31 August 2023

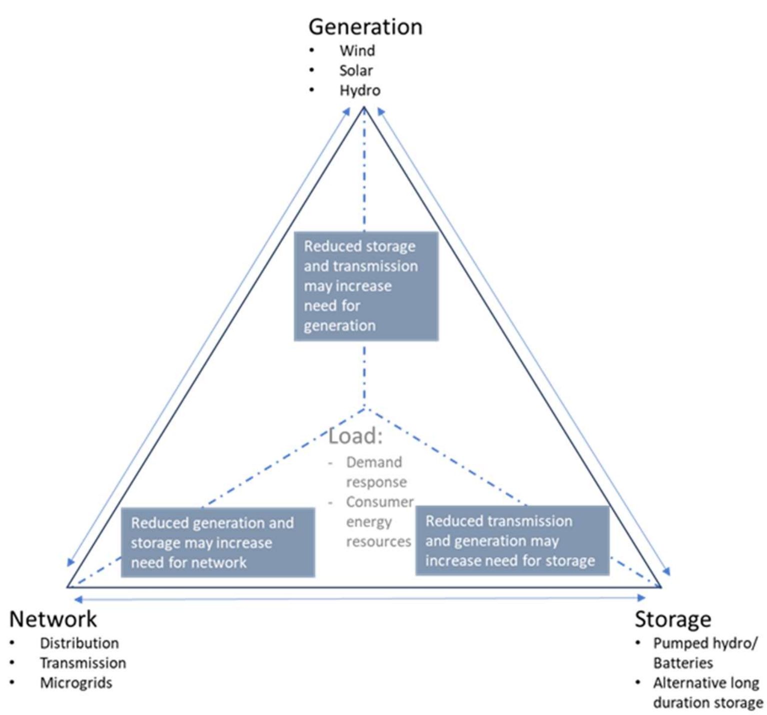
Department of Climate Change, Energy, the Environment and Water

The Clean Energy Council (CEC) is the peak body for the clean energy industry in Australia, representing over 1,000 of the leading businesses operating in renewable energy, energy storage and renewable hydrogen. The CEC is committed to accelerating the decarbonisation of Australia's energy system as rapidly as possible while maintaining a secure and reliable supply of electricity for customers.

The CIS in the context of the energy transition

The Capacity Investment Scheme (CIS) comes at a critical time in the process of NEM decarbonisation. Achieving the emissions reductions and renewable energy targets requires a rapid increase in the rate of clean energy investment. This investment includes generation, storage and transmission, complemented by active demand side.

Figure 1: The nexus of storage, network and generation



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Getting the balance right between these elements will deliver of the energy transition at the lowest cost to consumers. This can be achieved by harnessing their natural complementarity. Coupled with a sufficiently diverse mix of wind, solar and hydropower, the combined capabilities of storage and transmission will allow reliability to be met at the lowest total cost to consumers.

The CIS has a key role to play in delivering the necessary volumes of storage investment to support an efficient transition. However, the design of the CIS should be considered in light of several key factors.

Firstly, policies such as the US Inflation Reduction Act create powerful incentives that will pull clean energy investment away from Australia. The CIS helps address this, however the value proposition for investors must be clear and the design itself sufficiently simple so as to avoid further complicating the Australian clean energy investment market.

Secondly, the Australian power system has unique requirements, including management of minimum demand, provision of system strength and inertia, and managing the effects of increased energy variability. The CIS can support investment to manage these system requirements at lowest cost. However, this means supporting a portfolio of different storage technologies – including batteries, pumped hydro and the many emerging alternative Long Duration Energy Storage (LDES) technologies.

Finally, policy makers should recognise the very different risk profiles of pumped hydro and other LDES projects. Technologies like pumped hydro, for example, have long lead times and face unique geological risks associated with tunnel drilling etc. Other forms of LDES may be higher up the learning / deployment curve, and so face higher investment hurdles.

However, these technologies provide multiple high value characteristics, such as operating for a long period of time, supporting frequent cycling, enabling very long energy duration and are not exposed to the same input cost risk as battery technologies.

