owned distributor is responsible for administration of Rule 21 in its service territory and maintains its own version of the rule. This provides distributors with considerable discretion as to the details of their network access requirements.	Texas' Public Utility Regulatory Act (PURA) includes in the list of customer rights the right to on-site distributed generation. The Public Utility Commission of Texas (PUCT) has adopted Rules to address technical and procedural aspects of connecting distributed generation. The Rules include the technical standards that distributed generation must meet to connect to the grid.	Distribution network operators (DNOs) are obliged under their licenses to maintain their own Distribution Code. All DNOs currently use the same Code, which is decided by a panel of industry representatives. Mandatory engineering standards sit within the Distribution Code.	Under the Electricity Industry Participation Code, distributors can set connection and operation standards that customers must meet in order to connect their equipment. The Code requires distributors to make connection and operation standards publicly available and to provide information about which parts of the network are export congested.
Oversight arrangements	There is no regulatory oversight of networks' access requirements. The Australian Energy Regulator investigates complaints and takes enforcement action where appropriate.	The CPUC regulates investor-owned utilities operating in California. The CPUC is responsible for the development and revision of Rule 21, and has oversight of distributor's implementation of this rule.	The PUCT is the state agency that regulates electric, telephone and water utilities for the state of Texas. The PUCT writes and enforces the rules by which utilities abide.	The Office of Gas and Electricity Markets (Ofgem) regulates the gas and electricity networks and the competitive markets in gas and electricity supply and retail. Ofgem is independent from the government, accountable instead to Parliament. Ofgem approves any changes to the Distribution Code.	The NZ Electricity Authority monitors the compliance of distributors and generators under the Code and takes enforcement action where appropriate. The Electricity Authority also has a role in dispute resolution between generators and distributors. There is no direct oversight from the Electricity Authority over the development of distributors' connection and operation standards.

	Australia	California	Texas	United Kingdom	New Zealand
Use of international standards	Distributors may choose to refer to international standards in their network access requirements.	The requirements under Rule 21 have been developed specifically by the CPUC and do not include international standards. However, due to the size of the US market, standards developed in the United States are highly influential in the development of international standards, often adopted as international standards.	The requirements under the PURA have been developed specifically by the PUCT and do not include international standards. However, due to the size of the US market, standards developed in the United States are highly influential in the development of international standards, often adopted as international standards.	European network codes also cover grid connections. The EU Agency for the Cooperation of Energy Regulators (ACER) has set Framework Guidelines on Grid Connection. These guidelines include principles for developing grid connection requirements. Ofgem are involved in industry working groups to implement these EU codes in the UK via the UK codes (National Grid). There is also some monitoring and enforcement of implementation of EU codes in the UK.	Individual distributors may choose to include international standards within their network access requirements, however, this is not mandated. There is some focus on the use of international standards for safety and New Zealand makes extensive use of Australian Standards across a number of industries.
Process for standards development	Distributors set their network access requirements at their own discretion. ENA is currently undertaking a consultation process on principles for network access requirements.	US electrical standards significantly influence the parameters for local standards development. The national process for developing standards includes a very significant representation of the equipment manufacturing sector. At the local (state) level, to revise Rule 21, the CPUC convenes working groups of representatives from across the energy industry. A current review is examining whether an Integrated Capacity Analysis tool could be incorporated into the Rule to streamline the connection	US electrical standards significantly influence the parameters for local standards development. The national process for developing standards includes a very significant representation of the equipment manufacturing sector. The PUCT amends the interconnection rules following consultation with representatives from across the industry.	The Distribution Code panel includes representatives from across industry, including generators, DNOs, users, suppliers and Ofgem At the EU level, the Framework Guidelines on Grid Connection are set by ACER who consult with a stakeholder committee that includes energy industry associations, manufacturing industry associations, transmission network operators and distributors.	Distributors set their codes at their own discretion.

	Australia	California	Texas	United Kingdom	New Zealand
		process. The working group includes distributors, electrical equipment manufacturers and renewable energy industry associations.			

Sources: Agency for the Cooperation of Energy Regulators 2011, Black 2013, California Public Utilities Commission 2018, DCODE 2018, European Network of Transmission Service Operators - Electricity 2018, Gridworks 2017, Marsden Jacobs 2017, New Zealand Electricity Authority 2018a, New Zealand Electricity Authority 2018b, Public Utilities Commission of Texas 1999, Public Utilities Commission of Texas 2016, Public Utilities Commission of Texas 2018

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Published by ClimateWorks Australia
Melbourne, Victoria, March 2018

This report may be downloaded at www.climateworksaustralia.org

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