Cost Benefit Analysis of options to collect and share information about small scale battery storage

Energy Market Transformation Project Team

Consultation paper

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22 May 2017

2000001105

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Project No:	RO075500
Document Title:	Consultation paper
Document No.:	1
Revision:	0
Date:	22 May 2017
Client Name:	Energy Market Transformation Project Team
Client No:	2000001105
Project Manager:	Liisa Parisot
Author:	Liisa Parisot/ Michelle Freund
File Name:	\\Jacobs.com\ANZ\IE\Projects\04_Eastern\RO075500\Working Folder\CBA report\Jacobs CBA report_Consultation paper for battery storage register 22May2017.docx

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Document history and status

Revision	Date	Description	By	Review	Approved
1	19/5/2017	Draft consultation paper	LP	PR	LP
2	22/4/2017	Consultation paper	LP	MF/EMTPT	LP

Contents

Responding to this consultation

Submissions are invited on this consultation paper by close of business, **Friday June 9th**. Electronic submissions are preferred and can be sent to the COAG Energy Council Secretariat at energycouncil@environment.gov.au.

Those who wish to provide hard copies by post may do so by addressing their submissions to:

COAG Energy Council Secretariat GPO Box 9839 Canberra ACT 2601

All submissions will be published on the Energy Council website (www.coagenergycouncil.gov.au) unless stakeholders have clearly indicated that a submission should remain confidential, either in whole or in part.

Please note that this paper does not provide legal advice about any of the laws discussed in it, and it should not be relied on for any purpose. It is intended as a consultation paper only. It does not reflect the final views of officials or Energy Council policy.

The Energy Market Transformation Project Team consists of officials from the state, territory and Commonwealth agencies with responsibility for energy policy. It operates under the COAG Energy Council framework.

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Disclaimer

The primary purpose of this report is to provide a high level summary and consultation briefing to stakeholders on the scope, methodology and results of a Cost Benefit Analysis of a potential Energy Storage Register. This report is to be read with more detailed reference to Jacobs' Cost Benefit Analysis report for a battery storage register available here.

During the preparation of this report Jacobs collected data and advice from stakeholders through interviews, previous submissions to the Energy Market Transformation Project Team (EMTPT) discussion paper and through advice and collaboration. This information may have been relied upon and presumed accurate for the purposes of preparing the report. Furthermore, many of the assumptions used to estimate the benefits of a potential database have been derived from publically available sources (described where relevant), and have been relied upon and presumed accurate. In the future, manifestation of latent conditions may cause changes in assumptions that may require the report to be re-evaluated. Jacobs does not provide a warranty/guarantee (expressed or implied) to the data, observations and findings in the report to the extent permitted by law.

The report is to be read in full with no excerpts to be representative of the findings. The report has been prepared exclusively for the EMTPT and no liability is accepted for any use or reliance on the report by third parties.

1. Introduction

Jacobs Group (Australia) Pty Ltd (Jacobs) has been commissioned by the Energy Market Transformation Project Team (EMTPT) to undertake a cost benefit analysis (CBA) of options to collect and share information about small-scale battery storage.

The objectives for developing a register include the primary objective of improving the power system and network security, and to protect the safety of consumers, line workers and installers, as well as the secondary objective of supporting emergency services, for example when responding to a fire or another incident at premises where a battery is installed.

The EMTPT released a discussion paper on 19 August 2016 to test stakeholders' views on the need for a national register. While most stakeholders indicated broad approval for the stated objectives for a register, there were concerns about whether the costs of developing and maintaining the register (including those which may ultimately be imposed on system owners, tax payers or electricity customers), will outweigh the benefits. In particular, electricity retailers were concerned that requiring battery systems to be registered would add costs and complexity to an emerging industry. The purpose of the CBA is to ascertain whether there will be an economic net benefit associated with the register.

Jacobs' CBA report (refer here) provides the scope of the CBA, the methodology applied and the draft results. It also provides a discussion of the assumptions used and remaining information gaps to seek clarification and additional input from the EMTPT and other stakeholders prior to finalisation of the results. This document should be referred to for further detail on any of the issues and commentary raised in this report.

The identification and assessment of options was undertaken following targeted stakeholder consultation to gather stakeholder views, data and information on:

- The most appropriate option(s) for a national battery storage register. This included discussing the potential host of the register and data collection process, and the integration (where possible) with existing processes
- The benefits that would be expected as they relate to the primary and secondary objectives listed in the discussion paper. Where possible, stakeholders were also asked for data and input to support the quantification of these benefits within a CBA
- Potential costs associated with the different options being considered. This included, but was not limited to costs of setting up (or expanding an existing) register, ongoing register support, collecting data, sharing data (e.g. managing access, privacy compliance, etc.), and incorporating flexibility/scalability to allow for future expansion to cover a range of distributed technologies and systems.

