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Stakeholder views on the potential role of community scale storage in Australia

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Executive Summary

The Community Energy Model (CEM) project's social research component aimed to understand stakeholder perspectives of the barriers and opportunities to community-scale energy storage. We drew on an interdisciplinary framework of social acceptance to generate new insights into this little known question. The methodology involved a series of qualitative research activities which took place between July 2019 and May 2020. We spoke with 21 energy sector professionals (in the NEM) about their views on community batteries of 100kW - 5MW. We also spoke with 57 householders across 8 different locations in six States to explore their views on the concept of a shared battery. This research is the first attempt to consider the views of energy professionals and householders about community batteries side by side in this way.

Participants believed community scale storage could provide a wide range of benefits across economic, technical, social and environmental arenas. Indeed, many participants highlighted that the advantages of community batteries is that it provides benefits across multiple dimensions. While several participants highlighted multiple benefits, particular participants emphasised certain benefits (that relate to their position in the energy system). Importantly, there was no significant disagreement between participants on the benefits. However, the point that different groups emphasise different benefits highlight the inherently political nature of model selection - any selection of models will reflect a particular set of values and may come at the expense of another group in the energy system. Whether or not the proposed storage is actually viewed as a "community battery", will depend on a range of considerations including how householders are engaged in the design and how the benefits are distributed. As such, any proposed regulatory changes must take this into account and provide a pathway to explore different models so as to reveal which models are most likely to benefit all energy consumers. It also reveals the potential for some groups to resist regulatory or policy changes that enable benefits to be unlocked to new entrants.

Energy technology uptake generally also relies on its appeal to the public. This report sets out the range of benefits and concerns raised by people across a range of socio-economic contexts in rural and urban Australia. Analysis reveals some differences in expectations between the general public and energy sector professionals about future models of community batteries - centred around questions of ownership, in which the general public envision a minimal role for large retailers and networks. This research affirms that householders are not simply concerned about energy affordability but have a range of values and expectations for future energy systems. Community batteries are generally in line with values of sustainability and energy sovereignty, so long as the entity delivering the community battery can demonstrate these same

values. Enthusiasm about community storage does represent an opportunity for householders to re-engage with energy systems so long as concerns about potential environmental impacts of battery and governance of the battery can be satisfied.

While all participants were open to the idea of local, community scale storage in the energy system, all raised caveats, concerns or challenges that would need to be overcome for it to be feasible. None of these were deemed insurmountable. Concerns/caveats/ challenges can be divided into two categories: Practical challenges, which often relate to the material-technical aspects of battery installation/maintenance (some aspects of which require a regulatory response) and governance and regulatory issues (perceived and real), which relate to ways in which community batteries may require changes to the current institutional frameworks to be viable.

A clear finding out of this research was that a range of models are possible, all with different value propositions, and different regulatory barriers. Many participants also raised the point that regulation of community batteries needs to be adaptable and flexible. The grid is increasingly complex and heterogeneous - with changing technical needs depending on different sources of grid vulnerability (e.g. related to being edge of grid, or high penetration PV). In addition, communities will have different goals in terms of they want the battery to achieve and are also differentiated in terms of their composition of solar owners and non-solar owners. Finally, local and state governments have their own carbon reduction objectives and are also highly differentiated in terms of their strategies around storage investments.

There was strong consensus among participants about the value of trials and demonstrations. Participants argued that demonstrations would enable the sector to understand the different financial and non-financial values storage models could bring as well as the different options for community participation. Regulatory sandboxes were recommended as a way to enable these trials.

This report also briefly sketches out the policy implications of our analysis, many of which are exploratory and intended to open up the discussion about pathways forward.

Key findings

- Community batteries hold broad appeal for both energy sector professionals and the general community, for different reasons - some of which overlap.
- Community batteries can be designed to achieve different aims, and as such model design and ownership has implications for who benefits.
- Community batteries face a number of practical and regulatory barriers, although some of these are overstated and relate more to entrenched ways of doing, rather than formal rules.
- Energy sector participants welcome investment in trials and demonstrations of different models to explore their viability in 'real world' settings.
- Householders are likely to be sceptical of community battery models that cannot clearly demonstrate that they will genuinely benefit the local community. A strong preference was shown for models that are simple to interact with, owned by local government and that are run as a not for profit entity.

Acknowledgements

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1 Introduction

This report explores a relatively unknown question - what do people across the energy system think about local energy storage and community participation in this technology? Recent research into Australian attitudes to new energy technologies has found that households have an interest in battery storage in the home as a way to improve reliability. Early adopters and trial participants of battery storage have tended to be interested in helping the grid and improving electricity reliability for others – although concerns remain surrounding perceptions of unfair trading terms between households and energy companies [9].

If the terms of engagement are deemed fair by householders, researchers have found the idea (and practice) of sharing excess distributed energy with others to be attractive to early adopter households. This finding has significant implications for developing workable models of decentralised renewable generation. Community storage presents a technological opportunity for PV owners to store or share their excess production with others and for non-PV owners to participate in renewable energy. As such it is important to understand whether PV and non-PV householders or businesses would be interested in participation in community batteries and under what terms.

While householder views have not been thoroughly explored, we also do not have a clear idea about how the energy sector views community batteries and different potential models. This is important because technical experts, policymakers and special interest groups collectively influence what we see as technologically possible.

To understand whether or not community batteries may become a technology in our energy system we need to understand what both the sector and householders consider to be key benefits and risks [2]. This will help us identify points of potential tension which may result in the technology ultimately not becoming part of the energy system. In this way, our research sits within a 'responsible innovation' framework in which we explore what different people counts as a "useful" technology. To be successful, community batteries models must either fit within the existing electricity system, or, if it cannot thrive this way, it must 'stretch and transform' it [5]. Our research provides a critically important overview of the types of benefits that will accrue to different groups under different community battery business models

Our methodology for this research is informed by an overarching interest in involving energy users in decision-making and planning associated with the energy transition. A key requirement

for a timely and just energy transition is for citizens to be involved in the design and planning of new energy technologies [10]. We specifically asked all participants how householders could participate in a shared battery. While we originally explored this in quite limited terms - where householders participate either via their bill or as investors, householders articulated concerns about energy governance generally and raised the need to be involved early in discussions of what models should receive public investment.

We employed qualitative research methods which involved running interviews and focus groups with 21 energy sector participants in the NEM and 60 householders across 8 locations in rural and urban Australia. The format was a loosely structured discussion with 6 or so discussion questions covering benefits, community involvement and risks/concerns.

This research has received approval from the ANU's Human Ethics Committee (protocol number 2019/241). This report has been reviewed by all research participants and all names used throughout the report are pseudonyms to protect confidentiality.

1.1 Energy sector professionals' characteristics

In total, we spoke to 21 professionals working within the electricity sector about their views on community involvement in community batteries. Nine of the interactions were with individuals among our project partners. The remainder participated in two focus groups in Sydney and Melbourne. The 21 participants represented the following sectors:

- Local, State and Federal government (4 participants)
- Networks (DNSPs) (8 participants)
- Retail sector/consultancy (4 participants)
- Non-government, mostly in the consumer advocacy area (5 participants)

Five of our participants had worked directly on implementing energy projects with local communities. Nine of the energy sector participants were our project partners (which includes two community energy groups and one community energy retailers). We spoke with one participant two times (interview and focus group). See Appendix 2 for the full list of participants and their corresponding participant code. The gender breakdown of participants was 6 women and 15 men.

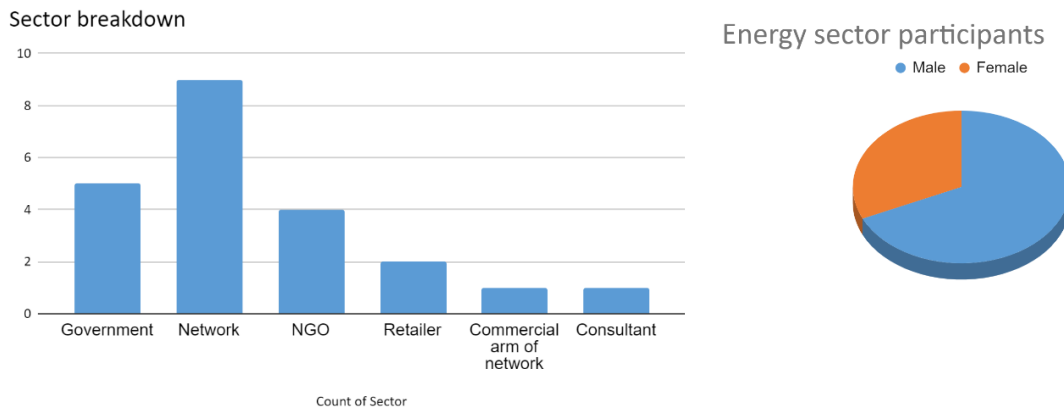


Figure 1: Energy sector participant breakdown

Non project-partner participants were recruited primarily through our project team’s network of contacts and were selected based on their specific roles within their organisation - i.e. they held positions working on the areas relating to community storage generally such as network innovation, distributed energy policy, etc.

1.2 Household demographic characteristics

In total we spoke with 57 community members in eight locations in rural and urban areas:

1. Canberra (inner suburban)
2. Cootamundra (regional NSW)
3. Adelaide (suburban)
4. Melbourne (suburban)
5. Narooma (regional NSW)
6. Noosa (regional QLD)
7. Sydney (suburban)
8. Broome (regional WA)

Given this was an exploratory study, we aimed for breadth of experience and diversity across the Australian community. We used ABS community profile data to understand socio-economic characteristics and AEC data to look at voting patterns in each location. We aimed to reach people across different political orientations with varying levels of education and income, but

could only control this to the extent that we targeted particular suburbs with recruitment. We targeted both rural and urban locations and PV and battery owners. We provided a \$50 Woolworths/Coles voucher to participants to reduce the potential for only topic enthusiasts to take part in focus groups. Participants were recruited via online (community Facebook groups and local council emails) and poster-fliers located in community spaces and cafes etc. Some were recruited via word of mouth of other participants. The five participants in Broome were Indigenous community members from different parts of the Kimberley and were recruited by Nulungu Institute of Notre Dame University.

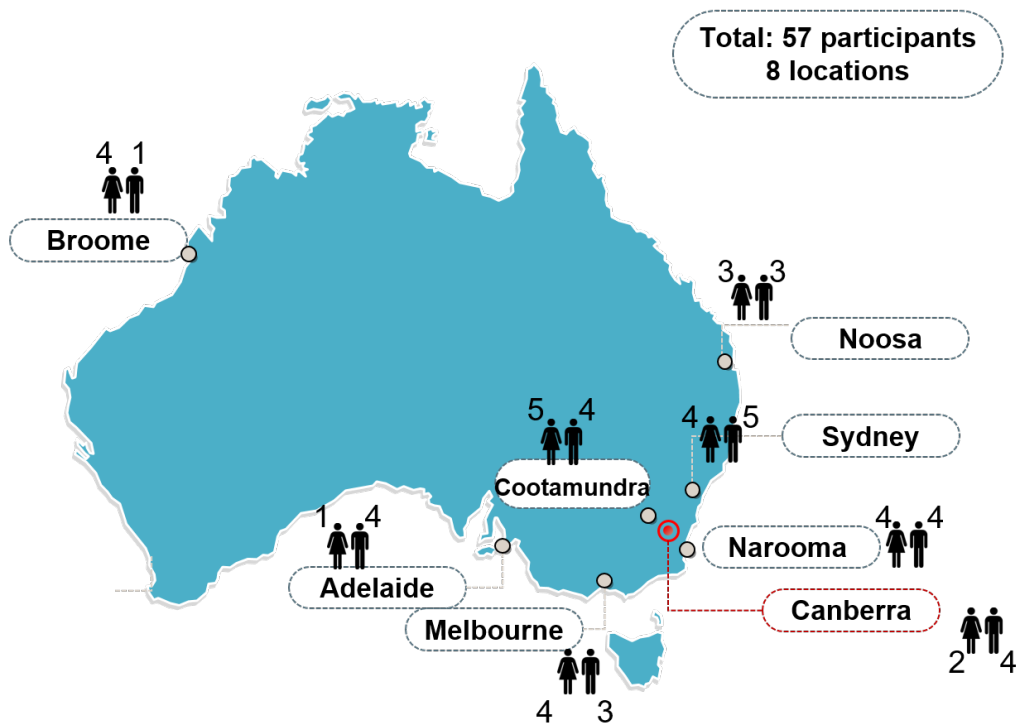


Figure 2: Community focus groups

Participants were evenly split along gender lines but overall participants tended to be on the older side (only 11% were in the 18-34 age bracket). 31% had Secondary and Vocational school education, 2 participants held a diploma while the remainder had a Bachelor or Post-graduate qualification. 60% of participants owned their own renewable technology and 70% of participants were owner-occupiers. 16% lived in apartments or townhouses. As such, even while we did have representation from householders who were not living in detached houses,

our cohort tended to under represent apartment dwellers, young people and renters, which presents a limitation to the scope of work and analysis. For future research, new modes of recruitment could target these groups.

