About this Report

This report – Roadmap for Energy Storage Standards – February 2017, was prepared by Standards Australia.

Financial support for the Roadmap for Energy Storage Standards from Standards Australia’s co-resourcing partner, the Council of Australian Governments (COAG) Energy Council is gratefully acknowledged.
Foreword

Dr Bronwyn Evans, Chief Executive Officer
Standards Australia

The transformation of energy generation and use comprises significant challenges and opportunities for Australian industry, consumers and regulatory stakeholders. For many, one of the most important pieces of infrastructure to emerge in the Australian market are energy storage systems, which enable occupants to interact with the “smart grid” in new and innovative ways. Energy storage systems allow occupants to consume and store energy for use at another time. For example, owners can store energy they have generated via a solar installation or some other alternative energy source, enabling the use of that energy when they need it, or sell it back to the grid.

In embarking on this unchartered journey of technology, it is critical that those inventors at the forefront of innovation can do so unhampered, and suppliers can get these products to market as quickly as possible. On the other hand, it is imperative that good technologies such as storage systems are safe, reliable and efficient. To do this, regulatory frameworks and technical infrastructure including standards are required. This ensures these systems keep people safe, they are fit for purpose and encourage competition and market growth.

This report outlines the methodology and process used by Standards Australia to develop a Roadmap for Energy Storage Standards in Australia. The report identifies the important role for standards in supporting economic growth and allowing innovations such as storage systems to flourish. This is critical for the ongoing development of infrastructure in Australia. The report also highlights Standards Australia’s role in the Australian economy, as an independent facilitator for standards development.

The report and the Roadmap were made possible with the generous support of the COAG Energy Council, in addition to the excellent contributions of a range of Australian stakeholders that have an interest in energy storage. Standards Australia remains proud to have facilitated the development of the Roadmap for Energy Storage Standards.
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Executive Summary

This report provides a roadmap for energy storage standards in Australia (Roadmap). The actions identified as part of the Roadmap are designed to support standardisation efforts in electrical energy storage.

This report was produced following a series of discussion papers, stakeholder engagement activities and a forum held in August 2016. This enabled industry, consumer and government stakeholders to identify priority areas of work and the potential path towards establishing standards for electrical energy storage systems.

Standards Australia facilitated the process to develop the Roadmap between May 2016 and September 2016. The work was designed to support the strategic adoption of standards in Australia as storage systems become a more prominent feature of residential electrical installations.

The Council of Australian Governments (COAG) Energy Council, as a supporter of this work, expressed the need for a robust regulatory framework for electrical energy storage systems, so that consumers can benefit from these new technologies and associated services and that any associated risks can be mitigated.

Summary of Insights

- Standards that support the roll-out of electrical energy storage in Australia must initially focus on the installation of systems, product safety and performance standards.
- Alignment and stronger engagement with the International Electrotechnical Commission (IEC) committee structures is recommended to leverage existing knowledge bases and accelerate numbers of compliant products.
- Recycling rules and guidelines should be developed by industry bodies such as the Australian Battery Recycling Initiative (ABRI) and the Clean Energy Council (CEC).
- Handling and transport rules and guidance should be incorporated into existing documents, rather than new standards.
- Standards Australia documents should remain independent of training initiatives. It is the responsibility of other industry organisations to develop and endorse training packages. However, organisations such as the Clean Energy Council (CEC) and the Australian Energy Storage Council can provide accreditation to those who undertake specific training packages through a Registered Training Organisation (RTO).
Background

Energy storage systems are rapidly being deployed in Australia within an ever-changing landscape of market entrants and industry players. The COAG Energy Council identified a need for energy storage standards to cover the increasingly diverse range of energy storage technologies, and thus sought to work with Standards Australia to develop the Roadmap for Energy Storage Standards. The Roadmap identifies standards that are needed to facilitate the safe installation, connection, maintenance, operation and disposal of batteries. Standards provide a common language for users, suppliers, manufacturers, installers, testers, government and other stakeholders to achieve acceptable safety outcomes and support market development, and it is with this in mind that the Roadmap has been developed.

The focus of the Roadmap is grid integrated and stand-alone storage systems installed at the small-scale commercial and residential level. Some of the outcomes of this Roadmap may also be relevant to grid-scale installations but the size and complexity of these systems also present different challenges that are not addressed in the Roadmap.
Methodology to Consultations

The methodology employed to provide the strategic input into the Roadmap comprised three separate phases, each building on the information gathered in the previous phase. Two consultation papers were released and a stakeholder/industry forum was hosted by Standards Australia.