The information collected from the stakeholder discussion was supplemented with desktop research and analysis.

1.1 Study limitations and exclusions

The CBA includes a high level assessment of the costs and benefits based on an indicative scope of all the options being considered. It is assumed that following the completion of the CBA, once the preferred option has been selected, detailed scoping and design will be used to provide a more comprehensive cost estimate. Some of the issues that would need to be considered further as part of more detailed design consideration are discussed in this report.

The assessment also excludes:

- Consideration and assessment of funding options for collection of data, development of the database and operation of the database
- Consideration of cost recovery options (e.g. options for membership fees). It is understood that the distribution of costs and benefits will inform future consideration of cost sharing or funding approaches.

2. Database hosting options

Two hosting options were evaluated; one in which AEMO hosted the register, and a second in which the CER hosted the register. The cost of a third hosting option where networks host individual databases and supply information to AEMO was not explicitly quantified in the study as it was demonstrated to be prohibitive in cost. Both hosting options are widely accepted by stakeholders.

These options were compared to a base case in which:

- There would be no further investment in a national register
- AEMO would continue pursuing and eventually installing a separate real time database, but this would not be complemented by complete and reliable static information
- Distributors would continue to enhance and develop their own databases, but because of data collection issues would only collect around 30% of new storage installations, consistently understating available storage capacity in their projections and operations.

We also assumed that the CER database would not be able to collect PV data from 2024 because of reduced incentives[1] to consumers to provide information, and that privately run databases would not be developed to a level exceeding present arrangements. Furthermore we assumed that national safety standards would be adopted.

2.1 Option 1: A national register administered by AEMO

Table 1 summarises the advantages and challenges associated with this option which would need to be considered further.

Table 1: Summary of pros and cons of AEMO hosting the database

Advantages	Challenges
• AEMO has the skills and experience to manage and host the database • AEMO has an existing register to collate, aggregate and analyse data that is accessed from the DNSPs. This database could be used as a platform for the new database (though noting that the significant amendments and expansion will be required) • AEMO is an independent market body who has already addressed privacy concerns in their existing database platforms • AEMO's existence is not subject to government funding or policy position • AEMO, as the host of the register, requires the greatest granularity of data. This reduces the risk of privacy issues being compromised; noting that access by other users will be limited through use of specified portals • AEMO would be the primary user of the data being collected. This would help ensure that data is stored and managed in a format that is most beneficial for its key purpose. It would	• DNSPs would still require their own databases for their operational needs and their own data collection processes, leading to potential duplication costs • AEMO does not currently have the power to collect information, only the power to access information. Without a change in powers, AEMO would still be required to rely on DNSPs to collect the data on its behalf. This change in powers would require regulatory change • AEMO does not currently have the regulatory remit to supply detailed data to non-market players. It is, however, possible for AEMO to provide a portal for aggregated data • CER believed it would still need to maintain its existing STC database and potentially its data collection processes, leading to inefficiency costs for installers as well as CER. (As discussed in more detail in the CBA report, there are ways in which these costs could potentially be reduced and options to do this should be investigated in the design phase) • AEMO would need to expand[2] its database to possibly include off-grid and/or minor grid applications[3].

[11] Small scale PV owners and installers are incentivised to register their systems under the Small-scale Renewable Energy Target (SRET). The incentives under this scheme are gradually reducing each year and by 2024 there is an expectation that these incentives are low enough that registrations will slow significantly.

[2] System planning is not relevant to off-grid applications, but health and safety issues or regulatory compliance requirements may require information to be held for off-grid applications.

[3] AEMO only monitors major grids, including the NEM (the national energy market located in the eastern states of Australia) and the SWIS (the south west interconnected system located in the south of Western Australia). Horizon Power in the north of Western Australia has advised Jacobs that they already collect and collate PV and storage data so a register is unlikely to be needed for this region. Jacobs is unaware of collection and collation ability in other minor grids such as the Darwin-Katherine interconnected system or Mt Isa.

Advantages	Challenges
also allow for the database to be updated and refined over time if AEMO's needs changed over time • AEMO already has database interfaces with DNSPs, which would reduce the cost of transferring data to them (i.e. reduce costs of harmonisation)	

2.2 Option 2: A national register administered by CER

This option would involve CER expanding its existing STC database to include other DERs, and to capture a more extensive dataset than what is currently being collected. Table 2 summarises the advantages and challenges associated with this option which would need to be considered further.