1.3 Report outline

This report is structured as follows. We begin with energy sector participants and their views of the community batteries, including benefits, concerns/caveats/challenges. The report then outlines the various business models discussed by energy sector participants, and overarching issues raised by participants that relate to possible future scenarios for community batteries. The next substantive section of the report covers householder views of local scale storage. We outline advantages and concerns that the community reported. We also consider how the different groups' views compared - where were the major points of overlap and of difference. Finally, we briefly outline several policy implications that emerge from these findings.

2 PART 1: Energy sector professionals views

2.1 Benefits of community batteries in our energy system

When we asked participants the question, “is there a role for community batteries in our energy system and if so, what role”, we received responses about a wide range of benefits across economic, technical, social and environmental arenas. In fact, many participants highlighted that the advantages of community batteries is that it can provide benefits across multiple dimensions. These are described below.

2.1.1 Economic

- Savings from avoided network investment costs
- Helping drive demand for batteries and bringing down the costs for future consumers
- Potential market design considerations
- Savings on energy bills for institutions like local councils or schools with positive flow-on effects to local economies
- In a scenario where it is jointly owned by small businesses, these businesses may be able to make savings during evening peaks in particular (e.g. restaurants and bars)

- In areas where there are reliability issues, improving the reliability of the network could decrease costs for existing businesses. One participant mentioned a case where improvements in reliability attracted new businesses to that (regional) location.
- Potential socio-economic benefit of addressing current inequity of access to Distributed Energy Resource (DER) benefits (renters, apartment dwellers etc).

2.1.2 Technical

- Providing a flexible asset in the energy transition, while uncertainty exists about which assets will do best across different locations in the network
- Providing voltage and frequency services to help stabilise the grid
- Providing charging stations for electric vehicles
- Helping solve local reliability issues
- Provides more capacity than VPPs because residential batteries prioritise self consumption and the density of VPP batteries tend to be low
- Maintenance and monitoring standards are likely to be higher than with residential batteries and VPPs ensuring greater efficiency of assets.
- Improve the resilience of the grid in times of natural disasters.

2.1.3 Social

- Increasing trust in the energy sector, not only where the battery is located but also across the nation
- Strengthening social connections within the community through ownership of a shared asset
- Potential socio-economic benefit of addressing current inequity of access to DER benefits (renters, apartment dwellers etc).

...and things like community batteries where you've got mums and dads using it, being actually physically, financially and emotionally invested in this is a great way of being able to tick all three potentially, especially when it can potentially augment or defer more expensive network investment, or investment further up the supply chain as well with new generation.

– Sachith, Consumer advocate

2.1.4 Environmental

- Helping meet emissions reductions targets through enabling greater renewable penetration in the local distribution system

2.2 Different perspectives across the energy sector

While several participants highlighted the multiple benefits to community batteries, particular participants emphasised certain benefits that relate to their position in the energy system. There was no significant disagreement between participants about the benefits listed above, although one participant (representing the regulatory sector), was not as convinced about the potential for community batteries to provide customers with as much control and choice as a residential battery. Other participants believed community batteries could provide all the services that residential batteries provide, but all depending on the design of the model (discussed further below).

2.2.1 Networks

Participants working for networks tended to focus on the potential for community batteries to solve local network problems. They highlighted the role that batteries can play in increasing the hosting capacity of the network in areas of the distribution network which have high volumes of distributed PV on residents homes.

... our ability to host renewable resources is quite – is restricted. There’s all sorts of technical complexity involved. Now, a lot of that complexity, batteries actually help you tremendously because you can end up applying it and using it as an instrument to balance load across the three phases of the distribution network. And, hey, that wasn’t thought about previously, but you can do that.

– Paul, Network

Importantly, however, even while the networks believe there is a value proposition for them to have community batteries in the distribution system, they were very open to the idea of allowing other actors in the energy system to access the other value streams that the battery can provide.

If you got to a point where you had sufficient, if you like, value in the network use cases, that almost sort of says I’ve got enough there, that actually this can be regarded as a network battery. But you don’t want to leave it at that because that’s always going to be suboptimal because there’s a lot of other things that you can layer on top of it which the networks can’t do.

– Paul, Network

Overall network participants were open to the idea of owning and maintaining the storage, particularly in a part of the network that is constrained. However, they also emphasised that they did not want to be “shoe-horned” into a position where they are always the owners of the battery.

2.2.2 Retailers

From a retailer perspective, the community battery provided some advantages that a virtual power plant (VPP) model could not provide, in particular, the large capacity of the community battery offers a greater ability to manage network capacity. VPPs are a form of aggregation, whereby several householders’ batteries can, together, provide a service to the network. VPPs require a large concentration of customers to sign up and have batteries installed to solve the network constraint, which is a challenging requirement for many network locations. One retailer participant put forward the idea that a retailer owned model may provide unique advantages of being able to aggregate the community battery with other customer owned DER and optimise

these assets collectively to meet the network needs. However, network participants also raised the point that networks may see third party claimed capacity as too uncertain to rely on for their concrete network upgrade plans.

2.2.3 Non-government, including community energy groups

Community energy groups in particular emphasised the value of community batteries in providing energy sovereignty, enabling microgrids and reducing greenhouse gas emissions. They also emphasised that current network charges present a significant barrier to the viability of community owned storage models.

... [our vision] is that we want to move into communities that can support themselves with energy, their own energy. Where they can share energy, they can share the benefits of the energy. We think this is totally feasible, we don't need to be relying, we're trying to minimise the amount of energy that comes from outside. We're not saying we want to step off the grid. The taxpayers already paid for the grid we'll make use of it, but we don't want to see over investment in the grid.

– Bridget, Community energy sector

Participants from the NGO sector also raised concerns about consumer protections and accountability for when the technology has faults, or issues during installation.

2.2.4 Government

State Government participants tended to have a broader perspective on the benefits of community storage compared with technical experts. For instance, participants from State Government emphasised the benefit of having storage at multiple scales, for redistribution of wealth to regional areas and for lowering carbon emissions. While, the energy sector in Australia tends to be dominated by neoclassical economic rationales for managing energy through market design, State Government participants in this research have raised other values they consider in program design, including regional development, grid resilience and meeting carbon reduction targets.

... looking at how you can provide security and reliability, you have to look at the gamut of options instead of just throwing all of your eggs in one basket I suppose, and as long as you have clear objectives with what the programs are trying to achieve and achieves those objectives, and it's not necessarily always about lowest cost. There's other aspects to it that are difficult to quantify and can sometimes appear a bit fluffier if you will.

– Kylie, State Government

3 Concerns, caveats and challenges to community batteries

While all participants were open to the idea of community batteries in the energy system, all raised caveats, concerns or challenges that would need to be overcome for community batteries to be feasible. None of these were deemed insurmountable. The concerns/caveats/challenges can be divided into two categories: Practical challenges, which often relate to the material-technical aspects of battery installation/maintenance (some aspects of which do require a regulatory response) and governance and regulatory issues (real and perceived), which relate to ways in which community batteries might require changes to the current institutional frameworks to be viable.

3.1 Practical challenges for storage installation and operation

Several practical/operation issues were raised in regards to community batteries:

- **Fire hazard management** is an issue that needs to be considered with any new infrastructure, but due to the toxicity of most batteries, emergency service professionals would need to be trained in how to “front up” to a battery which has caught on fire.
- **Maintenance** Participants raised the question about the maintenance of these assets, emphasising the importance of this work being carried out by an organisation that had the capacity to do this well. For instance, some participants raised concerns about the prospect of communities being responsible for maintenance.
- **Network mapping** Network (in)visibility has the potential to be a significant issue in terms of efficient storage investment. Without network maps detailing areas of constraints, it becomes difficult for networks or other parties to know where a battery investment may yield returns from potential network services. One participant for instance mentioned

a concern where batteries would be installed in suburbs where householders had the resources to invest, but where it would provide a negligible positive effect for the network. This is clearly a barrier to maximising potential value streams of the battery, depending on the business model the battery is working within (more discussion on business models below).

- **State of charge** One participant raised concern around the state of charge estimations for batteries, which can be lower than actual charge presenting a practical risk in terms of the operation of the battery. In addition, there's currently no standard for battery testing and so manufacturers can provide information on battery specifications "but it's done in a black box".
- **Educating decision makers and the general community** A lack of understanding of the energy system in both the general community and among politicians was seen as a practical issue for navigating the discussion about what type of storage might be feasible in different contexts.
- **Cost of providing reliability services** Grid batteries are likely to require significant additional investment to be able to provide back up (off-grid or islanding) services in outage scenarios.

...educating consumers around these technologies and what they can do for them at a community scale. Obviously I get a lot of comments from individuals like, 'We should do solar batteries at every single school and this is how we should do it.' Fantastic aspiration but the devil's in the detail of actually implementing it, and the amount of stakeholders involved as well is very challenging and limited capital budgets and things of that nature. So consumer attitudes and education is really – it's going to be a very practical issue in implementing any kind of storage solar solution at a community level.

– Kylie, State Government

- **Smart meters and "identifying electrons"** There was a discussion raised in both industry focus groups about the need for smart meters and for systems to account for the inputs of PV-owners into the shared battery. Indeed, one participant raised the potential for this accounting to be too complex for storage operators to make offerings promising that it is indeed householders own "solar" that is being received at night:

So, there's legal stuff around there about... what are you selling, is it renewable or not or is it recycled? And I think that that creates a whole lot of challenges for movers in this place about how do you actually describe what you've got.

– Terry, Consumer advocate

- **Battery life cycle** Participants raised the fact that the battery recycling sector is not very well established for lithium or other battery chemistries that are hazardous. This is not a minor issue given ongoing concerns about e-waste export to developing countries which are poorly regulated and pose serious human health and environmental hazards.

Participants raised other practical issues associated with different proposed business models but these will be dealt with below.

3.2 Regulatory and governance issues

The topic of changes required in regulation and governance, unsurprisingly given the complexity of the Australian energy policy landscape, took up a significant amount of discussion time.

Other researchers who have investigated the prospect of storage in energy systems elsewhere (UK, Canada) have concluded that distribution level storage is not an easy fit within de-regulated electricity markets because of the difficulties of any one actor accessing all the value streams [4] [6]. One of our participants summarised the challenge in the following way:

The whole energy system doesn't support storage very well at the moment. Obviously we have the concept of "competition where competition is possible" and then where it's not possible it's designated to be a monopoly service that's heavily regulated. And the objective overall is to minimise the role of the regulated assets because it's considered that they're going to be less efficient to what customers want so they're more heavily and tightly bound and regulated. But because we created those artificial boundaries we then have an asset that's trying to seek services across all those boundaries and therefore runs into all these limitations to doing it.