Phase 1 – Consultation paper one – May 2016
Consultation paper one sought to gather initial feedback, identify stakeholders and initiate discussion via a specific set of questions. The consultation paper was framed around the following topic areas:

1. Safety and Installation
2. Product Standards
3. Grid Connection
4. Recycling, Handling and Transport
5. Training

An additional consideration in the first consultation paper was international participation on IEC TC 120 (Electrical Energy Storage Systems) and also IEC TC 21 (Secondary Cells and Batteries).

Further detail on the first consultation paper is provided in “Appendix A – Consultation Methodology” on page 20.

Phase 2 – Consultation paper two – July 2016
Consultation paper two summarised the responses to the first paper, identified priorities and proposed next steps. The second consultation paper was used to confirm consensus on priorities and initiate dialogue with stakeholders, with the aim of developing a clear scope for any Standards Australia documents identified as urgent.

Building on the feedback received from the first consultation paper, the second paper highlighted topics which emerged as priorities in the previous round. The aim was broadly to address the following questions:

1) What are the areas in which standards documents are appropriate or needed to support the rollout of energy storage?
2) What are the top 2–3 priorities for documents in the coming year?
3) What should the committee structure look like for this work?
4) Should Australia be active in international standardisation work on this topic?

Further detail on the second consultation paper is provided in “Appendix A – Consultation Methodology” on page 20.
Phase 3 – Industry forum – August 2016

The forum was held to round-out stakeholder consultation on standardisation efforts for energy storage systems. The stakeholders present at the forum represented a cross section of views, and included organisations representing industry, manufacturers, consumer groups, research bodies, state electrical safety regulators, networks, electrical contractors and other interested parties. Presentations were given by Standards Australia (Jessica Curtis), Commonwealth Department of the Environment and Energy (Jessica Lane), CSIRO (Tony Hollencamp), IEC TC 120 Australian delegate (Peter Seebacher), Ergon Energy/Clean Energy Council (Michelle Taylor/Sandy Atkins), EL-054 committee members and a battery manufacturer (George Wilkenfeld, Steven Humphries, Andrew Reid).

Further detail on the industry forum is provided in “Appendix A – Consultation Methodology” on page 20.
Responses to Consultation Papers and Industry Forum

The consultation phases provided an opportunity for a cross-section of stakeholders to express their views regarding the need for standards to support the roll-out of energy storage systems in Australia. Stakeholders included electricity retailers, network operators, manufacturers, electrical contractors, state-based electrical safety regulators, consultants, the energy market operator (AEMO) and market commission (AEMC), consumer groups, researchers, energy consultants, in addition to a number of industry associations such as the Australian Battery Industry Association, the Australian Energy Council, Australian Industry Group, the Clean Energy Council, the Consumers Federation of Australia, Engineers Australia and others.

Storage capacity, size and technology
Questions around scope were raised by stakeholders, particularly regarding the upper and lower limits of capacity of the storage systems to be covered, the use of hybrid systems, and alignment with other standards. The classification of technologies that were identified in the consultation papers were seen to be mostly correct, although subsets could be introduced, if required. Standards for lithium-ion batteries were identified as a high priority in terms of the technologies by network operators. Stakeholders also indicated that decisions on scope, size and capacity should be made by the relevant committee. The scope of any documents developed should include on and off grid battery systems (i.e. secondary batteries). ‘Flow’ batteries were also identified as an emerging technology and thus engagement with international efforts currently in-train under IEC TC 120 (Electrical energy storage systems) was also recommended by a network operator.

Installation
During the consultation phases, standards for the installation of the systems were continually identified as critical. Many stakeholders expressed interest in contributing to the ongoing development of AS/NZS 5139, *Installation and safety requirements of battery storage systems*, providing technical insights in their submissions, while manufacturing interests expressed the need to align with international efforts and other existing Australian Standards. Broader engagement regarding the development of this standard could occur through the sharing of committee drafts pilot, run by Standards Australia. An industry body and network operator noted that installation requirements are still outstanding for larger storage systems which are outside the scope of AS/NZS 5139. There was wide acknowledgment that the Roadmap should focus on smaller systems, i.e. the residential market.

The need to amend to AS/NZS 5139 upon publication, due to the speed of the changes within the market place was highlighted. The Australian Building Codes Board expressed interest to participate on the responsible committee (EL-042), depending on the agreed scope of work, due to energy storage systems often being located inside or directly adjacent to residential dwellings.

It was noted that labelling requirements for safety constitute a component of the current AS/NZS 5139 draft document, with basic marking requirements to be

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1 The classification of technology as presented in the discussion papers were: lead acid, lithium-ion, nickel-based, flow, and sodium-ion.
2 The sharing of committee drafts pilot is a program run by Standards Australia, whereby individuals who are members of industry associations/nominating organisations but are not themselves sitting as a member of a Standards Australia technical committee, can have access to milestone drafts of standards during development/revision.
included in product standards, such as model, make, chemical composition and capacity rating.