We therefore recommend that the CIS should be designed in a way that actively recognises these risk / reward trade-offs, and captures long term benefits, rather than taking a short term focus on lowest cost bids only.

High level recommendations

In terms of the high level design, we make the following recommendations, some of which fall outside the specific questions asked in the consult paper. Those specific questions are answered in later sections of the submission.

Recommendation 1: The CIS target volume of 6GW should be defined as a floor, with flexibility to increase this number, or bring forward additional storage capacity, to account for unexpected events.

The CIS is currently targeting a 6GW reliability target for dispatchable supply, and this value is defined as a cap. We consider this cap should be redefined as a floor, with flexibility to adjust the CIS volumes. This will ensure greater protection against unplanned events, such as coal generation exit, which is key to maintaining consumer reliability and low energy prices.

While we appreciate that the CIS is not intended to meet 100% of the need for dispatchable capacity, it nevertheless will have a key role to play in helping to manage the reliability risks associated with unexpected events. This role may need to be expanded, to encourage the 'bring forward' of storage investment.

As identified above, storage is the natural complement of generation and transmission. This means storage can help manage any unexpected changes in transmission or generation investment.

The CIS will most effectively support consumer reliability where it actively brings new capacity investment forward in time, to occur well in advance of expected coal closure dates or major transmission line energisation. As repeatedly demonstrated in the NEM, coal generation can be subject to catastrophic failure, or may be removed earlier than expected due to challenging economic conditions.

In both cases, large volumes of dispatchable capacity can be removed sooner than expected. Similarly, major projects such as transmission interconnectors and large scale pumped hydro can be delayed due to supply chain issues or complexity of the build itself.

Both of these effects - earlier than expected coal exit, or delays in new project delivery - can reduce the overall reliability of the system.

The CIS can help manage these effects and support reliability, by bringing forward investment in other forms of energy storage. The extent to which this investment in new storage capacity is brought forward in time should allow not only for construction time but also to provide AEMO and network operators with as much time as possible to learn how to use the new assets in power system operation.

On this basis, we recommend the 6GW target be set as a floor, rather than a cap, with regular reassessments and adjustments made to the total target volume and timings, as conditions change.

We also recommend that the CIS be purposefully designed to bring forward new investment capacity in time. This will allow for additional storage capacity volumes to be brought forward as necessary, to provide a 'buffer' against unplanned events.

Recommendation 2: We recommend the Department consider system needs beyond reliability when developing the CIS, particularly those related to secure operation of the power system. This could be enabled by partitioning of the CIS procurement, or the establishment of merit criteria that would favourably weight storage solutions that help meet system security needs.

Reliability is a key system variable to be managed. Delivering bulk transmission, storage and generation capacity to meet demand is critically important. As highlighted above, the CEC considers that the CIS will be central to supporting system reliability.

However, it's also imperative that other power system needs are managed. System services to provide system strength, inertia, voltage control and frequency control are all key.

Services like frequency control are well recognised and valued through liquid and well-defined markets, however all the others are valued through non-market direct procurement mechanisms. These mechanisms are far from perfect as they are typically opaque contracts struck with TNSP buyers, who may have incentives to favour their own network investments over a non-network solution. As such, these kinds of system services are often difficult to make bankable for storage developers.

Beyond this, some services are not currently valued at all, either through established markets or direct procurement. These include provision of synchronous 'grid reference' services, or the 'grid forming' capability provided by batteries with grid forming inverters.

These services can often be provided at a relatively low incremental cost, at the time of asset construction and commissioning. For example, provision of grid forming capability entails a software upgrade and some additional testing. Provision of a full synchronous grid reference service might entail upgrading a pumped hydro or compressed air synchronous generator, to include a clutch between turbine and generator that enables the asset to operate as a synchronous condenser when not discharging power into the system.

We understand the Department's current view is these non-reliability services will either be valued through markets or other mechanisms external to the CIS. Alternatively, it is argued they may be supported through grant funding from ARENA.

