Government of Western Australia
Energy Transformation Taskforce

Reserve Capacity Mechanism

Changes to support the implementation of constrained access and facilitate storage participation

Information Paper

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Contents

Abbreviations

The following table provides a list of abbreviations and acronyms used throughout this document. Defined terms are identified in this document by capitals.

Term	Definition
Access Code	Electricity Networks Access Code 2004 (WA)
AEMO	Australian Energy Market Operator
Coordinator	Coordinator of Energy
CRC	Certified Reserve Capacity
DER	Distributed Energy Resources
DSM	Demand Side Management
ESR	Electric Storage Resources
ETIU	Energy Transformation Implementation Unit
GIA	Generator Interim Access
IRCR	Individual Reserve Capacity Requirement
MW	Megawatt
NAQ	Network Access Quantities
PoE	Probability of Exceedance
RCM	Reserve Capacity Mechanism
RCOQ	Reserve Capacity Obligation Quantity
RCP	Reserve Capacity Price
RCR	Reserve Capacity Requirement
RLM	Relevant Level Methodology
SWIS	South West Interconnected System
Taskforce	Energy Transformation Taskforce
WEM	Wholesale Electricity Market

1. Introduction

1.1 Context

This paper forms part of the work to deliver the Energy Transformation Strategy. This is the Western Australian Government's strategy to respond to the energy transformation underway and to plan for the future of our power system.

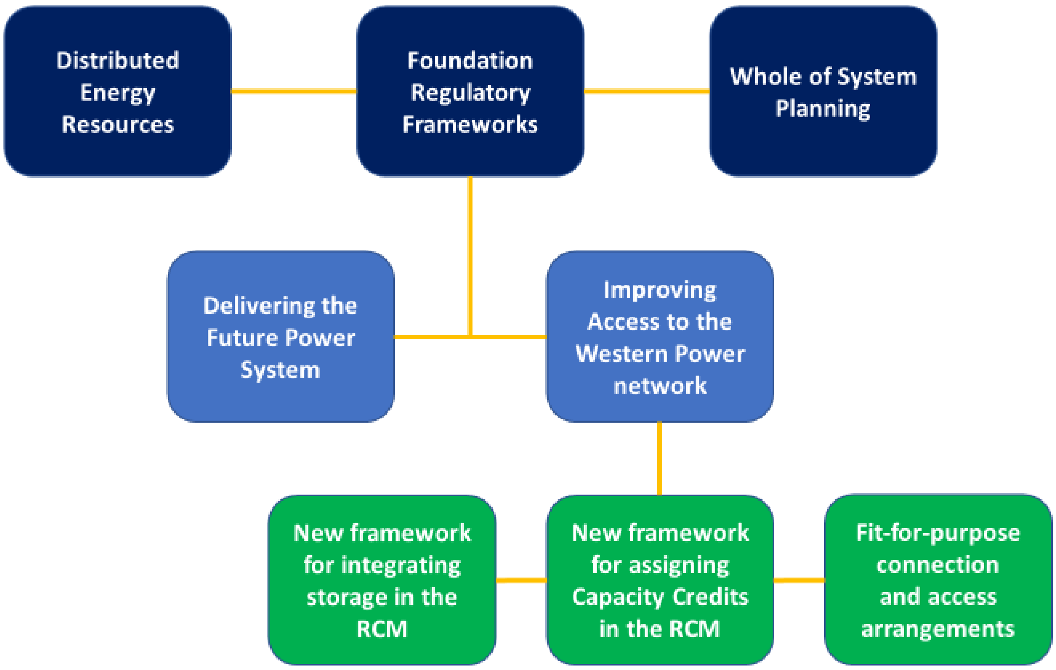
The delivery of the Energy Transformation Strategy was overseen by the Energy Transformation Taskforce (Taskforce), which was established on 20 May 2019. The Taskforce was supported by the Energy Transformation Implementation Unit (ETIU), a dedicated unit within Energy Policy WA, a sub-department of the Department of Mines, Industry Regulation, and Safety. The Taskforce successfully concluded its two-year tenure on 19 May 2021 and has laid the foundations for the ongoing and emerging power system challenges to be managed by Energy Policy WA .

More information on the Energy Transformation Strategy, the Taskforce, and ETIU can be found on the Energy Policy WA website at www.energy.wa.gov.au.

This paper is prepared as part of the Improving Access to Western Power's Network project (highlighted in Figure 1.1) within the Foundation Regulatory Frameworks work stream of the Energy Transformation Strategy. It describes the following key reforms to the Reserve Capacity Mechanism (RCM) as part of the Energy Transformation Strategy to support the adoption of constrained network access:

- The introduction of the Network Access Quantities (NAQ) framework.
- The treatment of storage resources (including hybrid facilities with storage) under the RCM.
- Consequential changes to the RCM to support the implementation of the NAQ framework and the storage participation framework.

Figure 1.1: Energy Transformation Strategy workstreams



1.2 The Energy Transformation Strategy

The Energy Transformation Strategy is the Government's work program to embrace new technologies to ensure the ongoing delivery of secure, reliable, sustainable, and affordable electricity to Western Australians. The strategy is responding to the energy transformation through fundamental changes to the way the power system operates and by developing a plan for the future.