**Products**

Safety and the labelling/marking of storage systems were critical points identified during the consultation, for both installation (covered under AS/NZS 5139) and the storage systems themselves. This appears to be the largest standardisation gap. State-based electrical regulators were strong on this point. The diversity of products means that international harmonisation would be highly beneficial. In addition, local battery manufacturing expertise is limited, thus underlining the need to harmonise. If international product standards are developed, a key challenge for Australia will be influencing such documents. However, Australian adoption of international standards would ensure that Australian requirements are consistent with developments in international markets. Australian engagement in developing international standards would need broad knowledge of the Australian market and local conditions, rather than specialist expertise on battery systems.

There was much discussion on the need for performance standards for products especially from manufacturing and supplier interests, and stakeholders noted that international leadership should also be followed on this front, again, with strong Australian input. Performance standards could set minimum requirements for the way an energy storage system would perform, addressing issues such as efficacy, efficiency and lifespan.

Operational control standards were also raised as an important component by a network operator. However, the priority for most stakeholders was to ensure the products themselves were safe. Thus product safety standards and marking requirements are the priority, with performance standards and operational control standards noted as a secondary priority.

Electro-magnetic compatibility (EMC) and environmental issues were identified as the next issues of priority for energy storage products by specialists in these fields. However, it was stakeholders who suggested minimum safety measures should first be defined, to then enable the evolution of the market to resolve other such issues. Innovative products that meet minimum safety requirements should be encouraged.

At a higher level, calls were received from stakeholders including an electricity retailer for standards to be as technology neutral as possible, focusing on performance outcomes. When required, technology specific rules as “deemed to comply” solutions could be included, however they should be written as generic minimum requirements.

**Grid connection**

The importance of the release of the revised edition of AS/NZS 4777.1:2016, *Grid connection of energy systems via inverters – Part 1: Installation requirements*, was expressed a number of times. AS/NZS 4777.1 provides rules for the safe installation of grid connected inverters. The inverter is the most critical piece of equipment supporting the link between energy storage systems and the grid. Some stakeholders, particularly those involved in the development of AS/NZS 4777.1, expressed the continued need for this standard to evolve as smarter and more enabled storage devices emerge in the market.

There were mixed views on developing guidelines for demand management outside the AS/NZS 4755 framework, *Demand response capabilities and supporting technologies for electrical products*, (i.e. for products without demand response enabled device [DRED] connections). Stakeholders close to the development of the AS/NZS 4755 series
expressed strong support for this framework, noting that its strengths lie in its simplicity as a communications protocol agnostic framework, and not precluding the use of more sophisticated demand response capability.

Others, somewhat less familiar with the AS/NZS 4755 series, expressed a view that it does not provide for non-physical connection technology such as wireless or cloud-based demand management. The mixed views and calls for potential alternatives to the AS/NZS 4755 framework, implies that there may be some level of confusion on this standard, with an education program suggested as a path forward. This could be done via a roadshow of information sessions to be run in major capital cities. The roadshow may have involvement from Standards Australia. One option could be for Standards Australia to administer the roadshow, however such a program would require resourcing and the support of stakeholders. The program could include half-day sessions including presentations about the AS/NZS 4755 series from key EL-054 personnel accompanied by an open Q & A session.

Grid connection requirements are important, and stakeholders specialising in power quality expressed the need for clear delineation between these and network operation and management needs. Further feedback from these same stakeholders was also received regarding grid connection requirements, noting that these should be informed by the Standards Australia committee EL-034-05 which mirrors IEC SC 8A (Grid integration of renewable energy generation). This would enable the interaction of storage systems and other renewable sources and their impacts on the functionality of the grid to be effectively managed. Thus, participation on IEC SC 8A, via the mirror committee EL-034-05 was identified as important.

Handling, transport and recycling
During the initial stage of consultations, handling, transport and recycling requirements for storage systems were identified for inclusion in the relevant existing standards, although some did advocate for a separate handbook on recycling.

Recycling of battery storage systems was noted on a number of occasions as an important consideration, but direct and specific standardisation efforts for battery storage systems were not generally supported. A recycling focused company suggested there is a current lack of industry-agreed, best-practice methods for recycling. As the consultations progressed, stakeholder views converged toward support for the work on industry guidelines for recycling of storage systems currently being led by groups like Australian Battery Recycling Initiative (ABRI) and the Clean Energy Council (CEC).