The CEC considers this approach is unlikely to lead to an efficient outcome. As identified, procurement mechanisms for many system services are either imperfect or non-existent. ARENA funding, while welcome, is somewhat ad-hoc and not conducive to delivery of the system security services so urgently needed.

Given that many of these services can be provided through relatively incremental additional investments, and that assets enabled through the CIS are likely to have a service life of at least 15 years - or well over 50 years for pumped hydro - a low regrets approach would be to encourage these additional capabilities to be enabled during construction of the storage asset.

We therefore recommend the Department recognise the value these projects enable, through the provision of additional system services. This could be achieved through the purposeful partitioning of the CIS as described below. Equally, it might be enabled through establishment of merit criteria that favourably weight projects that bring these additional capabilities to market.

Recommendation 3: We recommend the CIS be designed around recognising the value of a portfolio approach to storage technologies. While batteries have a key role to play, pumped hydro and alternative LDES technologies will also play an important role. This could be achieved through changing the timeframes of the CIS to recognise the lead times of pumped hydro and alternative LDES. The CIS can also be partitioned or otherwise adapted to purposefully support these other technologies.

Specifically, we recommend the Department consider:

- **extending or flexing the 2030 timeline to enable longer lead time technologies to participate in the CIS; and**
- **ensuring that the lead time between identification of a reliability need / commencement of a tender is such that long lead time technologies can effectively participate in the tender process; and**
- **partitioning some portion of the CIS funding for specific technologies, recognising the specific risk profiles of those technologies or the fact that they are higher up cost curves; and / or**
- **recognising the particular reliability and security benefits of pumped hydro and alternative LDES technology solutions in the system modelling assessments and/or duration metrics**

Batteries have a key role to play in the overall storage portfolio. They are (relatively) fast to build and modular in construction, allowing for significant flexibility. They have a rapid response rate which is conducive to effective power system frequency control. When coupled with grid forming inverters, they can also play a key role in supporting inertia, system strength / grid forming and voltage control.

However, as discussed above, an optimal system design involves batteries complemented with other storage technologies, such as pumped hydro and the many forms of emerging LDES technologies. These other technologies provide characteristics like synchronous generation and grid reference, as well as long duration and high cycling capability.

AEMO has clearly identified there is a need for synchronous generation and grid reference to maintain the security of the power system through the transition. While acknowledging the capabilities of inverter based forms of energy storage – like batteries with grid forming inverters – AEMO has clearly signalled the need for synchronous generation and storage to provide a 'grid reference' that allows for wind and solar generation to remain stable.[1]

As large scale coal generating units retire, AEMO will struggle to source this much needed synchronous grid reference. As noted above, grid forming batteries will assist, however some form of synchronous generation will still be required at least for the medium term. This is where technologies such as pumped hydro, compressed air or thermal storage can play a key role.

These storage technologies all operate in a manner that is generally equivalent to a traditional coal or gas synchronous generator. As such, they can play the same role of these exiting fossil fuelled generators in terms of providing a stable synchronous grid reference service.

Pumped hydro and alternative LDES also offer other capabilities which make them valuable – although it's noted that many of these capabilities are not currently valued under existing market frameworks:

- the ability to deliver long duration energy supply at a relatively low incremental cost, which is key to supporting the power system in the face of long seasonal supply shortfalls
- high cycling capability, meaning that they can fully charge and discharge very frequently, making them amenable to the provision of services such as primary frequency response,[2] as well as providing a regular 'ramping' service to help meet changes in daily demand due to increased rooftop solar. While batteries can provide this capability, it can dramatically shorten their operating lives, leading to the need to replace assets as well as creating recycling issues
- location 'agnosticism', meaning that some LDES technologies, such as redox flow and compressed air, can be built in a wider range of locations due to zero risk of thermal runaway. This could allow for alternative LDES to be located much closer to or within load centres, which would support distributed PV as well as reducing distribution network costs. A reduced reliance on water availability also puts some of these technologies at a clear advantage to pumped hydro assets.

While these technologies display key advantages and value to consumers, they are currently either less mature than battery technologies or face higher upfront capital costs and risks. This puts them at a relative disadvantage to battery technologies.