The regulations are changing but they need to continue to change and there's a lot more work to be done. So, we're in a very uncomfortable position here of trying to determine where the value stacks are but being restricted from access to them at the present time. And it's hard to see an avenue through that.

Do we open up networks to do more of this stuff and enter into competitive markets because we know that will – theory will say that that will damage the markets and the stress of other competitors from playing in there. Or do we more tightly restrict the networks from playing in there and therefore they might have less incentive to actually use the storage devices in Mallacoota and things like that. So, it's a really complex challenge that we've created for ourselves.

– David, Government

Similarly to findings from a study of business models of community storage in Australia and Germany, we find that models that rely on the transmission of electricity from individual rooftops to a shared storage through the public grid are facing regulatory barriers - as we outline below. At the same time, our findings reveal that the key energy sector professionals we interviewed do not believe these to be insurmountable or as highly significant as Müller and Welpé found in their analysis from 2018 [7]. Müller and Welpé also suggested that less regulated microgrid managed by the administration or strata entities of multi-household developments already seem promising under the current regulatory framework, as also mentioned by our participants.

3.2.1 Regulatory

The potential of community batteries to produce multiple benefits is the very feature that comes up against the current institutional arrangements in energy. As such, a significant theme in these discussions was the question of "first movers"; parties that would be able to navigate the

risks involved and demonstrate the value of community batteries.

3.2.2 Who will be the first movers?

Future market design uncertainty creates a context where incumbents may be unlikely to invest in storage without knowing possible rates of return. As one participant put it:

Putting my reliability cap on at the moment, you've sort of got to go to a capacity market, it changes the whole value proposition so why am I going to invest here when I don't know what the wholesale market design's going to look like? You've got retailer reliability obligations, how does it fit within that, or doesn't it fit within that. What's the ancillary service market going to look like moving forward?

– Terry, NGO

In a context of policy uncertainty at a federal level, State and Territory Governments and Local Councils are setting their own emissions goals and policy settings to encourage the take up of different renewable technologies. This creates potential opportunity for storage as it can become an attractive option for investing public funding to meet local targets. One participant believed that local councils were a strong contender to be the “first mover” in the storage space. Local Governments can leverage financing through rates and have an understanding of the local community and how to engage them productively in storage placement etc. Participants also raised local government involvement as a “no regrets” pathway in the context of high uncertainty about future technology options coming on to the market. At the very least, local governments can use the battery to service their own loads in council buildings etc (assuming a suitable tariff).

3.2.3 Network charges

Current network charges were seen as a barrier for economic viability of storage. Several participants raised the double charging of Distribution Use of System (DUOS) each time the battery is used:

...duos..[is] designed for a consumer, not a generator device. So, it needs to change and there's lots of work going on to assess it but we've got over 1,000 pages of regulations in this space that we need to – it takes time.

– David, Government

At the same time, one participant was concerned about the prospect of changes to network charges having implications for affordability:

So, the bit that keeps coming into my head is do you end up creating an environment where you're unwind postage stamp pricing in an uncontrolled way? Which will generally result in these people being left on postage stamp pricing who can't afford to come off of it; and they end up paying a lot more because everyone who benefits for moving off of it, does. So, I think, for me it's like we just need to be careful that we're not creating a world that is significantly worse for the people who can't afford to participate in these schemes

– Kate, Network

Kate raised the prospect of people on concessions or with a credit history being potentially excluded from community battery schemes, and being left on tariffs that are more expensive. From this perspective, it appears the caution highlighted by Paul around careful consideration on effects of regulatory changes is warranted.

3.2.4 Installation risks and questions of accountability

As a new piece of infrastructure, community batteries presents risks to public safety and grid operation. As such, some participants emphasised the need to develop a standard for installation of batteries in public spaces (similar to the process that Standards Australia worked through with residential batteries, AS5139). This standard would need to cover the risks of installation. In addition, the regulatory environment would need to contend with the question of accountability for when there is a fault in storage operation. There needs to be a clear chain of accountability for liability and how customers can seek effective resolution.

From a safety perspective, then also installation. Who's certified to install it and where are the issues that could lie – whether it's network or domestic. Are electricians capable of doing it? Who else is doing it? Because you've got non-electricians installing solar. I mean, I think they have to be certified.

– Lucy, NGO

3.2.5 Ring-fencing challenges: Real and perceived

As mentioned in the quote above on institutional barriers to storage, ring-fencing has been applied in the Australian energy context as a way to prevent Networks from abusing their monopoly status as distributors. In practice, ring-fencing requires legal and functional separation of a regulated network business from retailer businesses operating in the various energy markets. Our participants did raise ring-fencing as an issue which could inhibit networks from participating in storage business models. This is because Networks cannot gain any arbitrage revenue from the battery. However, many participants also believed that ring-fencing could be overcome, and that the conservative culture within some networks (as well as retailers and regulators) was a bigger barrier to participation.

I think the barriers are... more perceived in that people haven't really tried it, they haven't pushed the boundaries of what is actually possible within the actual framework, and that's as true for the networks and retailers as it is for the actual regulators themselves.

– Daniel, Network

3.2.6 Governance

Outside of specific regulatory considerations, participants also raised broader issues around how community batteries models fit into the broader governance of energy in the Australian context and the role of governments versus markets in promoting particular technologies. This remains a contested question and within that context, there were concerns about how community batteries would be part of an overarching strategy of renewable technologies in the grid (a strategy that is missing at all levels of government).

3.2.7 Transaction costs of collaboration

Network participants raised the transaction costs of establishing and maintaining relationships with collaborators on community batteries as a significant barrier for their involvement. Because establishing a community batteries model requires collaboration with a retailer, and, possibly, community groups, this becomes a significant risk for the network if these schemes do not eventuate and they have deferred network investments elsewhere.

And if that's a third party who's operating the battery or ourselves putting that in place or a retailer or someone else, or contracting with individual customers or contracting with an aggregator of those customers we have to have some comforts that they can deliver, and that's always a challenge. The bigger thing these days is just transaction cost. Transaction costs associated with lots of smaller customers or multiple aggregators is often a significant barrier to defer network investments.

– Daniel, Network

3.2.8 AEMO's potential interest in community batteries

At least two participants mentioned that AEMO may be interested in community batteries models as a preferable option to VPPs. Lucas who works as an energy consultant argued that community batteries would be easier to manage than several aggregated residential batteries. AEMO are exploring DSO models that enable greater visibility and control over distributed resources in the energy system. One advantage of community batteries raised is that there is less potential for privacy concerns from householders about AEMO having visibility over their energy assets.

3.2.9 Affordability

When this report's author raised questions about criteria for participation in community batteries models, one participant raised the possibility of a waiting list. Other participants agree that not everybody in that locality would be able to participate in the model, creating issues around access to cheaper electricity prices. One participant believed the question of affordability linked to broader questions in all energy investments, pointing out that these issues are yet to be resolved with PV roll-out:

So unless we actually understand what and why we're doing it, just simply saying how do we accommodate it is not a good idea because if you don't know where you're going you're surely not going to get there . . . I think you've got to be careful about seeing networks as just a full of disruption and then losing the essential point which was to actually supply customers with electricity as reasonable cost.

I think that is a risk in this whole thing [around community batteries] that the benefits could be being distracted off. As I said we've got enough issues with solar PV which I'm incredibly obviously supportive of because we spent so much effort on them, but I still think that nobody still really understands who benefits and who doesn't benefit from this rollout so far.

– Gary, Local Government

One participant mentioned that there is also a risk that early adopters of residential technology may be disadvantaged if shared local models provide a better return than residential batteries (thus disadvantaging the early movers on residential batteries). However, given the range of alternative measures available to households to save on their energy bills, and the range of motivations of battery purchasers, further research would be required to explore the extent of this concern among residential battery owners. In this project, focus group discussions with battery owners in Adelaide did not reveal any concerns along these lines. Battery owners were very supportive on community batteries, not seeing it in competition with their own systems.

3.2.10 Risk management and ownership

Risk management in relation to the operation of community batteries was raised several times. This was also often linked to questions of ownership. Participants believed that safety was an important consideration and that whoever owned the storage would have to prioritise the safety of the asset:

The big one is safety. Electricity networks aren't exactly the simplest and easiest and most safe of assets unless they're managed very well. Networks manage them very well but an individual small player, there's risks with that to them not turning up and maintaining the asset. We don't have much of a safety debate in Australia because we have a very safe and secure system but it's something that if we were to wind back those systems, I think we'd encounter some issues. . .

– David, Government

3.2.11 Anticipating future complications

Other than battery recycling at end of life, another future issue was raised by one participant. Terry was concerned that a high volume of storage assets on the distribution network, may begin to have effects on the transmission network.

3.2.12 Trust and governance

Several participants raised the prospect that, if managed well, community batteries could build trust in the energy sector. Yet other participants believed that because individual households will increasingly have greater opportunities to gain value from their individual systems, that distrust in established retailers, or even local councils, means householders would rather opt to have storage in their homes, rather than being involved in a shared community batteries model, if only (distrusted) incumbents were offering the service.

4 What business models might be viable for community batteries?

Across interviews and focus groups we explored questions of ownership, operation and community involvement in community batteries models. A key theme that emerged from these discussions is the importance of considering the specificities of each context. This question of local context has hitherto been less visible or important in a situation of centralised generation of the power system. This is a new challenge for the energy sector, and at the core, will require consideration from a governance perspective, particularly on the question of making transaction costs associated with collaboration and consultation less onerous. Importantly, participants reiterated frequently that business model design would depend on the primary aim of the storage.

[models could achieve] more the social equity type thing or more towards least cost or profiteering out of it that [Participant 1] mentioned. I think there's a [inaudible] 01:41:11 but sort of that's in the mix. You could get it to go either way.

– Paul, Network

What was clear from the discussions with energy sector professionals that a range of models were possible, all with different value propositions, and slightly different regulatory barriers.

Table 1 is largely taken from Burlinson and Giulietti [1] in their analysis of emerging business models for city-scale shared storage. There is an extra column to include perspectives of participants. Note, that these specific models were not presented to our participants, but rather emerged in the discussion.

4.1 Ways forward

There was strong consensus among participants from all sectors about the value of trials and demonstrations. Participants argued that demonstrations would enable the sector to understand the different financial and non-financial values storage models could bring as well as the different options for community involvement. Regulatory sandpits were recommended as a way to enable these trials.

In addition to the unanimous agreement about the value of trials, several participants also said it would likely be easier to implement storage in Greenfield sites, in contrast to retrofitting storage into existing infrastructure. Other participants also believed that institutions such as retirement villages, hospitals and schools would be potentially highly suitable for community batteries.

4.2 Battery technology and its influence on possible business models

There were specific technological features of batteries which were thought to influence the kinds of business models they could be integrated into. For instance, larger batteries were seen as able to bid into a bigger set of markets, but then the risk would be that it would no longer be “consumer facing”.

Several participants raised the idea that batteries are best used if they can get completely cycled. In that sense, matching batteries with particular loads (e.g. EV charging), was seen as an important consideration. Network losses were deemed insignificant as a consideration in pricing but battery losses were seen as a potential cost to integrate.