Table 2: Summary of pros and cons of CER hosting the database

Advantages	Challenges
• CER has the skills and experience to manage and host the database, based on their current STC database experience • CER has an existing register which could be amended and expanded to include other forms of distributed generation other than PV as well as more comprehensive data on PV systems (if needed). This may reduce the development costs and speed up the availability of the register for general use. • CER has an existing PV data collection process that is understood and used by installers. It has also invested in new processes to improve the efficiency and integrity of data collection (e.g. the Serial Number Validating Project) • CER has invested significant time and effort in establishing relationships with installers and agents and establishing processes that are well integrated with other industry processes and jurisdictional requirements • CER is more easily able to supply aggregated data on PV systems to non-market players than AEMO • CER has established processes for dealing with jurisdictional regulatory and safety bodies to ensure compliant connection processes are in place • CER's database has an established channel with AEMO that has been developed over two years. Currently, information is updated on this channel every three hours • CER is an independent government body with appropriate protocols in place to address any privacy concerns	• CER does not have the regulatory remit or the processes to collect data for non PV systems. Additional regulatory changes may therefore be required • CER's ongoing role and existence is not guaranteed. It was established on 2 April 2012 as an independent statutory authority by the *Clean Energy Regulator Act 2011* and presently collects information on PV connections under the SRET. Its continued existence and ongoing role beyond the RET scheme is subject to future government policies and funding decisions • CER's capacity to manage technology based or other market based changes that might be required for AEMO or DNSPs on an ongoing basis may be problematic given their distance from operational market management issues

Discussion points:

Which of the advantages and challenges listed in Table 1 and Table 2 provide the most compelling reasons for choice of host? Why? Which host would stakeholders prefer? Why?

Can stakeholders identify any other challenges or advantages for each option?

2.3 Information requirements

Information requirements for the register are listed in Table 3 which describes the required and available information by user category. We expect that users in different user categories will be able to access data at the required/approved level of granularity through the use of a data portal.

Table 3: Portal characteristics

Portal users	Granularity of data needed	Purpose of access
AEMO	• NMI identifier • Installation date • Decommissioning date • Manufacturer make and model number • Capacity • Performance derating (desirable but not critical) • Device part of aggregated control • Trip setting (inverters) • Enabled mode of operations (inverters)	• Dispatch power system security monitoring • Contingency planning • Forecasting and planning • Short term planning and operation • Management of load balancing including load shedding and potential system shutdowns resulting from large withdrawals of capacity
DNSPs	• NMI identifier (or postcode) • Installation date • Decommissioning date • Manufacturer, make and model number • Capacity (continuous kW and storage kWh) • Performance derating (desirable but not critical) • Device part of aggregated control • Trip settings (frequency and voltage) • Enabled mode of operations (inverters) • Demand side participation contract • Customer details - customer name, phone number, mobile phone number and an email address (preferred)	• System islanding[4] to allow works on local networks and improve occupational health and safety risks • Assist networks with development of proactive rather than reactive planning • Enable a strategic approach to upgrading the network • Reduce capacity upgrades • Build up heat maps to enable reduced forecast spend • Improve understanding of demand behaviour • Improve ratio of spending against quality of supply rather than quantity of supply
Emergency response agencies	• NMI • Address • Contact details • Existence of battery • Battery type and make • Chemical composition • Capacity	• To identify and prepare for potential risks prior to arriving at an emergency (unconfirmed)
Policy makers, researchers, consultants and market investors	Aggregated data only (by postcode, statistical area or zone substation): • Technology • Capacity	• Undertaking strategic policy studies to enable market transitions to low carbon technologies, undertake impact analysis of existing or potential policies or review existing market programs • Assess stranded asset risk for new market asset acquisitions, development or power purchase agreements

[4] May require regulatory change

Discussion point:

The stakeholder review indicates that a storage register would require a wider data collection net than available under present approaches which may not be uniform across all jurisdictions. Most stakeholders agree that the optimal source of information would be at the point of installation, so if a register went ahead installers would also be required to provide information on any system that is capable of exporting power to the grid, regardless of size or whether the network was to provide a service in relation to that system.

Do stakeholders see a more efficient approach for collecting information from this wider set of equipment categories?

Do stakeholders agree on the required degree of information needed and the need for various stakeholders to access the data shown?