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[1] See: AEMO | Operation of Davenport and Robertstown Synchronous Condensers at www.aemo.com.au
[2] See Primary frequency response incentive arrangements | AEMC at www.aemc.gov.au

There are several key design elements of the CIS that can be managed to help address these disadvantages, to help develop a portfolio of storage solutions. This will help improve the reliability and security of the power system, ultimately lowering costs for consumers. We consider the key ways the CIS can achieve this is by purposefully targeting support for specific technologies, as well as accounting for the different lead times associated with different technologies.

Recognising longer lead times

Many of non-battery storage technologies have longer lead times associated with their delivery. As identified above, pumped hydro faces unique challenges associated with geological issues, while other LDES are further up the maturity / cost curve.

Currently, the CIS follows a timeline out to 2030. Given the long lead time associated with developing and constructing many forms of energy storage, this target is likely to result in a mix of faster to build, more modular storage solutions, heavily slanted towards batteries with a lithium based chemistry.

Issues may also arise related to the length of time between identification of a reliability need / tender commencement and the required milestone date of delivery of a CIS eligible project. The same issues described above could result in a crowding out of these technologies.

Explicit targeting of support for specific technologies

Another approach could be to allocate a portion of the CIS funding to purposefully support given longer durations, specific technology types or the provision of specific system services. Equally, the metrics used to assess reliability contributions could be adapted to recognise contributions to broader system security and stability.

We recognise there are upsides and downsides to each of these options.

For example, a strict partitioning of the CIS would provide strong signals to support investment in a portfolio of storage solutions, which would come at a critical time in the technology development and investment certainty cycle of emerging LDES technologies like compressed air, redox flow or thermal energy storage, each of which bring unique capabilities and value to the power system.

Sending these strong signals now will help attract and retain the developers and OEMs that are ready to apply these technologies in Australia. A failure to do so may very well see them abandon Australia and focus on other markets with stronger incentive signals, such as in Europe and the US.

We acknowledge this approach could be seen as ‘picking winners’, an approach not typically favoured by policy makers on the basis that it is less efficient - although we note that assessments of efficiency are frequently biased by reference to the assumptions made regarding what costs and benefits are included.

Alternatively, an approach that considers other storage technologies through the ‘duration metric’, or through a merit criteria approach, may address this concern regarding picking winners. However, this is a relatively opaque mechanism and is unlikely to provide the same strong investment signals as a clear partitioning of the CIS funding.

Recommendation 4: We recommend that the CIS be designed with a view to minimising the amount of regulatory ‘lock in’ included in earlier stages of policy development. The design of the CIS should purposefully allow for key variables to be adapted and redefined as the Department and AEMO services progress through tender rounds.

We consider it is important there is scope to iterate and develop the design of the CIS to reflect the rapidly changing technological, commercial and regulatory environment. Design choices such as minimum duration requirements and relationships with contracting processes must be designed with this principle in mind.

SPECIFIC INPUT

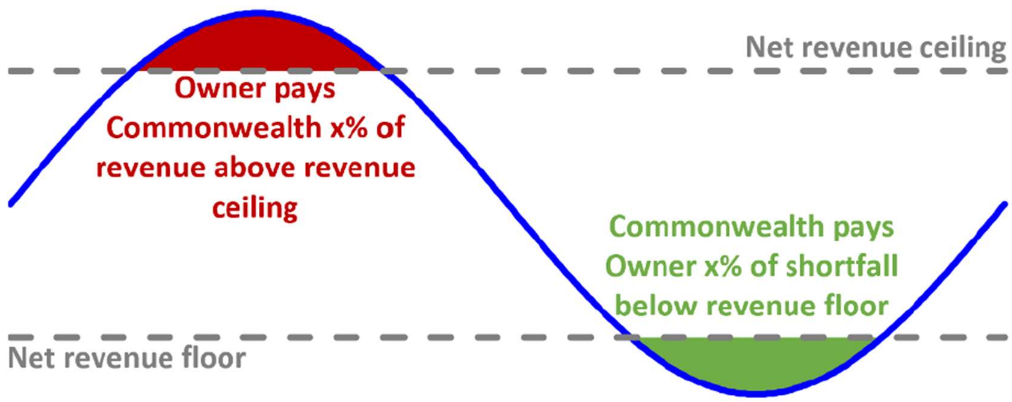
Question 1: what other implications might the CIS have on the energy market, and how the CIS can be designed to mitigate risks while delivering on key policy objectives.