Model	Value proposition	Consumer	Ownership	Participants views
Local council	<p>Non-for-profit</p> <p>Reducing energy bills (i.e. low tariffs) and tackling fuel poverty</p> <p>Premium customer service</p> <p>Local growth and redevelopment</p> <p>Training and employment opportunities</p> <p>Local emission and air pollution reduction</p> <p>Demand-side management</p> <p>Avoid risk of curtailment</p>	<p><i>Primary:</i></p> <p>Domestic sector</p> <p>Private sector</p> <p>Public sector</p> <p><i>Ancillary</i></p> <p>National grid</p> <p>Network operators</p> <p>Generators</p>	Local council or authority	This was a model that was seen as feasible in the Australian context
Network 3rd parties	<p>3rd party owns, manages or provides ancillary storage services to DNSPs, as DNSPs</p> <p>restricted to owning small scale generation (storage is currently defined as generation)</p> <p>Defer network upgrade and maintenance costs</p> <p>Share risk/costs (e.g. joint venture)</p> <p>Avoid risk of curtailment</p>	DNSPs	<p>Contracted DNSPs owns technology (restricted)</p> <p>3rd party manages the asset</p> <p>Contracted services</p> <p>3rd party owns and manages the asset</p> <p>DNSP pays for services</p>	Networks among our participant group appeared to be less convinced by this model as it wasn't accessing all the potential value stack
Service layer Licence lite providers	<p>Small supplier procures storage</p> <p>Contracted 3rd party licence supplier (TPLS) takes responsibility for standard licence conditions reducing risk, financial and technical barriers for suppliers</p> <p>Supply local consumers with energy and provide low energy bills</p> <p>Reduce emissions and local air pollution</p>	<p>Domestic sector</p> <p>Private sector</p> <p>Public sector</p>	<p>Local authority or council</p> <p>Local small suppliers,</p> <p><i>Contracted services:</i> Third party licence arrangement</p> <p>Licence Lite supplier contract</p> <p>local generators and storage systems</p>	
White label providers	<p>Parent supplier operates and manages the supply of energy and customer service (including billing)</p> <p>The white label differentiates itself from the incumbent suppliers (e.g. focuses on social enterprises, non-profit etc.)</p>	Generators	<p>Contracted services</p> <p>3rd party owns contracted services paid for by the generator/incumbent supplier</p>	Several participants raised distrust of incumbent retailers, which may make this model more feasible
Multiple service providers	<p>Provide multiple services: routes to revenue streams, investors and developers; contract and other management services; optimisation and revenue maximisation services; project development; finance; building and installation of energy storage technology; ICT services, data storage and data management</p>	Storage owners	<p>3rd party (Energy Service Companies (ESCOs)), local authority or council owns contract(s)</p> <p>3rd party (ESCOs), local authority or council does not own technology or energy generated</p>	
Community groups	<p>Deploy and aggregate energy storage locally</p> <p>Reduce energy bills, increase self-consumption</p> <p>Opportunities: FiT, ToU tariffs, time shifting and peak reduction</p> <p>Provide extra capacity and defer local network investment</p> <p>Fund local charities, social and nature projects (community fund)</p> <p>Free electricity (supply [demand])</p> <p>Create current/reserve account</p> <p>Avoid risk of curtailment</p>	<p><i>Primary</i> Domestic sector</p> <p>Private sector</p> <p>Public sector</p> <p><i>Ancillary</i> National grid</p> <p>Network operators</p> <p>Generators</p>	<p>'Bulk' storage systems owned by community investors (e.g. bond and shareholders, crowdfunding, social enterprises etc.)</p> <p>Joint ventures: commercial energy organisations or manufacturers</p>	Community groups among our participants were very interested in storage - cost the only barrier
Fully licensed retailer	<p>Retailer takes responsibility for standard licence conditions reducing risk, financial and technical barriers for suppliers</p> <p>Supply local consumers with energy and provide low energy bills</p> <p>Reduce emissions and local air pollution</p> <p>Provide extra capacity and defer local network investment</p>	<p><i>Primary</i> Domestic sector</p> <p>Private sector</p> <p>Public sector</p> <p><i>Ancillary</i> National grid</p> <p>Network operators</p> <p>Generators</p>	Fully licensed retailer	<p>Retailer participants believed this to be a viable model</p> <p>Other participants were skeptical due to issues surrounding distrust of retailers among the community</p>

Table 1: Business models for shared storage

5 What services can community batteries provide?

The services that storage can provide were seen as hampered by current regulatory frameworks, uncertainty in future market design and a lack of clarity over what is possible even within the current regulatory framework. The quote below demonstrates this particular challenge:

Well, because of the regulatory compliance framework around the delivery of an essential service, it creates a lot of other costs. And call centres and ombudsman schemes. Whereas if it's an ancillary – and I'm just making these words up – if it's an ancillary service, the local government, stick it here if you want. It's going to cost you two parts of nothing. It may be there or it may not be there for you at the end but you've always got your traditional retailer as backup to supply when you run out. But that probably is where you'd want to be because you can offer something but you don't have the burden of all the regulatory stuff and AER and ESC and –

– Terry, Consumer advocate

The following section elaborates the points raised in Table 1 about the various advantages and risks of different ownership structures, raised by participants.

5.1 Community or Local Government owned

Ownership structures: Cooperative, community groups or local councils, joint ventures between small business and community, strata management.

Advantages

- Having community involved likely increase the take-up (as with solar PV).
- Community involvement can facilitate efforts around demand management (as there is a sense of ownership and “care” towards a community asset).
- Creating a community fund can increase the prospect of community acceptance.

Risks

- The asset needs to be well managed and communities do not have this expertise, although other organisations at the local level may well be able to negotiate these types of roles. The workaround is for the community to contract out the management of the asset to a third party, e.g. the local DNSP, or other energy business.

- There may not be enough people living in that particular locality to meet the scheme's threshold for participation.
- Governance of community decision making can be burdensome and easily captured by the "loudest voices" (e.g. in strata contexts). This could be managed through facilitated citizen involvement in decision-making, or alternative institutional types such as cooperatives or local council.

Other issues

Participation in the scheme would need to be straightforward for participants who do not have time to engage more deeply:

...you might have the couple of people that are really engaged and willing to spearhead something, but having an option for maybe local communities to be able to opt into something that's very low threshold for entry. So something like green power, it's a very easy way, obviously you're just paying more money for the exact same service but you might be more inclined if you know that you're paying an extra 10 cents or something but for a project that is in your locality –

– Kylie, State Government

5.2 Network ownership

Network owned, leased out to third-party. This model involves the network owning the battery but leasing it out to a third-party.

Advantages

- Lower cost of capital (Networks can include part of the battery cost through the Revenue Asset Base)
- Experience managing safety of assets on the distribution system
- Confidence in the management of the battery's impact on the network.

Risks

- Lower cost of capital (Networks can include part of the battery cost through the Revenue Asset Base (RAB)) can also be a risk as RAB growth causes network cost increases. Consumer advocate participants argued that there's currently no mechanism to reduce underutilised assets from RAB which means consumers pay for network assets they may not be benefiting from.
- There is a risk that the network is not optimising the community batteries with other customer owned DER assets that it could be aggregating with and thus more efficiently meeting network constraints.
- The risk that networks may prioritise their own interests over whole-of-system or people's interests.
- One participant mentioned that there is also the risk of cross-subsidisation (inefficient sharing of costs between regulated and non-regulated services), though another participant believed this risk could be mitigated.

Other issues One retailer participant believed a model where the network owned and manages the battery to manage network constraints, yet the retailer is able to lease the battery to capture other value streams was a very feasible path forward.

Networks who have worked closely with communities on projects believed that "collaboration between the community and the network actually works really well" (Participant 2, Network). Both networks and community groups often have very similar concerns over reliability and lowering costs, especially in edge of grid locations where microgrids may play an important role in reliability improvements at lower cost.

5.3 Multi-party ownership models

Advantages

- Multi-party ownership can lower costs of investment for all parties, and in a community context, increase the sense of buy-in and energy sovereignty.

Risks

- Challenges to value stacking under current regulatory framework

And there's a lot of challenges in being able to access the value streams, and that's where I think if you can maximise the solar storage capacity that you have the community is a bit more interested in that, and that's the whole reliance and reducing costs overall for the community. So that is definitely I think a model that has been of interest. . . . but we've had quite a positive response to that program and a lot of councils really interested in that kind of work. But I think some of the regulatory challenges are how they work with the networks or how they work with retailers to actually extract the value that tends to be some of the barriers. But I think it is one model that is worthwhile, encouraging potentially or at least has multiple solutions

– Kylie, State Government

5.4 Key questions moving forward

An overarching theme in discussions with energy sector professionals about the future of community batteries was a lack of clarity about the role of markets and government policy in facilitating innovation in community batteries. Some participants believed that the market sending price signals would be enough to drive innovation (and that storage would “win” if it was the most competitive option), whereas others emphasised the need for policies around emissions reductions to enable the business case for community batteries, and the need for a more strategic approach to energy investments. This is a well-known debate in Australian energy policy so won't be discussed in any detail here.

As in the case of most emerging energy technologies, uncertainty over policy and a lack of ambition on carbon reduction goals at the Federal level, means there is unlikely to be significant pressure on incumbent retailers and networks to invest heavily in community batteries. For these reasons, and without leadership from the regulatory agencies in the NEM, participants believed that drivers of community batteries investment would come from local councils willing to invest for carbon reduction goals, and networks in network locations that are constrained. This point is captured in the following quote in which a participant believes that it is possible to “put aside” uncertainty in government policy and forge ahead in network locations in which it makes economic sense (likely to be network constrained):

Yes [community batteries] would draw on a value stream that might be impacted by these other [policy] decisions, but then it doesn't matter. The economics of that solution and how we assess those options are subject to sovereign risk anyway and always will be. So I think we just leave those decisions to be made by others, and focus on what can a community battery do...

– Daniel, Network

One participant did raise the point that local level storage may be seeking to solve a problem that is still in transition. In other words, if the transition to DER is only beginning, and we are moving to a highly decentralised grid, then semi-centralised DER may be a short-term and potentially inefficient solution.

5.5 No “one size fits all” model for community batteries

The need for greater clarity about the potential of storage to solve different problems in different locations was discussed extensively. Participants quickly realised that the purpose of the storage would play a role in what benefits it could bring about, and to which parties in the system. Indeed, because community batteries has the potential for creating multiple values, these may sometimes come into conflict with one another as illustrated in this exchange between focus group participants:

Participant A: ...But then you can arrange your battery so that you have 250 kilowatts doing something – if you build it correctly, 250 kilowatts doing something [else]...

Participant B: I totally agree, I'm just – there's multiple functions at different times and value streams to extract here, depending what AEMO wants at the time and the local network wants at the time to what I want as a consumer.

Participant A: And you can stack but you can't stack everything. There are some services you can't stack together so you have to have that understanding of what you can combine.

It was clear that any storage model would involve some level of negotiation between different users. Indeed, it's possible that some value streams will even be in conflict with one another. One consumer advocate participant asked the question of what institutional mechanism might

be in place to enable resolution about these questions.

Cynicism about whether or not community batteries is of public benefit was raised by at least one participant:

Are we just trying to achieve the fact that there are people out there who are pushing the idea because it suits their economic benefit, or are we putting it out there because it actually helps the electricity system, or are we putting it out there because we need to have innovation and networks are inherently conservative. . . ?

– Gary, Local government

But many participants also raised the point that storage regulations needs to be adaptable and flexible. The grid is increasingly complex and heterogeneous - with changing technical needs depending on different sources of vulnerability (related to being edge of grid, or high penetration PV), and different communities will have different levels of interest in how involved they want to be in their local energy system, the resources available (from e.g. local councils) to invest in carbon reduction from electricity as well as the number of households who cannot directly participate in DER and may have an interest in community batteries.

5.6 Community batteries as an interim technology

Several participants believed that community batteries could be a good ‘least regrets’ option in many network locations:

I think broadening our options is the best way to address the needs we have, and I think just that uncertainty in search and option value meaning if we’re able to avoid spending money on network assets by investing in some other alternate asset that has a broader value stream by extending the life of an asset we have, we’re not investing in a 40 year asset that we may not need in 20 years. So we need options that don’t necessarily last for 50 years, we’re looking for options – because that may not be the best solution in 50 years.

The Western Australian experience

Western Australia is the only state to have already established community batteries. Some of the regulatory challenges are less acute than in the NEM but professionals we spoke with during our research said that regulations did not enable it directly, but rather it took networks and retailers working together to take on the 'risk' of trialling new business models. Western Power have partnered with Synergy to establish three community batteries under the PowerBank model. Householders who are also solar owners are allocated virtual storage in the battery. As their solar panels generate solar power during the day, up to 6kwh or 8kwh of excess or unused power is automatically transferred to the battery, for them to draw on later. The Meadowsprings trial has demonstrated that this model works particularly well for households who make a lot of solar energy during the day, but are not home to use it.