2.4 Change to regulations

Discussion point:

A regulatory approach has been proposed because there presently are no proposed incentives for reporting. Some stakeholders identified regulations that would require amendment if a register were to go ahead. These include:

- Plumbers, Gasfitters and Electricians Act, 1995 (PGE Act) in South Australia, so that the definition of electrical installation does not allow non licensed electricians to install batteries
- Each of the following to require installers to provide requested data to a battery register host:
  - The Electricity (General) Regulations 2012 made under the Electricity Act 1996 (South Australia)
  - The Occupational Licensing Act 2005 (Tasmania)
  - Electricity Safety (Installation) regulations 2009 made under Electricity Safety Act 1998 (Victoria)
  - Electricity (Consumer Safety) Regulation 2015, Electricity (Consumer Safety) Electricity Act 2004 (NSW)
  - Electricity (Licensing) Regulations 1991 made under the Electricity Act 1945 (Western Australia)
- Australian Standards AS/NZS 3000 (Wiring Rules), to require that information from a wider collection of installations and equipment is required to be given

Are there any other regulations that would require amendment? Is it possible to quantify the cost of a single regulatory change?
Are there any issues with changing these regulations to capture batteries?

3. Cost benefit analysis approach

Cost Benefit Analysis (CBA) is a quantitative tool for assessing the economic viability of a project or policy. In order to assess the economic viability, the CBA attempts to value all costs and benefits relative to the base case (i.e. 'business as usual' scenario), in monetary terms. This includes valuing all market and nonmarket economic costs and benefits. Where it is not possible to quantify an impact in monetary terms, there is scope to discuss it qualitatively.

The key outputs from a CBA include:

- **Benefit cost ratio (BCR)** – a ratio of all the quantified direct benefits and costs (relative to the base case) associated with each option. A ratio greater than one indicates that the benefits are greater than the costs and that the project is economically viable
- **Net Present Value (NPV)** – the present value of the net benefits associated with a project (i.e. present value of the benefits less the present value of the costs). The option with the highest NPV delivers the greatest benefit, and subject to financial constraints is generally the preferred option

In a CBA, the totality of the costs and benefits are used in the analysis. This type of analysis is commonly presented in terms of costs and benefits to 'society' or the 'community'. The impact on a defined group is provided in a distributional assessment.

3.1 Summary of costs and benefits considered

Table 4 summarises all the costs and benefits relevant to the assessment and outlines whether they are quantified in the CBA or discussed qualitatively. Some of these costs are aggregated in their estimates, but have been listed separately for the purpose of demonstrating that they have been considered.

Table 4: Summary of costs and benefits

Cost/ Benefit	Quantitative	Qualitative
Cost		
Project establishment costs		
Initial hardware development or adjustment costs	✓	
Data collection systems development	✓	
Ancillary database adjustment costs		
Policy and design consultation	✓	
Legislative and regulatory amendment costs		✓
Training costs	✓	
Operation and maintenance costs		
Operation costs and maintenance (data management, data access)	✓	
Data collection costs	✓	
Data validation costs	✓	
Compliance costs (auditing)	✓	
Competition costs		
Market barriers to private sector businesses developing competing databases		✓
Benefits		
Market benefits		
Medium to longer term planning	✓	
Non-critical contingency example – the 2028 solar eclipse	✓	

System reliability assessments		✓
Power system security monitoring and contingency planning		✓
Central dispatch process		✓
Safety benefits		
Safety benefits to industry workers		✓
Safety benefits to emergency service workers and the general public[5]		✓
Improved fire risk management (e.g. training and resource location)		✓
Other benefits		
Innovation benefits (new market players from improved information)		✓
More informed policy decisions		✓

3.2 General assumptions

Table 5 lists the general economic assumptions used in the CBA model.

Table 5: General assumptions

Assumption	Definition
Geographical scope	The study is intended to cover grid operations in WA and the NEM
Study period	The study will evaluate costs and benefits to 2030. This allows for one year of implementation (2017/8) and 12 years of operation. This assessment period is considered to be reasonable given that technology usually has an economic life of 10-15 years.
Discount rate	Net benefits will be evaluated using a discount rate of 7%, based on the Infrastructure Australia guidelines. We will also test the sensitivity of the results to a change in discount rate (4% and 10%). All costs will be discounted to 2016/17 dollars, year 1 of the assessment period.
Database implementation period	12 months – commencing in July 2017
Design life	The design life of PV systems is assumed to be 30 years. The design life of batteries is shorter and assumed to be 10 years. In estimating timing of retrofits, it is assumed that main uptake of PV systems occurred from 2005, meaning that any retrofits would be outside the assessment period. For batteries, uptake is assumed to commence in 2017, with retrofits commencing in 2027. Degradation of capacity has not been explicitly modelled.
Data capture on national register	The national register is assumed to capture 100% of new PV systems and batteries as well as any retrofits.
Assumed end date for Small-scale Trading Certificates (STCs)[6] and therefore the reliability of the STC register[7]	It is estimated that PV data will be less reliable from 2024 when incentives are much lower than at present. It is assumed that under the base case, the STC database and associated PV data collection continues to 2024. Whilst it is reasonable to assume that from 2024 the reliability of the register will gradually decrease, as a conservative estimate, a simplifying

[5] There is presently insufficient information available to assess all of these benefits quantitatively, as risks include fire and electrocution from flooding. A high level indicative assessment of fire risk is provided

[6] Installation and registration of small scale PV will trigger creation of STCs under the Small-scale Renewable Energy Target (SRET). The sale of STCs creates an incentive for consumers to uptake PV because the value of STCs offsets the capital cost of their PV system.