In the most general sense, the consult paper asks how the CIS might be designed to mitigate risks. If we take this to mean mitigation of investment risk, the CIS should be designed in the context of the overall investment environment. Tight supply chains, strong investment pull from other jurisdictions and a complex techno-regulatory environment means that clean energy investment is already challenging in Australia.

Policy makers should therefore consider how they can make the CIS “as big a carrot as possible”, in order to help overcome these headwinds. This means avoiding overly onerous requirements or punishing revenue clawback structures, both of which will discourage investment and may also result in unintended operational outcomes.

We therefore welcome the fact that the consultation paper is based around the concept of minimising impacts on energy markets. Ensuring the continued effective function of wholesale and contract markets is key to supporting efficient investment. There are several elements of the CIS design that can be clarified to further support this.

We urge caution regarding how the structure of the key elements of the CIS contracts are struck, as these may have significant implications for investment and operation of the assets. This includes the specific collar values, as well as the ‘x’ values above and below the revenue collars described in the consultation paper.



The CEC understands the Department's current thinking is that the revenue collar prices and the upside and downside 'X% value' will be determined through a centrally determined process, rather than determined through each individual bid.

This fundamental design choice will have implications for the way that CIS contracts are structured and ultimately, for the wholesale contracting and operational incentives created for participants.

For example, if the revenue cap is set too low, or the 'x' clawback value above the ceiling heavily favours the government guarantor, then operators may have reduced opportunity to benefit from high wholesale prices, and therefore less incentive to make assets available when they are most needed.

This could also flow through into changed contracting behaviours. For example, if the clawback value is set at a high value, storage operators may be incentivised to keep their capacity out of the contracting market and instead focus on spot market revenue. This is because the relative percentage of revenues available through the spot market – with the potential for prices to exceed $15,000/MWh – may exceed that available through issuing a cap contract.

The performance requirements described on page 25 of the consultation paper will affect these incentives – such as by mandating specific volumes of capacity be enabled during LOR3 events. However, a more effective way to ensure efficient outcomes is to preserve the strength of wholesale market price signals, to the greatest extent possible.

We therefore recommend the Department leave the revenue collar and 'X%' values open, with the specific values of each to be determined through the CIS contract bid process. This will deliver increased flexibility and maximise the number of parties offering into the tender. It is also likely to deliver improved outcomes for consumers by allowing the market to deliver lowest cost / highest value tenders into the CIS.

Relatedly, members have raised queries regarding the way that CIS contracts and traditional wholesale market contracts will be aligned. The wording of the consultation paper implies that CIS contracts are linked to specific projects. However, wholesale contracting does not necessarily work this way, with wholesale contracts structured around a portfolio of projects.

Question 2: What minimum storage duration should be required for tender eligibility, to achieve CIS policy objectives?

Consistent with our general support for a portfolio of storage solutions, duration requirements should reflect the diversity of reliability risks now faced in the NEM.

These 'reliability at risk periods' are changing. Traditionally reliability was most at risk during the short, sharp super-peak periods that occur in late summer due to increased commercial and residential demand coupled with reduced output from thermal units due to heat stress.

Increasingly however, reliability at risk periods will also include shoulder / winter periods, where a combination of winter heating load, coupled with reduced renewable output and the general unreliability of an ageing coal fleet, may lead to more prolonged seasonal reliability at risk periods.

As these reliability at risk periods change in the power system – reflecting the shift away from dispatchable, centralised thermal generation to variable, distributed renewable generation – so to will the need for different duration types. This means there is a need for durations that match the 'short sharp' at risk periods associated with traditional summer peaks, complemented with longer durations that match the growing seasonal at risk periods.