Another community battery is located at Alkimos beach - a greenfield site north of Perth. The Alkimos Beach Energy Storage Trial (ABEST) is a joint project between Synergy, Alkimos Beach development partners DevelopmentWA and Lendlease, and was supported by ARENA. Similarly to other new technology trials, follow up customer research revealed that householders had significant needs around regular and comprehensive information dissemination. Community engagement of this kind is resource intensive and is generally not built into feasibility cost-benefit analyses, but remain critical to project success. Any exploration of community batteries must build in resources for ongoing engagement with householders.

6 PART 2: Householder views on community batteries

I think we do need to have a conversation or a real debate about whether we do want to see electricity as a social good, not necessarily just an individual good.

– Margaret, Noosa

6.1 Preferred energy futures: Renewable, community-led and local

This section will outline the benefits raised by participants in considering whether or not community scale storage would be a desirable technology. It is unsurprising that when presented

with a new energy technology option – in this case community storage, householders drew on their (often sophisticated) understandings of energy systems to interpret whether or not this would be a positive and viable technology. Energy in Australia is characterized by political contestation, change and uncertainty and so it is unsurprising that participants spent a great deal of time speaking about the broader governance challenges surrounding energy policy, in order to make sense of how storage would fit into this context.

While questions of politics and governance will form the basis of the next section, it is important to keep in mind that perceptions of whether community batteries could be a feasible and positive technology for the energy system are heavily influenced by the politics and policy landscape of energy. They are also influenced by people's previous experiences with technology, their knowledge about how the electricity system works, and norms (expectations and aspirations) around energy. Norms and previous technology experiences feature heavily in the analysis.

6.1.1 Benefits of community batteries

As long as the overall environmental benefits were convincing, participants discussed many benefits that community batteries could provide. Several participants had a very sophisticated understanding of the technical benefits. These participants tended to be owners of residential renewable technology and have some level of understanding of how the electricity system functioned. Yet other participants quickly picked up concepts from those more knowledgeable of the system and the focus groups provided an opportunity for collective learning. It is noteworthy that all participants engaged readily in the discussions, contributing enthusiastically and raising and exploring questions. Many participants were self-confessed as disinterested in the technical workings of the grid, yet others described themselves as 'tinkerers' and had developed their own software to manage their home battery. Nevertheless, all held views about the potential benefits of community scale storage.

Pro-renewable

Overall community-scale storage held broad appeal across all the focus groups, including residential battery owners. A chief reason across all groups that community batteries was seen as a valuable technology was because it was seen as a means to increase renewables into the energy system. This pro-renewable energy attitude is unsurprising as successive surveys have found a similar result in Australia. Nonetheless, it is a valuable insight to learn that people immediately tied the benefits of storage to increasing renewables in our energy system. All participants – bar one – articulated pro-renewable views. The one participant who was not convinced for the need for renewables in the Australian energy system believed that fossil fuels

provide the cheapest and most reliable source of power. Concern about Australian economic productivity was the basis for viewing storage at any level to be an undesirable technology option

... we've got the sun, it's literally hot and it's getting hotter; we've got the wind, so why not utilise what we've got for free, and get away from coal?

– Angel, Cootamundra

My gut feeling, my instinct with energy is always right now that the awareness that we have about the environment is to move in every way we possibly can towards renewable sustainable energy

– Anne, Sydney

Local

Another clear theme emerged which has been less explored outside of the often rural community energy context. That is, many participants valued the idea of locally producing, consuming - and importantly sharing - their energy. Several participants appeared to value the idea of keeping production local, without providing explicit justification for this. Others raised the idea that it would provide jobs, keep money in the locality and reduce the need for expensive grid infrastructure. This theme was most evident in Canberra, Cootamundra, Adelaide and Noosa – groups that often identified sustainability and environment values in their discussions.

In terms of consumer take up, I imagine myself if there was some sort of community battery scenario I'd feel I had a lot more power over my usage and that would be really attractive. So I'm technically illiterate but it would be a big selling point for me if I could see that on my bill and I thought okay, well that's something that I have some agency in.

– Julie, Canberra

Well for somebody like me who's, I'm a producer overall . . . if it was stored in the battery and I buy it back at night I'd still be generating more than I consume, and I'd be delighted if other people in my street or people that couldn't have solar who are in the community could then draw on the stuff that I've generated locally.

– Scott, Noosa

Smoothing out the grid and load shifting (including in locations of high PV penetration)

Four focus groups discussed the issue that community batteries can help smooth out the fluctuations in demand for electricity on the grid, including in situations where there is high penetration PV. These participants articulated a clear understanding that community batteries could help solve this technical problem at the network distribution scale. A couple of participants were critical of solar FIT policy to date because they argued these had been rolled out without consideration of network stability. As one participant said “[FIT policy as a flat rate is] not fair for the grid because it doesn't actually help the grid to be more stable” (Terry, Noosa).

Well even forgetting solar, load shifting right, you can charge these batteries up during the day when everyone's at work and all the PV systems are dumping power into the grid, and then when people come home at 5pm and there's a spike on the network they can flatten that out very nicely.

Yeah, like the South Australian big battery except smaller would help to even out things at a smaller scale.

– Gavin and Thomas, Canberra

Enabling more PV in the system

Participants in the Melbourne focus group (none of whom owned renewable tech) raised the idea that the feed in tariff to solar owners to participate in the battery could provide an incentive for people to invest in PV. One participant in Noosa made the point that retailers would not be providing any FIT in locations with high PV penetration. In these contexts, community batteries would be critical to enabling people to purchase PV.

So it'll reach a point where there's too much energy being generated locally for it to be used, and so if it can't be used it'll just put – you won't be able to do a feed in, so that's where a community battery is probably essential, unless the distribution companies update all the poles and wires because they won't be able to handle too much export from rooftops. So by doing it, it actually enables the solar penetration on roofs to increase and increase without then having to do massive infrastructure upgrades

– Scott, Noosa

Deferring network upgrades

Sydney, Adelaide, Canberra, Noosa, Cootamundra, Narooma participants all raised the benefit of community batteries that it could defer costly network upgrades. Narooma participants were very aware that one purpose of community batteries was that they could provide network services to distribution companies, as well as arbitrage to consumers.

I think one of the big benefits is that you can defer network upgrades because the network has to be sized to the peak capacity, and because batteries can level out those peaks by pulling power during off peak times and then delivering it during peak times, it means that you can defer potentially five-10 years upgrading the networks for more capacity. . . .So there's a massive community benefit there.

– Gavin, Canberra

A shared community asset can build social capital in the community

The question of ownership was a significant concern for participants across all focus groups. This theme will be discussed in detail later in the report, but assuming the community had some level of ownership in the battery, several participants thought it could build social capital in their community. Participants often came to this conclusion after some discussion, because it was such a new concept to consider co-owning a piece of electricity infrastructure. In that sense,

analogies like local firefighter groups were helpful in thinking through how it could work. Participants joked that having a local battery could become a new source of conversation between neighbours, rather than talking about the weather.

[Referring to a local firefighting group]. . . and they have a cup of tea and bring cakes and say “hi” to one another. So it [the community battery] could be a good community bonding exercise maybe.

– Jean, Sydney

. . . but what would be really interesting for me is a community owned shared battery so that it’s not by some company but it’s actually the community that feels an ownership of it and is therefore more connected to it.

– Terry, Noosa

Reliability and going ‘off grid’

This was an interesting topic to consider. Reliability did not emerge as a critical theme of importance for all participants, nor did the majority of focus groups immediately intuit that having community batteries would improve reliability of their network. At the same time, several people did grasp that one possible alternative to a community battery – going off grid – would be very expensive and that a community battery might be a cheaper alternative (and still in line with their sustainability values). Others framed this as question of markets, where whatever is helping the grid achieve a balancing should be rewarded.

I think it shouldn’t matter whether it’s production or consumption, it should be rewarded in the same way. So if you help the grid to go into the direction it needs to go you’re rewarded, and if you do the opposite then you’re penalized. I think that’s a mechanism that would be completely fair. . .

– Terry, Noosa

Several groups discussed the importance of reliability but had different views. It was a topic that generated some discussion in the Cootamundra and Noosa groups with participants saying it was more or less important. Some participants in Cootamundra said that the odd black out was

not necessarily a bad thing – that it could make people more cognizant of their energy use. Yet in Narooma, reliability was discussed as being particularly important for those who experienced unreliability. These participants were more likely to want a physical metered connection with the battery, as opposed to a virtual relationship (e.g. as an investor).

6.2 Peer-to-peer trading and microgrids

While none of the facilitator questions raised microgrids or peer-to-peer trading, these were themes that emerged organically in Clayton, Cootamundra, Canberra and Sydney. Two participants raised the idea of microgrids without explicitly using the term ‘microgrid’ – but described a context in which there would be storage throughout the system that would usually feed into the local suburb, but would be able to contribute to neighbouring suburbs if they experienced an outage.

But yeah, I mean one of the things that comes to mind, like all these big power stations that are now falling apart because they're so old and whatever, and we've got to replace them. Well instead of replacing them with power stations, we should be downscaling, and dare I say, the internet, but power networks, you know, the internet, that's all connected. We should do the same thing with power, have lots of small generating systems, one falls over it doesn't matter, and another one can supply.

– Michael, Cootamundra

People on the whole really liked the idea of “their” energy being circulated among their local community rather than going into “an amorphous blob” (ie the grid). One solar owner who owned several properties said for example that he would like to ‘sell’ his excess power to his other property rather than being charged the standard rate from his retailer.

6.2.1 Being involved via your bill versus as an investor

Participants rarely gave straightforward answers to this question of whether they would like to be involved in the battery as linked to their bill, or as an investor. This question relied so much on specifics of the model – who owned the battery, and whether it was a for-profit body for instance. Generally speaking, it was thought that the investor model would only be viable if it was very clearly benefiting the community in which the storage was located. And then, there were concerns that people who were not able to invest in the battery would be excluded and it

would exacerbate inequities that already exist:

... it's something that I hadn't thought about before, but my first take on it is it's [the investor model] probably something that I wouldn't want to support. I think it would get very complex. ... it could lead to a range of unforeseen consequences, because when it comes to people putting down money, then of course, those with the most money will benefit the most, and I think you would end up excluding a lot of people. So, I don't think that would be a good idea, potentially.

– Yiannis, Adelaide

Overall, many people felt positively about the idea of using the battery directly – i.e. it was linked to their bill – but they also suggested it could be used by nursing homes, for street lights and had some caveats around this – as discussed in later parts of the report. Participants' thought that having it connected to your bill would serve as a stronger emotional connection to the battery.

Terry: And I think even more real time in an app, yeah that linkage, that's the key part.

Scott: Yeah, if you could see something that said this is what – if you're a producer this is what I'm producing, this is what I'm consuming, this is what I'm storing, or if you're just a renter, a tenant you'd say this is what's coming from the battery, this is what's coming from the grid and this is what I'm consuming. Then you've got some sort of idea about where your power's coming from.

– Noosa focus group

Finally, participants did link these different models with the governance of the battery. For instance, when we asked about how the battery could serve the community in an outage, this participant then raised the issue that if it was for a 'for profit' purpose, there would be a clash with the needs of the community, raising concerns about the privatisation on energy as outlined below:

... so this is where you get into issues like if I'm an investor in something, it would be a hard sell for – if people have put money into something, then they will expect – I'll put it this way. There's not very many benevolent people who would go "Yeah, I think that would be good – I've paid for it, but everyone else benefits." It would be like "Well first, if I've put in 100,000 and the next bloke put in 80,000 and so forth, then I want my 100,000 worth", and then he gets his 80, and the other, and dah, dah, dah, dah, dah. So, if it's in private hands and it's privately owned and it's been privately invested in, that's the behaviour you're going to get.