Stakeholders considered that while guidance in this area is important, and an appropriate Standards Australia document could be developed in the medium to longer term, this would depend on uptake of industry-developed guidelines and industry consensus on the need for an Australian Standard. AS/NZS 5139 will provide some information on recycling of battery systems.

There was support for transport and handling issues to be addressed using existing committee structures and documents, rather than new stand-alone documents. This then would be addressed by Standards Australia technical committee CH-009 (Safe handling of chemicals), with which a liaison relationship with energy storage committees could be established.
Training
Stakeholders considered the CEC accreditation for battery installation, and endorsement of Registered Training Organisations (RTOs) to deliver battery installation training. It was noted that units of competency in battery installation, that are yet to be endorsed by the industry as a whole, are already being delivered by RTOs.

The feedback was that Standards Australia plays an important but indirect role in training and accreditation. Any standards that are produced should support independent training and accreditation programs, to facilitate rather than hinder efforts in the creation of nationally recognised training units.

At the time of writing, two new Units of Competency for the design, installation and maintenance of battery storage systems for grid connected photovoltaic systems are being reviewed by the Electrotechnology Industry Reference Committee and will be considered by the Australian Industry and Skills Committee.

Committee structure and international participation
Stakeholders identified existing committees with an interest in storage: EL-005 (Secondary batteries), EL-034-05 (Grid integration of renewable energy generation), EL-042 (Renewable energy power supply systems and equipment), EL-054 (Remote demand management of electrical products) and EL-061 (Electrical energy storage).

Stakeholders called for the clear delineation of committees’ scopes.

Stakeholders involved in the development of AS/NZS 5139 expressed concern regarding the increasing size of the subcommittee undertaking the development of this standard, raising issues of delay and risks to achieving consensus. A re-invigoration and possible reconstitution of EL-061 was suggested, with a view to transferring the maintenance of AS/NZS 5139 to the newly constituted EL-061 when the current development process is complete.

In the interests of alignment, stakeholders expressed the need to mirror the IEC division of technologies as far as practicable, “Figure 1 – Structure of Energy Storage Engagement”, below. There would need to be clear delineation between the terms of reference for each Australian committee. Thus, maintaining the existing committee structures is appropriate, although some committees would need to be re-invigorated.

Overall, international participation was identified as critical given Australia will become a net importer of energy storage products. Influencing international standards through participation in their development is vital, but the speed at which international documents are developed, may not align with market pace.
Figure 1 – Structure of Energy Storage Engagement
Roadmap

Calls from stakeholders for installation, product safety and performance standards were the dominant themes of the roadmapping exercise. Unsurprisingly, strong views were heard from electrical safety regulators, but also others on this issue. Stakeholder submissions and the forum crystallised agreement amongst stakeholders that international alignment and participation are critical. This was typically the view of manufacturers and suppliers seeking flexibility in the marketplace to offer variety and choice to consumers. Rules for recycling were identified as important, however, responsibility for documents on this should be handled by existing bodies such as ABRI and CEC. Handling and transport matters were raised, and stakeholders noted that any requirements should be addressed by existing committee structures and documents rather than new publications. Finally, stakeholders expressed the view that training requirements are not the remit of Standards Australia documents, and that the development of training standards are being sufficiently handled by other organisations. However, Standards Australia documents should not hinder training initiatives, and it is the role of the Australian Industry and Skills Committee to endorse units of competency that are delivered by RTOs. See “Figure 2 – Recurring themes”, below.

Figure 2 – Recurring themes
Action Plan

The action plan below provides a summary of the key priorities for future standardisation efforts in electrical energy storage systems. The conclusions reached in the roadmapping exercise were based on the responses received from stakeholders during each phase of consultation. The actions below highlight the topic areas that were raised repeatedly and which received strong support for efforts towards standardisation. Consensus among stakeholders when preparing standards is a key principle of the Standards Australia process.

The following responses are offered to the original questions posed throughout each consultation phase:

i. The following areas require standards to support the rollout of energy storage:
   1. Installation including labelling
   2. Product safety including marking
   3. Performance measurement
   4. Energy storage system operation (operational control)

ii. The two to three priority documents for the coming year are:
   1. Installation including labelling: AS/NZS 5139
   2. Product safety including marking
   3. Performance measurement of products

iii. The structure of the committees should mirror IEC committees as close as possible

iv. Australia’s participation in the current international efforts needs to continue, albeit to a greater level of engagement, specifically with IEC TC 120 (Electrical Energy Storage Systems) and IEC SC 8A (Grid integration and renewable energy integration). See “Figure 3 – Priorities” on page 16.

Notes:

1. No direct immediate Standards Australia action for recycling. Stakeholder feedback suggests recycling guidance to be led by groups such as the Australian Battery Recycling Initiative (ABRI) and the Clean Energy Council (CEC).