We consider the duration requirements in the CIS should be shaped to reflect this need for a mix of durations.

As described above, this could be achieved through partitioning the CIS so that some funding is directly reserved for durations of a particular type. Alternatively, defining the specific reliability contributions of different durations, and reflecting these in some form of weighting behind eligibility, is another way to support a portfolio approach.

In regards to battery storage solutions specifically, we also suggest the Department consider the benefits of allowing 'partitioning' of capacity in the underlying eligibility criteria. As we have previously suggested regarding LDS LTESA design, this approach could lead to more efficient outcomes, by enabling a wider range of physical and commercial solutions to tender.

As noted in the consultation paper, the NSW Long Duration Storage (LDS) LTESA design purposefully set a requirement to operate at registered capacity (or 'full' capacity) for a minimum of 8 hours continuous. This requirement creates specific incentives, driving particular solutions.

For example, in the first LDS LTESA round, a direct outworking of the minimum duration / max capacity requirements was the development of a battery solution that operates at a capacity rating of 50MW, but which is rated for energy provision for 8hrs (50MW * 8hrs = 400MWh). Notably, the last round of the NSW LTESA did not bring a pumped hydro project to market, which is widely understood to be the intention of the scheme.

Alternative approaches to duration eligibility would create different incentives, and are potentially able to deliver more flexible solutions. Allowing for partitioning of a storage asset's total capacity - or splitting that capacity across multiple assets – could enable a greater range of lower cost solutions.

For example, a 100MW battery with a minimum duration of 8 hours, but with a partitioned ***half*** of the registered capacity in the CIS, would deliver the same outcome as the 50MW battery described above (ie, (100MW / 2) x 8hrs = 400MWh).

However, this would likely make the overall project more profitable as it would allow the operator to capture the scale efficiencies from utilising the same connection assets and using the remainder of the battery to operate in arbitrage and ancillary service markets.

We encourage the Department to consider this partitioning of capacity of assets, as this may allow for more efficient operation and lower overall cost for consumers in the long run. While it appears this is considered in the consultation paper, specific confirmation would be welcome.

Question 3: What methodology for modelling and measuring duration requirements for various technology durations would be appropriate?

The CEC recognises the benefits associated with utilising existing modelling approaches, such as the ISP and ESOO. These are relatively well understood by industry and governments. We also note that a combination of these, plus bespoke approaches where necessary, will be used in setting the jurisdiction specific requirements.

We consider there are several implications associated with use the ISP and ESOO to set reliability targets:

As noted the ESOO operates over a 10 year period, however identified reliability gaps can appear in much shorter time frames within that 10 year forecast – this can be particularly acute given the relatively short notice of closure periods for retiring gas and coal generators, as required under the NER.

Any overreliance on the ESOO for triggering a tender round could therefore result in insufficient time to identify the lowest cost solution to address a reliability need, as it would preclude long lead time technologies from effectively participating in the tender.

Utilisation of announced coal generation exit dates may give rise to similar risks, where coal exits are suddenly brought forward due to unfavourable operating conditions, or where a unit is removed from service due to technical failure.

We welcome the acknowledgement of this in the consultation paper, through the potential development of economically efficient retirement trajectories. However, such an approach may still underestimate the risk associated with earlier than expected thermal retirement, as it doesn't account for forced outages and premature exit due to unit failure, or individual generator owners adopting more aggressive retirement schedules to meet ESG objectives.

We encourage the Department to adopt a more conservative approach when considering thermal coal exit, recognising the significant reliability benefits in bringing forward investment in storage capacity to occur well in advance of planned or unplanned thermal retirement.

Question 4: How could the CIS eligibility criteria and assessment methodology change and adapt over time?

We welcome the acknowledgement in the consultation paper that the tender targets will need to recognise the lead times associated with different technologies, particularly those related to pumped hydro.

Further information will need to be provided on these ‘additional assumptions’ regarding the treatment of lead times. This information must be provided well in advance of the actual tender process, to allow parties to respond accordingly.