– Claire, Adelaide

6.3 Other social norms and influences

As an icebreaker question, we asked participants "what does energy mean to you"? In answering this, and other questions, people raised the following kinds of influences in how they think about energy:

- Concerns about climate change disruptions to the grid and foreign ownership of energy assets
- A concern about unnecessary investment and wasteful use of resources "maybe the solution is to just use less energy"
- Solar owners' discussion about awareness of energy consumption, a willingness to adjust some habits to maximise cheaper solar electricity during the day, and a general discussion about how energy behaviour is largely habitual
- Australia should seize on the advantage of solar resources and become an energy exporter via solar
- Resisting the notion that people should adapt their behaviour at the expense of convenience i.e "I want to cook when I'm hungry"
- Enjoyment of the idea of self-sufficiency in energy. e.g. "I've spent a lot of my life doing things that other people do with using electricity or other means or fossil fuels or whatever, and I do them with my body. I don't know why I do that. I think it's because I strongly suspect that it's not a sustainable system" (Paul)
- An awareness that we have become disconnected from energy and that this is a problem.

- Case studies of self-sufficient microgrids in Bangladesh from the documentary movie 2040 (mentioned in two focus groups)

7 Governance: “Are we Commies or are we Capitalists?”

As many participants articulated, the question of how the community should be involved in community batteries is inherently political – some participants preferred the term ‘ideological’. As discussed, they viewed community batteries as a fundamentally positive solution to variability in renewable generation, with many social and economic benefits. However, questions over how the community should be involved in the storage immediately became entangled in complex discussions about the privatization of energy, equity in access to renewable technology, the role of government, the speed of technological change and whether or not community batteries would stand the test of time, among other issues.

Participants raised a wide range of concerns about the way the energy system currently works. Discussing these collectively was a necessary step for participants to understand what type of model of community batteries they thought would be workable. At the heart of these questions were issues of power around access to the benefits of the storage. As Patrick in Noosa put it, “are we commies or are we capitalists?”

The following excerpt from the discussion in Cootamundra provides an insight into this process:

Female: Wasn't that the PMG, Post Master General, they used to do electricity, water, post office and -

Female: It was the telephone, PMG.

Female: Telephone, PMG, yeah.

Male: No, we had Telecom, or we had PMG for the telephone.

Male: We had the county councils for electricity and water, and sewerage.

Female: Oh, did we?

Female: Yeah, until they privatized it, that's what I mean, it can't change.

Male: And then they privatized it, and that's when it started to go wrong.

Female: Yeah, privatization - but they reckon if government owns anything its socialism. That's what they reckon, they reckon, "oh we can't own anything, its socialism".

Male: Well what's wrong with that?

Male: What's wrong with a little bit of socialism?

Female: Yeah.

Female: Yeah, like even if council say own it, or run it -

Male: We're not talking communism.

Female: No, that's right.

– Cootamundra

The Cootamundra group largely agreed that local council, with some oversight from the community, was best placed to own the battery and operate this in the best interests of the community. But as the report will further discuss, local government emerged as a trusted owner for community batteries in other focus groups discussions as well. This is largely because there are significant concerns among the community about the privatization of energy, and energy is

viewed by many as an essential service.

7.0.1 Privatization concerns and energy as an essential service

Explicit concerns about privatization of energy were discussed in Noosa, Cootamundra, Melbourne, Canberra and Adelaide. This theme was also articulated in other ways – Adelaide, Sydney and Noosa participants said that the energy system was too complex for what is an essential service. In the two lowest socio-economic locations with the fewest number of solar owners, energy was framed, like transport, as an essential service that should be run in a way that is very low cost and affordable for everyone. Finally, these concerns were also expressed in a distrust and dislike of retailers – a theme discussed across all focus groups except Sydney (however the Sydney group did see the need for government to play a more important role than it currently does). Successive surveys from the ECA have revealed distrust in the retail sector, but qualitative data reveals more about the nature of this distrust:

I trust energy retailers as far as I can throw them because they are a complete waste of time. I don't get a choice of what energy wholesaler I have, and it doesn't matter just about wherever I live in Australia there's only one. So the retailer is a middle management issue stripped away entirely. That's just my opinion on that.

– Thomas, Canberra

... I know what it's like with these energy companies, all they can think is dollar signs, and they really don't care about the customer.

– Angel, Cootamundra

Many participants articulated that marketization of energy and competition has failed both from the perspective of the environment and social good. Essentially the rationale for these concerns boiled down to the profit motive and its associated incentive to dupe consumers into paying more than they need to in the form of 'smokescreens' and 'cutting corners'. People also felt that markets were easily able to be manipulated by large players to promote their interests. In short, participants felt that competition has not lived up to its promises.

Well, we had government-owned electricity and then in the '90s, they decided, "Let's privatize it," and the same with public transport, "Let's privatize it." There is this balancing act. If government owns things, people get slack and funds get abused and blah, blah, blah, and everyone takes it for granted but then when the capitalists come in and take control, then they're always trying - like our aged care at the moment. They're finding out yeah, we handed it over to private people and look at all the abuse. Why? They're trying to cut corners to pay their shareholders.

– Ian, Melbourne

Concerns about privatization were in the forefront of many participants' minds were exploring the question of how they want to be involved in community batteries. As such, major retailers were never explicitly put forward as an ideal institution to operate community batteries.

While many participants were concerned about privatization, several participants took a pragmatic approach to markets being used in energy. For these participants, the government's role was to create a regulatory framework that would create a level playing field to enable the renewable industry to "get on with it".

I totally agree that markets have led to some undesirable outcomes, but we can't reset and we can't go to a place where a kind of large market doesn't exist anymore, so we might as well exploit the fact of markets being there to achieve an outcome that's less bad than increased fossil fuel generation and some of the – as much as I agree that people can get really caught up in entrepreneurialism and thinking this is going to be a big thing, if that's what it takes to get more efficient energy grids, or for more apartment complexes to have solar as part of the Body Corporate investment strategy or – if that's what it takes then fine as far as I'm concerned. If that's what it takes that's what it takes, it's the world we're living in. I'm not happy about it, but I'm happier knowing that at least the mechanism is being exploited for a better outcome.

– Thomas, Canberra

7.1 Retailers are unpopular but citizen ownership is not straightforward

While (for profit) retailers were not viewed as feasible options for delivering community batteries, nor was it viewed as viable for the community to directly own and operate the storage. This is likely to do with a lack of existing templates (or institutions) that people have experienced as successful models of collective community ownership. People provided examples of Strata meetings or local community groups where there were competing views in the room with no agreeable mechanism for resolution. The quote from below shows an understanding that overseas contexts may have developed more sophisticated models of institutions for managing distributed renewable generation such as in Germany.

It's a bit like solar panels. Everyone's talking about community solar panels but but 99.9% are all on people's homes, they put it on themselves. There's no government really involved except for some of the discounts. I think at least with the Australian human nature, it's just easier that way than trying to change people's thinking. We're not Germans.

– Juris, Adelaide

Yet, even if people raise skepticism about community management, they do see citizen involvement, in the design or as an accountability mechanism, as important.

7.1.1 An important role for local councils and nursing homes

So if neither large retailers nor a collection of citizens could own and operate community batteries, what institutional options are we left with? Not for profit retailers, local councils and organisations such as nursing homes and schools were raised as good options for owning and delivering community batteries.

I've always thought that it's an opportunity for local government to step in and run these microgrids. And the regulation and all this sort of stuff. That's what I think would be a preferred solution, and they could even take between communities, basically. I think what they could end up doing is, if it's communities that are doing it, then that can breed some healthy competition, where my local government publishes its details, and the number of citizens were using X amount of carbon. And then there's another suburb that goes "Shoot, we should be doing better than what we're doing," or whatever.

– Yiannis, Adelaide

Participants in Adelaide, Sydney, Cootamundra, Narooma, and Melbourne all mentioned local government as a possible leader of community batteries. The details of this differed. In Cootamundra, people were used to the idea that local council would deliver essential services and could see local council acting essentially as a retailer. In Melbourne, however, people could not see the bill linked model being workable if a local council was involved:

Prishna: I think it comes down to whether they're in charge of the batteries or not. I think if they're the ones providing the service, then it would make sense collating it together but if it is a private person doing it, it doesn't make sense to have the council involved because then it'll be too many people and it'll be another headache of this bill and that bill.

Hedda: Yeah, so you would only want one bill essentially.

Prishna: Yeah. Like when people pay rates, it could come in with that or something that is related to the council, then fair enough but if it's not, then it doesn't make sense.

– Melbourne

For Prishna, and another participant in Sydney, they saw local council involvement essentially about storage from the battery going to service local council buildings. Essentially then, it might be the case that any future savings from using energy from local council could go to either reducing rates, or subsidizing further investment in renewable generation or other community projects.

I could imagine that Ku-ring-gai Council would be interested in looking at certain areas, it might be Council Chambers, I don't know, it might be community hall or community outbuildings. I'm being a bit fanciful, but you do see councils committing to some form of sustainability or renewal.

– Jean, Sydney

Luke in Cootamundra also mentioned nursing homes as a large user of energy that could also be a possible candidate for community batteries:

... the Coota[mundra] Nursing Home here for example, is a community owned co-op, and they've got big power needs. . . And they've been spending a lot of money on alternative power sources for costs and reliability increases. You could see a group like that doing an expanded version of a battery, type thing, to meet their needs, but then offer that to other people as well.

– Luke, Cootamundra

Not for profit, community based retailers were also mentioned by Narooma residents as trusted alternatives for running community batteries. The importance of transparency and a lack of profit motive was underscored by the comment made by one participant in Cootamundra that community batteries could be run by passionate university researchers with no financial stake in the operation of the battery.

7.2 The role of government

The key roles articulated for government felt to be missing in energy in general, and community batteries specifically were:

- Long-term strategic planning involving citizens
- Subsidizing storage technologies to provide an incentive for people to participate in community batteries
- Preventing inequality in access to affordable energy (as has historically occurred with PV policies)

Echoing Future Grid work conducted by researchers at Monash University [8], a number of participants expressed frustration at the lack of long-term thinking on energy policy, displayed

by successive Federal governments. In contrast, one Canberra resident (Karl) expressed relief that he did not have to worry about energy as much because of the ACT government's 100% renewable target. South Australians similarly viewed some state government in positive terms:

... if you look at South Australia particularly, with Jay Weatherill, take the politics out of it, there is somebody who actually saw an opportunity to move down the renewable path, introduced Elon Musk, got the big battery up, and it was laughed at by Morrison and co. Yet it's proven to be very, very successful.

– Steven, Adelaide

Some participants (Cootamundra and Adelaide) bemoaned the influence of the fossil fuel lobby on government policy, arguing that the Federal government is less proactive on renewable energy because they are “making millions” from coal. Only one participant in all focus groups felt that coal was an important part of our near term energy future. Other participants spent some time trying to persuade this participant that coal was no longer as cheap and reliable as it had been historically.

An interesting dialogue occurred throughout the discussion in the Canberra group between using the market to solve questions around technology choice, and a counter argument that market framing has led us to all the problems we face now. The two participants who felt comfortable with the market framing had different backgrounds and concerns. One was worried about public investment going into the “wrong” technology and another had a confident understanding of energy market dynamics so felt he could comfortably participate in energy trading himself. These issues were explored and discussed collectively but no real conclusion was reached in the time the group had. Yet they all agreed that it was refreshing to be able to explore these ideas and have their voices heard. Lisa observed that “a lot of the time the community voice isn't heard”. One participant in particular whose father was an engineer for a utility believed that infrastructure decisions were increasingly being made by “bean counters”, rather than experts guided by the long-term interests of the public.

... in the old days they used to say, “What do you think would be a good idea to make sure this keeps going over the next 30 years?” and then engineers would say this and that and so on, and it was already smart stuff, really long term thinking. Then they cut them all out of the process and everything got changed.