2. Handling and transport matters to be addressed by existing documentation and Standards Australia committees, with a liaison relationship to be established with EL-061.

3. No direct action from Standards Australia for training issues, however EL-061 to monitor and ensure standards are written so as not to inhibit existing training programs.
Safety of Installation
- Highest priority, with document in process: AS/NZS 5139, Installation and safety requirements of battery storage systems.

Product Standards
- Product safety (including marking) standards remain the highest priority and are currently lacking.
- Performance measurement is mid-to-high priority for certain stakeholders (consumer advocacy groups and government).
- Operational control standards gained moderate support from stakeholders.

Grid Connection
- Participation on IEC SC 8A was identified as important to ensure effective management of renewable energy sources and their connection to the grid.
- Demand response management (AS/NZS 4755 series) was identified as mid-to-high priority for certain stakeholders (networks, retailers, and battery manufacturers), with a specific need for education around this series.

Recycling
- Mid-to-high priority for some stakeholders, with industry bodies such as ABRI and CEC to lead initiatives.

Handling and Transport
- General consensus is that this is most appropriately handled by existing committee structures and documents.

Training
- Standards development of the above topics will support training, but no identified need for Standards Australia activity in this area.

International Participation
- Greater international participation was a common theme, especially as it relates to active participation on IEC TC 120 (Electrical Energy Storage Systems) and IEC SC 8A (Grid Integration of Renewable Energy Generation).
The consultation process indicated that the following Roadmap is recommended.

<table>
<thead>
<tr>
<th>Priority</th>
<th>Action</th>
<th>By Whom</th>
<th>Implementation period</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INSTALLATION</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underway</td>
<td>Engagement in development of AS/NZS 5139 via sharing of committee drafts pilot</td>
<td>Stakeholders to express interest via relevant industry associations/nominating organisations</td>
<td>2015 – publication (maintenance then to be transferred to EL-061)</td>
</tr>
<tr>
<td>Underway</td>
<td>Underwrite standards development process for proposed AS/NZS 5139</td>
<td>Standards Australia technical committee EL-042 and subcommittee (Safety of battery systems for use in inverter energy systems)</td>
<td>2015 – publication (pending consensus; publication expected Q1 FY 2016–2017, maintenance then to be transferred to EL-061)</td>
</tr>
<tr>
<td><strong>INTERNATIONAL PARTICIPATION</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underway</td>
<td>Reinvigorate EL-061 to mirror IE CTC 120</td>
<td>Standards Australia/stakeholders</td>
<td>Feb 2017 – Jun 2017</td>
</tr>
<tr>
<td><strong>COMMITTEE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Undertake reconstitution of EL-061</td>
<td>Standards Australia/stakeholders</td>
<td>Feb 2017 – Feb 2017</td>
</tr>
<tr>
<td>1</td>
<td>Delineate scopes between committees (EL-061, EL-005, EL-034-05, EL-042 and EL-054)</td>
<td>Standards Australia</td>
<td>Feb 2017 – May 2017</td>
</tr>
<tr>
<td><strong>PRODUCTS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Development of product safety standards including marking</td>
<td>Stakeholders to submit proposal</td>
<td>Round 14 (Feb – Mar 2017)</td>
</tr>
<tr>
<td>2</td>
<td>Development of performance standards</td>
<td>Stakeholders to submit proposal</td>
<td>Round 14 (Feb – Mar 2017)</td>
</tr>
<tr>
<td>3</td>
<td>Development of operational control standards</td>
<td>Stakeholders to submit proposal</td>
<td>Round 15 (Aug – Sep 2017)</td>
</tr>
<tr>
<td><strong>GRID-CONNECTION</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underway</td>
<td>Participate in EL-034-05 which mirrors IEC SC 8A (Grid integration of renewable energy generation)</td>
<td>Stakeholders to express interest</td>
<td>Feb 2017 – ongoing</td>
</tr>
<tr>
<td>2</td>
<td>Education program for AS/NZS 4755, in particular Part 3.5</td>
<td>Standards Australia may be in a position to co-resource this initiative with industry/government</td>
<td>February 2017</td>
</tr>
<tr>
<td><strong>RECYCLING</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>No direct action at present. ABRI and CEC and industry guidelines</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td><strong>HANDLING AND TRANSPORT</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4</td>
<td>Liaison with CH-009 to be created with EL-061</td>
<td>EL-061/CH-009</td>
<td>February 2017</td>
</tr>
<tr>
<td><strong>TRAINING</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>AS/NZS 5139 may assist. EL-061 to monitor</td>
<td>EL-061</td>
<td>February 2017</td>
</tr>
</tbody>
</table>