It’s unclear how the concept of ‘rolling forward annual average of capacity requirements’ will be used to address the issue of long lead time assets. Further explanation is welcome here.

We also note commentary in section 3.2 of the consultation paper around how the tender budget and jurisdictional allocations will give consideration to unit costs, and how this affects total allocated financial budget.

In any process that gives consideration to ‘costs’ we recommend that adequate consideration is also given to the full suite of benefits associated with investment in different technologies.

For example, while the upfront cost of a storage solution such pumped hydro, compressed air or redox flow batteries may appear relatively high, its important to recognise the additional benefits associated with each technology. Longevity, increased cycle life and the provision of system services - such as synchronous capability in the case of hydro and compressed air - are examples of such capabilities which will provide consumers with additional long term benefits.

Any metrics and assumptions developed to set the financial budget allocations should consider the full suite of these capabilities, when determining ‘unit costs’ that are utilised.

Question 5: What methodology for considering a project’s contribution to zero scope 1 emissions would be appropriate?

Question 6: How could this criteria and assessment methodology adapt as technology matures over time?

Question 7: What types of demand response would be consistent or inconsistent with the CIS objectives?

Question 8: How can the CIS design be future-proofed for an evolving/changing technology mix?

Question 9: The Department is seeking feedback on the eligibility requirement of projects in the NEM for equal to or greater than 30MW registered capacity.

The CEC is broadly supportive of the positions taken in regards to these questions of eligibility, subject to the following recommendations.

Consumer energy resources

The CEC acknowledges that the CIS consultation excludes Consumer Energy Resources (CER) storage and orchestration from earning a capacity incentive under the proposed Scheme.

The CEC notes that orchestrated CER can provide firm flexible capacity to support the system reliability and security. AEMO's ISP predicts up to 4.5GW of CER orchestrated storage by 2050.

However, at the moment there is no nationally co-ordinated policy framework that enables the uptake of orchestrated CER that recognises the benefits CER storage and orchestration provides to the energy transition.

The CEC considers there is a critical need to create a credible path for achieving this target. There are variety of policy levers available to so, including potentially expanding the CIS, broadening the SRES or some form of tax rebate. All are viable policy levers to support the uptake of CER storage orchestration. The CEC recommends the federal government take the lead and urgently co-ordinate a viable policy response to support the effective achievement of the 4.5GW of CER orchestrated storage.

Other issues

A relatively minor point to note is that further clarification will be required regarding the treatment of biomass projects and what is needed to define such a project as having zero scope one emissions.

We also recommend the Department give further consideration to whether colocation of a storage asset with a renewable generator should change the reliability assessment of the asset.

Finally, the Department should consider the technical complexity of co-locating batteries with new or existing renewable generators. Establishing new so called 'hybrid' facilities is a complex and time consuming process, as is retrofitting a storage unit to an established generator, in both cases due to the complex modelling and compliance processes imposed on these kinds of projects.

We encourage the Department to consider whether these complexities can be accounted for the allowed timeframes of the tender processes.

Question 10 The Department is seeking feedback on each of the eligibility requirements including:

- **the focus on a base level of development status of land tenure, planning and connection approvals.**
- **the impact of participation in other government schemes on CIS eligibility.**

- **the eligibility of existing projects to bid into the CIS, and questions of CIS additionality that result from this approach.**
- **the technology risk appetite of the CIS**

As noted previously in this submission, the CEC strongly recommends the Department consider the value associated with adopting a portfolio approach to storage in the NEM. Currently, several of the proposed design elements of the CIS could drive a very battery focussed storage portfolio. While batteries have a key role to play, we consider other technologies should be in the mix.

The CIS should be used to complement and support other mechanisms, to enable these technologies to be brought to the Australian power system. Enabling a portfolio of storage solutions will help deliver lowest long run cost electricity supply for Australian consumers.

The CEC welcomes further opportunities to work with the Department to progress this important reform. Further queries can be directed to czuur@cleanenergycouncil.org.au.

Kind regards

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