– Paul, Canberra

Just as with energy professionals, householders realised that community batteries could fulfil different functions and purposes. One participant articulated the need for this type of decision to involve a much broader dialogue across society:

I think at the moment energy is seen as very much an individual thing. It's a consumer good if you like, we consume it individually on our properties or in our homes, whatever they are. So it does need to be as Terry was saying, it's a societal shift in the thinking around how we use our natural resources away from electricity. You can have a big five bedroom house, five bathrooms, have all the lights on all the time if you like if you want to and can manage paying the big electricity bills, so that's a choice at the moment. So in order for this [the community battery] to occur as a natural part of Australian communities I think we do need to have a conversation or a real debate about whether we do want to see electricity as a social good, not necessarily just an individual good.

– Margaret, Noosa

Participants had varying levels of concern about access of all householders to renewables. However government was seen as an important player in redressing this problem, through the provision of targeted subsidies. Notwithstanding one participant's concern about public investment in the wrong technology, participants were generally supportive of public investment in renewables and subsidies for groups that would otherwise be excluded.

7.3 What about Networks?

The existence and identity of networks tended to be higher among participants who were solar owners with some interest in the system. They were not highly visible actors to most participants. One Adelaide and Noosa participant was comfortable with the Network managing the battery, as long as they were not the battery owners. Several Narooma participants thought

the Network could be part-owners of the storage. A Noosa participant was aware of network double charging and saw this as an impediment to community batteries being viable. Another in the group believed that Networks with their technical know-how could also own it and trade energy and appeared to have faith that Networks would pass on those savings to customers.

I think [community batteries] would be the most sensible technology way to go, and then whatever savings they make get reflected back in a reduction of their costs. Or they could have a value added service. They're not allowed to be generators, they're not allowed to sell electricity at the moment, but if the rules changed and they could, well then the benefits could flow back to a community.

– Scott, Noosa

Thomas in Canberra, however was not convinced that Networks would pass on savings to customers. Participants did see storage and its connection to the electricity system as highly technical and requiring the input of technical experts which meant Networks were in some ways seen as a natural contributor to maintaining and managing the battery. But there were concerns about whether savings would be passed down, and participants rarely mentioned raised Networks as preferable owners of the battery, given the general preference for the owner to be a third party not for profit institution.

8 Concerns, challenges and caveats

Overall environmental impact of storage

Just like energy sector professionals, householders had concerns and caveats around community batteries as a future technology. By far their biggest concern surrounded issues of access and benefit as outlined above. But another common area of concern was the overall environmental benefit of the storage. Participants were concerned about the lifecycle of batteries and the social and environmental costs of the supply chain. This was a serious concern for many participants. They had knowledge of human rights abuses and environmental impacts of rare minerals and many said they would need to be convinced of the environmental credentials of any proposed storage technologies.

Involvement in community batteries has to be simple

Any involvement in community batteries via one's bill had to be straightforward and simple.

There was no interest or appetite in dealing with retail multiple bills although including it within the rates bill was discussed as being a viable option.

Fire risk associated with batteries There was not widespread concerns about the storage and spontaneous risk of fire combustion and people had enough familiarity with batteries in laptops, phones and cars to feel relatively comfortable with batteries located on their street. One participant suggested that a strong metal casing would be a protection option were it to catch on fire. As long as there were safeguards in place, this was not a concern that people spent too much time discussing.

Maintenance and battery care

Many participants understood that having a battery in the system would need technical expertise for maintenance.

Electric vehicles making community batteries redundant A couple of participants who very engaged in energy issues did have concerns about whether the increase in electric vehicles with two-way (vehicle to grid) charging would make community batteries redundant.

Resolution of complaints

Maintenance was an issue but so was customer resolution. This linked back to governance. One participant asked the question "who takes the complaints when you go, "Just a minute, this doesn't look right." You don't want to have to go online and talk to people for hours." (Julie, Canberra).

Other issues of concern are dealt with in the next section on differences between different demographic groups.

8.0.1 Questions raised by participants

Given the novelty of the concept of shared storage, it is unsurprising that many participants had questions about community batteries. These show the range of questions that people have raised:

- What's the benefit of a community battery as opposed to the giant Tesla battery, or the one that the ACT government announced it's going to buy?

- What size are we talking about for these things?
- What would be the price difference between individual residential batteries and a shared battery?
- How would renters be able to access this service?
- Would this solve our reliability issues?
- Would community batteries be installed by the energy companies or is this a private initiative by a group, or would it be either?
- Is fire an issue with - we've had lots of bushfires recently, we're in fire prone areas, how about bushfire and battery service?
- What will it look like and will it make a noise?
- Who's in and who's out? How is "community" defined?
- Could it emit some electronic waves that might have health impacts?
- Who is managing the build, and to whose benefit is it to, whose software, is it the Network's, is it managing it so everyone makes as much money out of the battery as possible?

9 Differences between demographic groups

There was a surprising degree of overlap of perspectives between and across demographic groups. However, there were some differences between groups that may have some relevance in terms of community batteries interest and acceptance.

9.1 Rural versus urban

Rural people were unconcerned about land availability for the physical location of the storage itself. As already alluded to, rural people were also likely to be more comfortable with the idea of rural councils delivering energy via community batteries since they already had other services such as water being delivered by council. Melbourne participants raised issues of land value – citing petrol stations as already reducing the house/land value of adjacent properties. Urban participants were also more concerned about the possibility of the storage site being vandalised.

9.2 Solar versus non-solar owners

Solar owners liked the idea of their energy going to a specified battery that was serving their local community. Battery owners were also very positive about community batteries, not seeing this as an option that would be in competition with their own residential batteries. In relation to questions of equity, solar owners rarely saw themselves as implicated in driving inequity in the system (bar one participant). They tended to focus on their positive role in the energy system.

9.3 Renters

Participants that were renters did explicitly point out that they are currently excluded from the accessing solar, and saw a community battery as a great option to be able to increase their access. Renters also wondered whether they would be able to participate in this scheme without the explicit consent of their landlords. Clarity around accessibility to renters would be very important. Non-home owners also reported needing to see bill savings immediately. Unlike home owners who could see the return on their infrastructure investment over time, renters who may need to move in a short space of time were keen on any bill savings from the storage scheme to be seen immediately.

Well, right now for example, the house I'm living in, it just got sold and we've only lived in it for two years now. It's a townhouse. So, if you tell me, "Would you like the subscription and further down the line, your power bill is going to reduce," for me, that's not going to make much of a difference because I don't know how long I'm going to live here.

– Aram, Melbourne

9.4 Apartment dwellers

One participant mentioned that notwithstanding some challenges around making decisions in body corporate contexts, people that buy into townhouses are used to the concept of having shared resources. Particularly in the case of new builds then, a shared battery for townhouse complexes could be a good model, as it is not too different from what people are used to already.

I would've thought it would've been a fantastic thing to have built in originally. The retrofitting is always a bit awkward isn't it, but I think it's a great idea for particularly units into the future just building it into the cost of development.

– Jean, Sydney

9.5 Younger generation

While the overall sample within the focus group was on the older end, a couple of younger participants provided a clue that younger generations may have slightly different nuances in terms of their view of shared storage. In answer to questions about sharing their battery to non-participants of a shared storage scheme, Sky, indicated the following:

I always want to help someone else. I think this generation is very 'let's put ourselves aside and help each other and all grow together' rather than individual, "You climb up the ladder, I'll be at the bottom." We all want to work together and make it a better place. Plus, right now with all the environmental stuff, we have to work together. We don't really have much of a choice.

– Sky, Melbourne

In our sample, it seems younger people may be even more favour of collective solutions than older generations, particularly if home ownership proves to be increasingly elusive. Further research into younger generations perspectives may reveal more rich information on this topic.

9.6 Indigenous participants from the Kimberley region

The Broome focus group was facilitated by two researchers from the Nulungu Institute (Notre Dame University). Indigenous householders in the Broome focus group were also highly supportive of renewable energy as a direct result of personal experiences. Many remote communities have experienced improvements in energy access and affordability since the Bushlight program [Bushlight was a renewable energy program managed by the Centre for Appropriate Technology from 2002-2013, during which over 130 renewable energy systems were installed across remote NT, WA and QLD]. In remote Aboriginal communities, solar systems have meant

people can live more safely, securely, and flexibly compared with the earlier times when they relied exclusively on diesel generators.

Householders were well aware of the lack of solar access in Broome, and believed there should be greater choice for householders to access solar PV. The local distributor - Horizon Power - has been unable to accept recent applications for PV installations because of network constraints. Horizon Power has been actively exploring solutions to this problem, including a community battery option (something we only learned about after we had already selected Broome as our focus group site).

Due to their extensive experience directly managing solar and battery technologies, participants were highly aware of the need for ongoing maintenance of these technologies. They have also experienced different third parties who were contracted to maintain these systems and had a clear preference for regular and responsive maintenance. The quote below demonstrates the in-depth knowledge that some participants have had to develop to manage their own communities systems, in a safe way:

What you do is you kill yourself if you don't know what you're doing simply as that. So number one I check the batteries the wet season, I use gel that works for me, you need to check the water every month keep the water up in your batteries, only use distilled water not tap and this is where a lot of people go wrong just get water out of the tap and put it in then it's going to bugger your cells up you know so it's gotta be distilled water, there's another cost to the people. You need know how to shut the system down uh so you can clean the thermals, if you get corrosion in the thermals you need to clean them up properly, this means hosing the system down, isolating the positive and negative

– Rex, Broome

Like participants from other focus groups, participants wanted any community model scheme to be very simple and easy to understand and not to contribute to bill and payment complexity (something that has historically been a significant problem, see [3]).

Participants held strong preferences for models which would provide employment opportunities for community members, especially those with the capabilities to carry out the servicing and maintenance, rather than relying as much on external providers. They also sought to understand how a community battery could be used to service large remote communities, who did not

already have the Bushlight systems. They identified the importance that community capacity (such as good governance) and readiness would be in engaging with opportunities to develop suitable energy plans, acknowledging that some communities face increased challenges compared to others and may need longer lead times and more support. Critically, participants identified the importance for information and planning to be designed for communities for building energy literacy.

Outside of the question of community batteries, and critical to the Kimberley context, participants believed that large renewable energy investments from outside the region should ensure that local communities can achieve highly subsidised, if not free, power for communities.

Finally, participants did not raise any practical concerns in terms of noise etc. Many of the communities have lived experience of being in the vicinity of conventional power stations and close to noisy diesel generators for many years, and typically this does not raise any specific concerns.

10 What role could community batteries play in an outage scenario?

The community focus groups explored the follow question in relation to usage of the shared battery in an outage scenario:

If you were part of a shared battery scheme and there was a power outage, would you be ok with the battery providing power to everyone? The small capacity of the battery means it wouldn't be able to service everyone for a long time. Or, perhaps you could elect for it to power critical, vulnerable or community spaces such as a nursing home, or local library?

– Facilitator

Overall, people were relatively happy with the idea that they could share the battery with non-participants in the scheme, particularly vulnerable groups. "I think it'd be hard to argue against giving it to people who critically needed it." Broome participants held no concerns about this idea. At the same time, some participants also saw that being a subscriber should also entitle

them to have 'first' access to the battery, and the other groups could then also access as summarised in this quote:

I'm not a selfish person but I would look at it from a selfish perspective that, well, initially the reason I've done it is to compensate for my usage at night time, so I'd expect that to be the first port of call. Then my second port..., okay, let's put it in the vulnerable environments, such as the hospitals and whatever, then that would make a whole lot of sense as well. So you may have several tiers of how much is available.. so it's kind of like a drip down effect from that perspective.