[7] The STC register is the database maintained by CER to monitor and manage the SRET. It includes a range of information about creation of STCs including customer NMI, system size, manufacturer, etc. CER maintains a public version of the database on their website.

Assumption	Definition
	assumption was made that the data stops being collected under the base case from 2024 onwards. This is a conservative assumption that suggests that any collection costs incurred beyond 2024 (under Option 1 and Option 2) are incremental relative to the base case.
Combined installation of batteries with PV systems.	Projections of PV and battery uptake were developed using Jacobs' proprietary modelling which considers technology costs and operating parameters, market policies and local factors including existing uptake, insolation levels, population growth and upper constraints on uptake. Our modelling approach presently assumes that batteries will be installed at sites where PV already exists, based on the economics of uptake.
Base case data capture	It is assumed that with current processes: • 100% of new PV system installations are captured in the STC database and on DNSP databases up until 2024 • 30% of new battery installations are captured[8]
Benefits	Benefits of a register would be equivalent for each register hosting option under consideration.
Requirements for accreditation of installers	The CBA assumes that requirements for accreditation of storage-system installers are a separate issue outside the development of an energy storage register.

[8] During stakeholder discussions Energy Queensland (which combines the networks formerly known as Ergon Energy and Energex) estimated they thought they were only capturing data for 30% of installations using the connection notice approach. As the Queensland network operators are considered to be relatively advanced in their data collection processes compared with other states, it was thought that this would be a relatively conservative estimate if applied to the whole of Australia.

4. Quantified costs of a National Storage Database

The costs quantified as part of the CBA were based on inputs provided through the consultation process and desktop research. In some cases, data requirements were incomplete, and an indicative estimate was developed, with the aim of testing underpinning assumptions when the CBA is released for public consultation.

All costs provided are incremental to the base case unless otherwise stated.

Indicative, high level hardware and software development costs and data collection system costs quantified in the CBA were provided by AEMO and the CER for Option 1 and Option 2 respectively. Other establishment costs such as any costs borne by parties accessing the national register and policy and design consultation for the development of the register were estimated separately.

The key difference between the establishment costs of the two options relates to the assumed data collection process. Option 1 costs, developed by AEMO, assume that a new data collection mobile app or web service is developed for installers to use. This app could also be used to complete connection processes, thereby streamlining processes where possible. CER's establishment costs developed for Option 2 assume that the data collection process used for the REC database is maintained and expanded to include collection for battery storage and retrofits (upgrades to existing PV and/or replacement of aged PV installations).

4.1 Data collection costs

In the assessment of both options, data collection costs are a dominant element. These costs have been estimated based on a range of assumptions relating to the additional time it takes an installer or agent to complete the information requirements of a national register relative to the base case. It is therefore necessary to consider data collection processes under the base case, the likely streamlining of new requirements with existing requirements, and the additional time to collect new information. The relevant assumptions used in the analysis are summarised in Table 6.

Table 6: Assumptions for data collection costs

Assumption	Detail
Electrician hourly rate	$75/hour
Base case data collection – time and cost assumptions	• **Time to complete connection notices**: 9 minutes. This is a weighted average assuming 25% of connection notices are paper format (20 minutes) and 75% are electronic (5 minutes) for the duration of the assessment period. These assumptions are based on feedback (verbal and written) from DNSPs. • **CER data collection time:** 10 minutes for PV systems until 2024 (Applicable while the REC database is assumed to exist. Battery data is not collected under the base case, so collection time is 0 minutes) • **% of new PV systems needing connection notices:** 100%.
Option 1 data collection costs	• **Time to complete connection notices: 5 minutes.** This option assumes that all connection notices will be electronic (i.e. linked to a streamlined data collection process). • **Time to collect data for REC database:** No change to base case. CER has advised that under this option, its database and current data collection process would remain in place. • **Time to collect PV data on new app**: 5 minutes while REC database still exists (until 2024), increasing to 8 minutes after 2024. This assumes that there may be some data supplemented from the REC database to reduce duplication while the two systems exist in parallel. • **Time to collect battery data:** 2 minutes if collected with PV data and 5 minutes if collected separately.