*See next page for footnotes.*
Footnotes to Roadmap

a Standards Australia has adopted the ISO definition of consensus, see Standardisation Guide 001: Preparing Standards (PDF).

b Standards Australia technical committees operate via participating nominating organisations. A selection of nominating organisation types can found in Standardisation Guide 001: Preparing Standards (PDF).

c Standards Australia technical committees from time-to-time are reconstituted, which will include reviewing the list of participating nominating organisations. There are many reasons for a technical committee to be reconstituted.

d A Standards Australia technical committee may undertake “mirroring” activities. Mirror committees monitor and/or participate in the work of one or more ISO or IEC committees. Further information is provided in Standardisation Guide 015: Australian Involvement In International Standardisation (PDF).

e All Standards Australia projects, whether revisions of existing documents or the development of new documents, require initial processing as proposals. Project proposals must contain a clear and specific scope of the project, must provide clear net benefits to the Australian community and must be accompanied by broad stakeholder support from relevant interest groups and stakeholders.

f Liaison relationships between Standards Australia technical committees can be established enabling high level periodic updates of project work, usually facilitated by common membership of the committees.

g The development of a product safety standard will involve a number of choices for the technical committee. The choices are to develop a local standard, or adopt (identically or with modifications) an international document, if such a document exists and is fit for purpose. The development of Standards Australia documents requires a consensus position from Government and industry stakeholders, at proposal, development and publication stages. The above available options correlate to a timeline, in most cases, ranging between six months to three years from proposal approval to publication, pending stakeholder consensus on the technical content of the document and the development option chosen.
Conclusion

The Roadmap for Energy Storage Standards was developed via an inclusive and consultative methodology which included input from interest groups representing government, industry, consumer, research and other key organisations.

Stakeholders examined the key questions posed during each successive consultation paper and at the final forum held in August 2016. The topics under consideration were: installation, international participation, committees, products, grid-connection, recycling, handing and transport and training.

Considering the outputs of the Roadmap, there is an opportunity for appropriate guidelines to be developed for training for battery installers, standards’ compliance, and recycling, handling and transport. Standards Australia plays only one part in the larger picture of rolling out energy storage in Australia.

The Roadmap comprises an action plan for the short and medium term, and also includes actions already underway. Standards defining rules for the installation and labelling of energy storage systems and rules for the safety, marking and performance of the products themselves are of particular interest to Australian stakeholders.

Standards Australia’s agenda and programs of work are driven by stakeholders and thus it is crucial that new proposals for the development of Australian Standards for energy storage products be championed by industry.

The Roadmap is an informative tool to help stakeholders navigate the future for electrical energy storage standards in Australia.
Appendix A – Consultation Methodology

This appendix provides further detail on the three phases of consultation during the Roadmapping exercise.

**Phase 1 – Consultation paper one – May 2016**

The first consultation paper was framed around a series of questions repeated below in *italics*.

**Scope and Technologies**

- Lead acid – well established standards
- Lithium ion – in need of relevant standards
- Nickel-based – well established standards
- Flow – in need of relevant standards
- Sodium ion – in need of relevant standards

*Are there any stationary technologies currently or soon to be deployed which are not listed in the consultation paper?*

*Is the list of technologies [above] an accurate summary of the state of standards for each technology?*

*If there is a subject area where it is identified that a technology neutral document is impossible, thus necessitating technology specific documents, which technologies should be prioritised?*

**Installation**

Currently in development is AS/NZS 5139 covering safety of installation aspects of storage systems for use with inverters.

*There will be a public consultation action specific to AS/NZS 5139 in the coming months. For the response to this consultation paper, Standards Australia asks stakeholders to identify if there are any other topic areas under safety of installation not currently addressed by AS/NZS 5139, in order to consider the need for other documents.*

**Product standards**

*Is performance measurement standardisation possible? If so does this need to be technology specific, or can a document be drafted which applies across all types?*

*How should environmental condition resilience be addressed in standards documents? Can this be technology neutral?*

*Is there an architecture for performance standards that would be beneficial to industry and regulators, allowing for future changes/new standards to be drafted in an orderly and strategic manner?*

*Are there any other topic areas which can be addressed in the short-term related to product standards?*

**Grid connection**

The grid connection of solar photo-voltaic (PV) and energy storage at a small scale is enabled through the AS/NZS 4777 series. Recent updates to these standards have occurred in 2015/2016 and take account of the new developments, particularly in relation to energy storage systems connecting to the grid. This series covers both the inverter product (Part 2), and installation (Part 1) safety requirements.