– Steven, Adelaide

Claire, a battery owner in Adelaide also articulated the need for these types of decisions to be situated within the context of developments in other policy domains, for instance health care. With a push for 'home based' care, vulnerable groups might be more distributed spatially, rather than concentrated in hospitals and nursing homes. Likewise with trends associated with working from home. It is possible that reliability will become more important for particular groups. Claire alluded to a precedent in terms of the NBN policy where rural people get priority of access:

I was just thinking now about there are people, for example, that are home on ventilators and stuff like that, but they're not in hospitals. There's pushes in the public healthcare system for home care, and so again, if you were to set this, "Okay, which places get priority?" I also know that with the NBN rollout there was a bit of a thing, of saying, "People that have all the rural needs at home need special consideration for the NBN rollout, because it's going to cut some landline things." So, even though we might only need five percent or something, because we don't have super special needs in a blackout or whatever, and frankly I think my toddler would think it was fun if we had a couple of candles and cold dinners, I definitely think that the same shouldn't necessarily apply to everyone, because there might be people with special needs.

– Claire, Adelaide

Whatever the decision, one participant said it had to be clear and not re-negotiated for each outage. This same participant suggested if there was additional revenue from the battery operating in an outage, that this revenue could go to "bulking up the battery further" so that more

people could get involved.

Like Sky above who said that she had no problem with the idea of sharing a battery, many participants spoke of the solidarity that Australians demonstrate when there is a natural disaster. This anecdote is an illustration of the potential for community coming together during an outage:

When the power went out in South Australia five years ago or whatever, we had that big cyclone. We were trying to get food... just down the road here. There was nothing open, no ATMs, there was no power... There was one place open and it was a wood fired pizza place, wood oven fired pizza place. It was chock-a-block, they didn't have EFTPOS, we didn't have any cash, people lent us money, they gave us money to buy a pizza. It was the most amazing community experience and I'll never forget it for the rest of my life.

– James, Adelaide

11 PART 3: Community vs Energy sector: How do their views compare?

The final section of analysis presents a summary of points of overlap and points of tension between different groups within the energy system. This analysis provides a sense of how the debate may evolve and issues that need consideration by policy and decision makers.

11.1 Overlaps

Benefits

- **Government** and **householders** emphasise importance of affordability and increasing renewables
- **Networks** and **PV owners** emphasis the need to maintain grid stability
- **Consumer advocates** and **households** who see the potential for community batteries to build social capital
- **Householders** and **energy sector professionals** concern about maintenance

- **Householders** and **energy sector** not overly concerned about fire risks - is able to be managed
- **Consumer advocates** and **Householders** concerned that any issues with community batteries able to be easily resolved (importance of accountability and easy resolution of issues)

Risks around community involvement

- **Householders** and **Networks/Government** concern about community managing the battery
- **Consumer advocates** and **householders** question the capability of retailers to deliver storage models in the community interest

11.2 Points of disjuncture

- Some sectors of the energy sector and some householders who have different views of the role of the market and government in terms of leading and managing storage models

12 Policy implications

The regulatory framework in Australia favours the uptake and deployment of behind the meter (largely residential) storage. This is despite the fact that there is no technical evidence that smaller systems are more beneficial to a sustainable energy system. Given the success of residential PV uptake in Australia, it is understandable that many policymakers at the State Government level have been encouraging the uptake of residential storage. Yet, energy sector professionals in this study do believe that community storage has numerous benefits, including many that cannot be achieved through even aggregated residential storage. The following policy implications are sketched out as an exploratory conversation starter.

A number of policy implications emerged from the analysis in this report including:

- Trials and sandboxing are needed to resolve key questions about the potential costs and benefits associated with (a) community batteries models and (b) how these compare to other options. Trials should include exploring institutional innovations that trial different forms of ownership and management that can deliver genuine benefits to all householders, including those that cannot currently engage in DER.
- Overarching guidelines could be developed for local councils, networks, community groups and retailers on what types of storage business models may suit different contexts.
- There is a need to clarify the regulatory framework for organisations interested in pursuing community batteries. Regulations need to be flexible to adapt to the different purposes that community batteries may be designed for, without compromising safety, equity and consumer protection.
- There is a potential for network maps to 1) increase visibility of locations for potential investment in community batteries; 2) enable the community and policy makers to identify which Networks are already actively supporting such models and which are still lagging (and may require more support). Network mapping should be done in a standardised form to enable comparison across networks and be built on early work that has been already conducted (e.g. the AREMI National Map project).
- Policymakers could evaluate options for how Networks can be turned into active facilitators of community energy solutions. For example, policymakers could explore ways that networks could be further incentivised to realise network solutions that also have community benefits.
- Without clarifying the role of energy storage, certain models would be subject to double charging of DUOS and thus remain a niche with limited potential for growth.

- Standards need to be developed for installation and maintenance of storage assets.
- Guidelines for involvement of local emergency services in managing any potential hazards associated with fires.
- Clear policy guidelines around managing any other material risks of storage identified in this report.
- Clear guidelines and institutional mechanisms for resolving the potential for different conflicts in potential value streams associated with the battery. Further research on how these may relate to operational models and their respective associated objectives.
- Clear pathways and assurance for end of battery life management is needed to ensure that storage does not become an expensive and hazardous material.

13 Appendix 1: Background and methodology

Social acceptance of new energy technologies is an interdisciplinary research field that is of increasing interest to researchers and practitioners alike. In our project, we draw on a well-known framework for understanding new energy technology acceptance originally developed by researchers [10]. The framework conceives of social acceptance as a process in which actors and organisations across three dimensions negotiate and influence each other to take up (or not to take up) energy innovations: 1) governance and regulation; 2) markets and innovation; 3) socio-cultural and public acceptance.

A key assumption of our framework is that understanding the views and belief systems held by different groups in the energy system is critical for ultimate social acceptance of energy innovation.

In order to understand the perspectives of various people across the three dimensions we have developed a series of qualitative research activities involving 1) interviews with the project partners; 2) focus groups with key decision makers across government and industry; and 3) focus groups across a diverse section of the community.

The purpose of the project partner interviews was to gain an understanding of the perceived regulatory, social, technical and practical barriers and opportunities presented by different proposed shared local battery models. The models for community involvement we explored with project partners were abstract enough to enable exploration of the spectrum of different models of community involvement. The two models we explored in interviews with our project partners were: 1) community as investors and 2) having a shared battery as linked to a customer bill.

The project partner interviews were conducted between 9 July and 6 August in person in Canberra and Hobart or by phone/Skype. Our project partners are: Yurika, Totally Renewable Yackandah, Repower Shoalhaven, Enova Community Energy, Evoenergy, Energy Consumers Australia, TasNetworks, Thinking in Colours and Energy Networks Australia. In addition, we also interviewed an interested program stakeholder from Essential Energy.

The project partner interviews were conducted as the first phase in the social research component of the project. The next phase has involved revising the research questions based on findings from the project partner interviews to explore for discussion with key decision makers across industry, government and community (as focus groups).

There are several limitations to the methods we employed in this study. Firstly, the analysis we present is one of 'point of time'. It is possible that participants in this study have since changed their views on some of the points discussed. We have addressed this to some extent by asking participants to review the first draft of this report to add any new layers of analysis that we may have missed or to point out points on which they may have changed their mind on. Secondly, focus groups, especially in the context of professional may sometimes not be an arena in which participants are able to be as frank as they might like. Participants work for organisations that often have public positions on topics under discussion, which, participants may fear to contradict. We have been able to mitigate this to some degree by holding both focus groups and interviews. Our 9 interviews provide an additional source of data by which to triangulate the sorts of views expressed in our focus groups. Interviews in which anonymity is guaranteed generally tend to be a method that provides an opportunity for participants to speak openly about concerns and issues they may be less comfortable articulating in a focus group setting.

Below is a high level summary of the themes that emerged from the interviews. This is a descriptive overview, rather than an analysis of the findings.

13.1 Research activity 1: Overarching themes from project partner interviews

1. While there is consensus that, on paper, there is considerable value that can be unlocked from community batteries, partners believe there is a need to pilot different storage models in real life contexts to demonstrate the value and convince others that they will work. In addition, from the network view, there is a further need to test these models on their individual networks. Data from such trials, as well as data from modelling would be needed to demonstrate the value stack to potential investors.
2. Unsurprisingly, currently, the economics of in front of the meter storage do not stack up. Network charges + cost of batteries are key challenges.
3. Community energy groups among our project partners are very strongly supportive of local energy generation. The term "energy sovereignty" was used to capture this concept of valuing local generation linked to local consumption.
4. Project partner networks appear willing in spirit to engage in community batteries models. However there are some challenges that include: ring-fencing; culture in which the ring-fencing rules provides a barrier for people internally to consider work-arounds; lack of internal capacity to manage the risk of this new/unfamiliar asset; the requirement to work

with multiple actors (as opposed to resolving the constraint by themselves); and some regulations such as the exclusion of 'natural events' as part of reliability reporting, making it hard to make the business case for precinct batteries in terms of improving reliability. Some participants believed the heart of the challenge is that networks require a cultural change to resolve the challenges just identified.

5. Views on the community investment model included: 1) If payment is required upfront, this could exclude certain consumers (one option around this is that consumers may pay off their 'slice' gradually, and then see a bill savings once the slice is paid off); 2) that this model would be a niche market because what drives people to invest in batteries is taking control of their energy bill; 3) views this as providing opportunity for people to engage in 'energy sovereignty', 4) if aim of model is to maximise profit, it would exclude network considerations which is a problem for the network (networks may be more likely to push boundaries of operational envelope if they are involved in managing the asset).
6. Views on the customer bill linked model: 1) Any dynamic form of shared battery use is challenging, because "complexity is a killer". Shared battery business models need to be very simple; 2) community energy needs to harness the sense of 'greater than the sum of parts', or it doesn't fully harness the power of the community; people value knowing where their energy is going.
7. General thoughts on models: One participant made that point that either model could "tick" the customer perception box depending on how they are structured. In the future, there will likely end up being a bunch of variations of these two models. Yet another said that the high transaction costs of designing new models means we should only have three 'archetype' models for different contexts. There was a theme that particularities of network constraints + geography + community profile mean that different models/types of storage technology will suit different contexts.
8. Regulatory changes: Concern that winding back postage stamp pricing on network charges could worsen situation for 'have nots' who may be excluded from community energy. Prefers idea of pulling of remote area systems to reduce overall network costs. One interviewee saw community-scale as attractive to actors like AEMO as it reduces the number of distributed resources to manage.
9. Practical matters for local energy storage: High cost of battery; high land prices in urban infill; aesthetics and how that intersects with the best location electrically for the storage to sit; NIMBYism (can be overcome depending on how community is engaged); if lots of parties involved in managing asset and they each take a 'clip' along the way concerns

about savings for customers; Batteries would need to be aggregated to at least 1MW to be able to participate in FCAS market and access that part of the value stack.

10. Local energy sharing is an opportunity to improve energy transition equity. Some partners concerned about privatisation, marketisation of energy system, and community involvement in storage assets is seen as a possible way to redress these concerns.
11. Generally, community energy driven by grassroots groups do present challenges because people get exhausted/move away/struggle to attract financing etc. Although it's also worth noting that the benefits and opportunities of community involvement in energy have also been well documented. Some interviewees made point that "community involvement" in community batteries could work without the asset being directly owned by the community, but that the benefits could be redistributed, and that community could still be represented in governance arrangements.

14 Appendix 2: Energy Sector professionals

Name	Sector	Gender	Details
David	Government	Male	Federal government
Paul	Network	Male	
Terry	NGO	Male	
Sean	Government	Male	State government
Julia	Network	Female	Peak body
Lucy	Government	Female	State government
Sajith	NGO	Male	
Sam	Network	Male	
Daniel	Network	Male	
Aarush	Retailer	Male	
Gary	Government	Male	Local council
Ian	Network	Male	
Kate	Network	Female	Project partner
Paula	Network	Female	Project partner
Kylie	Government	Female	state government
Nick	Commercial arm of network	Male	Project partner
Bridget	Community energy retailer	Female	Project partner
Pete	Network	Male	Project partner
Lucas	Consultant	Male	Project partner
Tom	Community energy	Male	Project partner
Andrew	Community energy	Male	Project partner

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