Assumption	Detail
	• **% of batteries installed with PV system:** 80%. Although it is expected that most new batteries (i.e. excluding retrofits) will be installed at the same time as a new PV system, as a conservative estimate, it is assumed that 20% of batteries will be installed separately. This is a conservative assumption to ensure that the costs of data collection are not underestimated. • **% of new batteries needing connection notices under the base case**: 30%. This is consistent with the assumption in Section 3.2 that 30% of batteries are currently captured in the network databases.
Option 2 data collection assumptions	• **Time to complete connection notices:** 9 minutes. There is no streamlining of processes under this option, and this estimate is consistent with the base case estimate which accounts for the current split between paper and electronic applications. • **Time to collect PV data:** 10 minutes while the REC database is in place; reducing to 8 minutes from 2025 onwards (assuming requirements are less onerous). • **Additional time to collect data for REC database:** 0 minutes. The two systems are streamlined. • **Time to collect battery data:** 2 minutes if collected with PV data and 5 minutes if collected separately (Same as Option 1). • **% of batteries installed with PV system:** 80% (Same as Option 1) • **% of new batteries needing connection notices**: 30% (Same as Option 1)

Discussion point:

Do the time estimates and other assumptions in Table 6 seem to be reasonable? If not, are you able to provide evidence to more appropriate estimates?

4.2 Data validation and auditing costs

Data validation and auditing costs considered in the assessment include those that are incremental to validation and auditing that would occur under the base case. These are the second biggest costs and the relevant assumptions are summarised in Table 7. Note that auditing proportions are assumptions and may vary according to CER or jurisdictional regulation policy.

Table 7: Assumptions for data collection costs

Assumption	Detail
Base case data validation and auditing	• **Cost per audited installation**: $14.10. This allows for desktop analysis, which includes approximately 15 minutes per installation at an FTE rate of $100,000 per annum. • **% of installations audited:** While a percentage of solar PV installations are subject to auditing, no auditing for battery installations occurs under the base case.
Data validation and auditing costs for Option 1 and 2	The costs are the same for Option 1 and Option 2: • **Cost per audited installation:** $14.10. These are consistent with base case assumptions. • **% of PV systems validated and audited**: The percentage of solar PV installations that are subject to auditing are expected to reduce after 2024 as

Assumption	Detail
	the value of the commonwealth incentive decreases and not all installations may be subject to a claim. • **% of battery systems audited**: 5%. In some cases PV and battery audits will be undertaken simultaneously but this conservative assumption recognises that the focus would be on PV audits in the short term (mainly to avoid fraud with respect to issue of STCs), some separate audits for batteries are likely to be required.

4.3 Data validation and auditing costs

The total costs for Option 1 and Option 2 are summarised in Table 8.

Table 8: Total cost summary (present value)

Cost	Option 1 assumptions (AEMO host)	Option 2 assumptions (CER host)
Initial hardware development or adjustment costs	$ 0.74 m	$ 0.65 m
Data collection systems development	$ 0.24 m	-
Ancillary database adjustment costs	-	-
Policy and design consultation	$ 0.57 m	$ 0.57 m
Operation and maintenance	$ 0.74 m	$ 0.74 m
Data collection costs	$ 6.97 m	$ 9.04 m
Data validation and auditing	$ 1.41 m	$ 1.41 m
Total cost	**$ 10.67 m**	**$ 12.42 m**

Option 1 is less costly to implement. This is largely due to the lower data collection costs due to the efforts to streamline the connection notices process.

Option 2 has lower development costs and if development of an app is not considered to be viable, Option 2 will likely become the more cost effective option.

A detailed design process may alternatively suggest a blended approach for the data collection process which may be appropriate and cost effective and could apply to either Option 1 or 2. .

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5. Quantitative Benefits

Descriptions of quantifiable market benefits are provided in Table 9. The same benefits apply to both options considered. Further detail is available in the detailed CBA report.