*Despite the publication of AS/NZS 4755.3.5 which covers demand response*
capabilities for electrical energy storage systems connected to Demand Response Enabling Devices (DREDs) and AS/NZS 4777.1, which covers safety aspects of installation of grid connected inverter systems, rules controlling the impact of renewable energy sources on the overall functioning of the grid, due to their variability and predictability, remain outstanding.

A new technical specification is yet to be scoped. Would it be possible to develop an entirely performance based technical specification covering all new and potential connection technologies. If not, what technology types (in addition to DRED devices covered by AS/NZS 4755.3.5) would need to be covered in separate documents?

What other documents and standards should be referenced in a Handbook on grid connection of battery storage systems?

**Recycling, handling and transport**

Where does this subject area fall in the broader priority list of needed document development to support battery storage? Is there a specific topic within it of particular urgency?

Is the standards process the appropriate method to consider handling and transport of battery technologies?

If so, what are the highest priority gaps?

With best practice still being developed, how can Standards Australia best support the safe recycling of storage technologies?

Would a handbook similar to that proposed in the “Grid Connection” subject area (above) be of assistance? If so, would Standards Australia be the appropriate organisation to facilitate the development of such a document?

**Training**

How can Australian Standards support the safe installation of storage, in terms of training?

Would it be beneficial to industry for Standards Australia to be involved in this process? If so, how would you envision this?

**International participation**

Should Standards Australia not move ahead with any of the specific documents/topic areas addressed previously due to this work, and wait on international documents to be released and thus adopted/adapted?
Phase 2 – Consultation paper two – July 2016

The second consultation paper summarised the responses received on the first consultation paper, but also, sought to narrow the focus and target areas of priority. This initial summary of responses is presented below.

Scope, capacity and technologies
Following feedback from the first consultation paper the scope was refined: no specific kilowatt hour limits should be imposed on the types of installations being covered. The feedback received indicated these decisions should be taken by the relevant technical committee. The Roadmap should consider both grid connected installations and off-grid storage installations.

The Roadmap was contextualised by energy storage systems as a whole; whether this translates to individual component standards, or larger system standards is a question for the technical committees.

The list of battery technologies and status of corresponding standards were confirmed by stakeholders:

- Lead acid – well established standards
- Lithium ion – in need of relevant standards
- Nickel-based – well established standards
- Flow – in need of relevant standards
- Sodium ion – in need of relevant standards

Stakeholders also suggested that additional technologies be considered including subdivisions of the listed types other than electro-chemical (fuel cell, flywheel etc). However the general consensus was that lithium-ion batteries were the highest priority.

Installation
There was strong support for AS/NZS 5139 to be the highest priority document.

Products
The initial feedback indicated a need for both performance and safety standards for products. Both were identified as important with no clear direction as to which was more important.

Grid connection
The feedback received indicated that network operation and management was considered out of scope for standards on storage systems, however it was noted that engagement with IEC SC 8A (Grid integration and renewable energy generation) and eventual adoption of these standards would provide needed technical infrastructure to support the interface between the energy storage system and the grid.

A range of views were expressed in regard to demand management, and specifically the efficacy and flexibility of the newly released AS/NZS 4755.3.5, covering the demand response grid-connected storage systems.

The proposal of a handbook to support the various existing and newly proposed technologies for demand management did not find overwhelming support.

Recycling, handling and transport
There was moderate support for recycling standards. It was noted that technical committees should remain aware of this aspect when drafting standards to ensure recycling efforts are not unknowingly hindered. The first consultation paper elicited feedback that identified the Australian Battery Recycling Initiative and the Australian and New Zealand Recycling Platform as key the stakeholders in this process.
Responses suggested that existing documents already covered rules and requirements for the handling and transport of dangerous goods such as the Australian Dangerous Goods Code and the United Nations Recommendations on the Transport of Dangerous Goods Model Regulations. CH-009 (Safe handling of chemicals) is the Standards Australia technical committee responsible for handling and transport of chemicals including dangerous goods. It would be prudent to set-up a liaison with this committee.

Training
The feedback received indicated that training regarding storage systems is best carried out on the basis of AS/NZS 5139 and other future documents, rather than a stand-alone document at present.

Committee structure
The four committees associated with this work are below. Stakeholders expressed that an exercise be undertaken to clearly delineate scopes between each of these committees.

Figure 4 – Relevant committees

<table>
<thead>
<tr>
<th>Committee</th>
<th>Description</th>
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| EL-042: Renewable Energy Power Supply Systems | - Very active with a broad scope  
- Current projects and publications include AS/NZS 4777 series and AS/NZS 5139  
- AS/NZS 5139 will remain in scope until publication and may move to EL-061 for future maintenance  
- Possible future scope (as related to energy storage systems): Inverters and related concerns |
| EL-061: Electrical Energy Storage | - Active, but in need of reconstitution  
- Mirror to IEC TC 120  
- Possible scope: Coordination of work, product standards |
| EL-005: Secondary Batteries | - Currently inactive, will likely be reactivated  
- Previous published standards had a broad scope across battery types, including some relevant to this process.  
- Possible future scope: Secondary batteries not included in household/building storage systems. This could include automotive batteries and others.  
- Management of standards relevant to household/building electrical energy storage systems could be moved to EL-061. |
| EL-054: Remote Demand Management of Electrical Products | - Active  
- Currently working on the AS/NZS 4755 series  
- Possible future scope (as related to energy storage systems): Update of remote demand management technologies in batteries. |
| EL-034-05: Grid Integration of Renewable Energy Generation | - Active, and in initial stages of engagement  
- Mirroring IEC SC 8A  
- Look to adopting standards at a future date |

International participation
Strong support was received for active participation on IEC TC 120, to stay abreast of developments at the international level. This is to ensure Australian perspectives are included in any documents developed, which would allow the smooth uptake (adoption) in the Australian context.
Phase 3 – Industry forum – August 2016

A total of 55 stakeholders registered to attend the event. A list of registered organisations that were represented is shown below.

AGL Energy
Alternative Technology Association
Ampcontrol
AusEng
Ausgrid
Australian and New Zealand Recycling Platform (ANZRP)
Australian Battery Industry Association (ABIA)
Australian Energy Council
Australian Energy Market Commission (AEMC)
Australian Energy Market Operator (AEMO)
Australian Energy Storage Alliance
Australian Industry Group
B&R Enclosures
Caldwell & Ass
Century Yuasa Batteries
Clean Energy Council
ClimateWorks Australia
Commonwealth Department of the Environment and Energy
Consumers Federation of Australia (CFA)
CSIRO
DNV GL
Eclectic Engineering
Energex
Energy Consumers Australia
Energy Safe Victoria
Engineers Australia
Enphase Energy
Ergon Energy
Ethnic Communities’ Council of NSW
Evergen
Facility Management Association of Australia (FMAA)
George Wilkenfeld & Associates Pty Ltd
Goodwe Australia
GT Power Electronic Consulting
Master Electricians Australia
National Electrical and Communications Association
Rheem Australia Pty Ltd
Seed Advisory Pty Ltd
Solar Australia
Sydney Law School
Tegart Consulting
Tridonic Australia Pty Ltd

Like the second consultation paper, the following questions framed the forum:

1) What are the areas in which standards documents are appropriate or needed to support the rollout of energy storage?
2) What are the top 2–3 priorities for documents in the coming year?
3) What should the committee structure look like for this work?
4) Should Australia be active in the international standardisation work on this topic?

The process for consultations was explained to stakeholders in “Figure 5 – Process” on page 25.
The topic areas were also presented as per "Figure 3 – Priorities" on page 16.

The speakers gave presentations covering the following topics:

- Jessica Curtis – Introduction, Agenda for forum, Standards Australia, Consultation Process, Background, Purpose of forum, Topic Areas.
- Jessica Lane – Roadmap context and COAG Energy Council
- Tony Hollencamp – CSIRO/CEC research and recommendations
- Peter Seebacher – IEC TC 120 engagement and work program
- Michelle Taylor/Sandy Atkins – AS/NZS 5139 progress
- Jessica Curtis – Recycling handling and transport
- Steven Humphries/George Wilkenfeld/Andrew Reid – Remote demand management and battery manufacturer perspectives
- Jessica Curtis – Product standards
- Jon Avery/Jessica Curtis – Next steps

The formal consultations were concluded at the close of the forum.
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More Information

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Jonathan has extensive operational experience in standardisation, having spent 4 years in the standards development team, both leading a team of project managers and managing the delivery of his own projects, including AS/NZS 3000 Wiring Rules. Jonathan has represented Australian interests at IEC and ISO governance meetings in Europe and South-East Asia respectively.

Jonathan previously served in multiple project manager/engineering roles in Australia, Europe and sub-Saharan Africa delivering civil infrastructure projects in telecommunications, mining and public works.

Jonathan holds a Bachelor of Engineering, a Bachelor of Science and a Masters of International Relations and is currently based in Sydney.

About Standards Australia

Founded in 1922, Standards Australia is an independent, not-for-profit organisation, recognised by the Commonwealth Government as the peak non-government Standards development body in Australia. It is charged by the Commonwealth Government to meet Australia’s need for contemporary, internationally-aligned Standards and related services. The work of Standards Australia enhances the nation’s economic efficiency, international competitiveness and contributes to community demand for a safe and sustainable environment.