Table 9 Market benefits attributable to a battery storage register

Description	Benefit evaluation	
Medium to longer term planning		
Investment in large scale generation and network infrastructure typically require 2 to 4 years of planning (and sometimes longer, depending on the asset). If planners are unaware of the scale of batteries in the market it is significantly more difficult to estimate requirements for peak and baseload demand, and this is likely to result in overinvestment in generation or network assets.	***Wholesale market***	***Networks***
	Avoided wholesale market infrastructure costs assessed using two representations of wholesale market design: *i. Perfect knowledge of batteries and PV* *ii. Imperfect knowledge of batteries and PV* *Market assumptions include AEMO 2016 NEFR neutral demand growth and corresponding carbon policy, and that new centralised renewable technologies require two years of planning. The market outputs from each of 'With register' and 'Without register' are compared to reveal a net benefit. Cost elements compared were capital expenditure, fuel and abatement costs and operating costs.*	*Avoided distribution infrastructure investment costs assessed using a counterfactual approach based on the approach networks use to justify investment under the RIT-D test. A storage and distributed generation register improves the ability of networks to estimate the value of energy at risk and reducing early augmentation decisions.* *Assumptions include that networks require two years of planning for augmentation decisions.*
	Benefit = $14.1 million (present value)	Benefit = $ 11.6 million (present value)
Power system security – improved solar eclipse management event		
Non-credible contingency events may cause DERs to disconnect. The solar eclipse that will cover the east coast (especially NSW) in the middle of the day in 2028 is one example. Such an event requires a great deal of planning, which is more difficult without adequate information.	Appropriate management of such events can avoid load shedding incidents that might be caused by the inability of AEMO to appropriately manage frequency and voltage levels in the system. This could be a very expensive outcome. However, from a CBA perspective, we would have to assume instead that AEMO would not allow for this to occur and would instead put in place additional system management options such as increasing FCAS. This is consistent with what is planned by the Californian market operator (CAISO) for their upcoming solar eclipse in August of 2017.	
	Benefit is up to $40,000 (present value)	

Discussion points:

Are any of the quantitative benefits or the assumptions or approach underlying their evaluation questionable? If so, why?

6. CBA results

The CBA results are presented in the following table.

Table 10: CBA results

	Option 1 (PV) (AEMO host)	Option 2 (PV) (CER host)
Establishment costs - for host	$ 1.0 m	$ 0.7 m
Non-host establishment costs (design consultation and auxiliary databases)	$ 0.6 m	$ 0.6 m
O&M	$ 0.7 m	$ 0.7 m
Data collection	$ 7.0 m	$ 9.0 m
Data validation an auditing	$ 1.4 m	$ 1.4 m
Total Cost	$ 10.7 m	$ 12.4 m
Avoided expenditure - wholesale	$ 14.1 m	$ 14.1 m
Avoided expenditure - networks	$ 11.6 m	$ 11.6 m
FCAS benefits	$ 0.0 m	$ 0.0 m
Total benefits	$ 25.8 m	$ 25.8 m
NPV	**$ 15.1 m**	**$ 13.3 m**
BCR	**2.4**	**2.1**

As can be seen, both options considered are economically viable, with NPVs ranging from $13.3 million to 15.1 million. The difference between the two options is predominantly due to the collection costs being lower for Option 1 which assumes that data is collected using a new app which allows streamlining of some of the existing processes (i.e. connection notices for networks). If the same data collection process was applied to both models, Option 2 would have the higher NPV. These issues will be resolved as part of the more detailed design process.

7. Qualitative costs and benefits

This section discusses some of the costs and benefits that could not be quantified as part of the CBA results and the potential impact they would have on the economic viability of the national register.

Table 11 Summary of qualitative costs and benefits

Item	Description	Barriers to quantification
Costs		
Legislative and regulatory amendment costs	In establishing the national database, regulatory changes will be required to mandate data provision for new and retrofitted PV systems and battery systems (and potentially other DERs as they become more relevant). Regulatory changes may also be required to enable the necessary data collection and data sharing by AEMO and the CER. The nature and extent of these changes will depend on the final collection process applied.	Cost information unavailable.
Impacts on competing businesses and emerging business models	Data is a valuable commodity and some businesses have creatively found ways to harness its value. With respect to the storage sector a prime example is the Energy Storage Council's partnership with Global-Roam to develop a subscription based national storage database. A national database, if free and/or regulated will most likely eliminate demand for their product and result in reduced earning potential. Early investment costs may be at risk of non-recovery.	Cost information for businesses already investing in this is confidential and there it is not known with certainty how many businesses have commenced investigations and/or investment in this area.
Benefits		
Short to medium term market operation	AEMO regularly provide projected assessments of short to medium term system adequacy covering periods 1 to 2 years ahead (ST PASA and MT PASA). These assessments provide market signals that affect the scheduling of maintenance, fuel contracts and unit commitment. AEMO co-ordinates a 5-minute dispatch model in which they create 5-minute ahead load and power flow projections that are converted into week ahead load and power flow projections to enable market participants to plan generation and bidding strategies. Furthermore, AEMO needs to ensure that power flows and the voltage profile through the network remain within technical limits and sometimes may need to constrain generation in the market to ensure that these technical limits are maintained. This process creates a load shedding situation which impacts on the system's overall reliability standard. This requires that a maximum of 0.002% of required energy is not delivered to consumers in any year. Reduced ability to predict load with the presence of batteries means that market operators will increase the likelihood and volume of load shedding incidents. Inaccurate short term forecasts can lead to: • Greater imbalances in forecast supply and demand, resulting in greater levels of FCAS, increasing costs • Impacts on power system security and monitoring, as described above • Higher cost dispatch occurring when higher cost generation may be called upon based on unit ramp up time and/or location rather than bid value.	Localised nature and diversity of circumstances under which operational benefits may be incurred are varied and difficult to quantify robustly in the time frame for the CBA.

Item	Description	Barriers to quantification
Safety	• ***Early risk identification and management.*** In the absence of a national register, emergency responders approach a fire without prior knowledge about whether a battery storage device is on-site. Lithium-ion batteries when placed under conditions of extreme heat and/or high pressure can combust, explode, or release hazardous substances. Early warning may enable first responders to approach an emergency area with the correct equipment (e.g. breathing apparatus) and extinguishers, noting that different extinguishers are needed for different chemical compositions. • ***Improved fire risk management***. Knowing the location, prevalence, and types of batteries in different areas will enable better resource allocation (skills, training and equipment) and response times. • ***Recall benefits***. There have been a number of international battery recalls in recent years, and if ignored, these could lead to increased fire risk. Under a recent recall, only 30% of the batteries were returned. A storage register could ensure that recall information is accurately and efficiently communicated to the correct households, and provide an opportunity to follow up if there is no response. • ***Disposal benefits***. DER needs to be correctly disposed of and may create a fire hazard if it ends up in landfill.	Lack of available data on: • How better information on location of batteries will be used by emergency services to reduce the risk to property or safety. This will depend on new training implemented and new processes introduced as a result of this information being made available. • Fire risk associated with defects • Disposal risks
Safety of line workers and installers	Improved ability to isolate another source of electrical current during standard operations	Considered to be a negligible benefit because current operating practices make the risk of electrocution from line work extremely low by isolating the entire property.
Policy development	Policy makers frequently use market modelling approaches to assess the adequacy of prospective policies before testing these policies on stakeholders and going live with a new policy. Improved data for market modelling is likely to improve outcomes for policy developers.	Policy responses and directions are unknown (e.g. may vary by government) and therefore not possible to quantify
Innovation	Better information can lead to new business opportunities for some businesses. As mentioned above, there may be opportunities from recycling businesses or even aggregators. The potential for these benefits will depend on the privacy and access laws that are introduced.	Possible business models are diverse and not quantifiable

Discussion points:

Are stakeholders able to provide data or case studies that would support the quantification (in monetary terms) of any of the costs and benefits listed above?

Are any of the qualitative benefits questionable? If so, why?

8. Conclusion

With benefits from a national register extending beyond those that could be quantified, and expected opportunities to further reduce the implementation and collection costs through the design process, the economic benefits of a national storage database appear to outweigh the economic costs. The NPV of the register is assessed to be between $13.3 million and $15.1 million over a 14 year assessment period.

The study was developed using a conservative approach and a number of benefits could not be captured quantitatively. The NPV is expected to increase once factoring in some of these additional benefits associated with safety, short term market operation, policy development and innovation. Furthermore, the CBA results currently capture all the costs associated implementing the national database in Western Australia without being able to capture the full benefits associated with deferred infrastructure benefits due to data limitations. These impacts would further increase the NPV.

From the modelled results, it appears that the choice between the two database hosting options (AEMO or CER) is equally viable with little separating them. A decision on the appropriate host may therefore not be purely driven by economic factors.

A significant factor in the NPV results is the data collection approach adopted. The choice surrounding whether AEMO develops a new data collection process or whether CER enhances its existing data collection process are presently tied to each option in the CBA, but each collection process could theoretically apply to either option. As such, it may be better to evaluate the database hosting and data collection options in a more detailed design process which considers the practicalities surrounding implementation for stakeholders.

Discussion points:

As a data collection option, an app could be developed that would provide streamlining opportunities for other stakeholders to also receive data (e.g. networks). This app would be designed to maximise efficiency of data entry and make use of existing research and lists from the CEC. However, it might not eliminate the existing data collection arrangements undertaken by CER, potentially requiring two processes in parallel for some period of time.

Would a new data collection app be appropriate if it was designed to streamline time taken to fill in forms? Or would industry have a preference to use existing industry developed apps? What advantages do industry developed apps offer?