An imperative element of the Energy Transformation Strategy is the adoption of a constrained model of network access and market dispatch whereby generator access to the Western Power Network in the South West Interconnected System (SWIS) and the Wholesale Electricity Market (WEM) is subject to network constraints. This reform will facilitate the entry of new generation capacity and technologies that will ultimately benefit electricity consumers through cheaper and cleaner energy without imposing significant network investment costs onto consumers.

Complementary reforms to the design of the WEM are being made to ensure that consumers reap the full benefit of the Energy Transformation Strategy. Separate tranches of Amending Rules are being gazetted to cater for the new security constrained market design, a new essential system services market, revised power system security and reliability arrangements, and new frameworks to govern generator performance standards.

The Energy Transformation Strategy also provides for the integration of storage resources that will help strengthen the resilience of the SWIS while providing new opportunities for market participants. In the short term, it is more likely that storage facilities will enter the market as part of a 'hybrid' facility, that is, co-located with another type of generation technology. New rules governing the treatment of these hybrid facilities have also been developed.

1.3 Improving Access to the Western Power Network

Improving access to the Western Power Network is key to unlocking the value of investment in the network. This involves adopting a framework of constrained network access whereby generators compete for access to the network through the WEM, with dispatch subject to network constraints to maintain system security. This provides an economically efficient means for capacity resources to access the transfer capability of the network, facilitating more cost-effective network connections.

Security constrained economic dispatch will apply to all facilities in the WEM from the new market commencement date (scheduled for 1 October 2022). This includes facilities that have connected under access agreements that may grant, or be perceived to grant, access to the Western Power Network on an unconstrained basis.

The Improving Access to the Western Power Network element of the Energy Transformation Strategy consists of the following projects:

1. **New framework for assigning Capacity Credits.**

   On 24 December 2020, changes to the WEM Rules were made to provide for a new Network Access Quantities (NAQ) regime, altering the framework by which Capacity Credits are assigned to capacity resources under the Reserve Capacity Mechanism (RCM).

   The NAQ framework is intended to protect existing capacity providers from an unhedgeable risk that would otherwise arise from the introduction of constrained access and to establish locational signals that, together with the Whole of System Plan and other sources of information, will guide new capacity investment in the SWIS.

2. **New framework for integrating storage resources in the RCM.**

   On 24 December 2020, changes to the WEM Rules were made to provide for the participation of storage resources under the RCM, including the certification of storage capacity and its obligations.

   The framework also provides for storage resources to enter the market as part of a 'hybrid' facility, where storage technologies are co-located with other types of generating technologies behind the same connection point.

3. **Fit-for-purpose network connection and access arrangements.**

   On 18 September 2020, changes to the *Electricity Networks Access Code 2004* (Access Code) were made to increase opportunities for new technologies, maximise network utilisation, and improve the Access Arrangement process.

   Several additional amendments subsequent to the 18 September 2020 changes to the Access Code are required in order to complete the implementation of the constrained network access regime, together with consequential changes to Western Power's Electricity Transfer Access Contract, the Applications and Queuing Policy, and the Contributions Policy. These measures are the subject of the April 2021 Consultation Paper referred to below.

This Information Paper focuses on the changes that have been made to the RCM to support the introduction of a constrained model of network access and the accreditation of storage resources (items 1 and 2 above). The new RCM regime was developed incrementally during 2019 and 2020 and this paper provides a complete overview.

Any references in this paper to sections and clauses of the WEM Rules relate to the amendments to the WEM Rules gazetted on 24 December 2020, noting that some further amendments will be required in the lead up to the commencement of the new market on 1 October 2022 to complete implementation of the RCM changes.

For a discussion on the new network connection and access arrangements to support a constrained access regime (item 3 above), please refer to the following documents that can be found at the Energy Transformation Strategy website.

- Energy Transformation Strategy, Access Code Changes, Consultation Paper May 2020.
- Energy Transformation Strategy, Proposed Access Code Changes.
- Energy Transformation Strategy, Proposed Amendments to the Electricity Networks Access Code 2004, Consultation Paper April 2021.
  - Attachment A, Proposed Amendments to the Electricity Networks Access Code 2004, Mark-up, April 2021.
  - Attachment B, Proposed Amendments to the Electricity Networks Access Code 2004, ETAC amendments.
  - Attachment C, Proposed Amendments to the Electricity Networks Access Code 2004, AQP amendments.
  - Attachment D, Proposed Amendments to the Electricity Networks Access Code 2004, Contributions Policy amendments.

2. The Reserve Capacity Mechanism

A well-functioning electricity market should attract and retain the optimal mix of capacity resources to ensure system reliability with the lowest overall cost of supply. Reliability in the context of electricity markets means having sufficient generation, demand-side[1], and transmission capacity available to meet electricity demand, particularly during periods of peak demand.[2]

The purpose of capacity mechanisms like the RCM in the WEM is to provide consumers with a reliable electricity supply by incentivising investment in adequate generation and demand-side capacity to meet peak demand. This is achieved by providing investors with a stream of expected revenues (in the form of capacity payments) that, together with other revenues such as from energy and essential system services, provide financial viability.

In particular, capacity mechanisms are designed to avoid price volatility, especially in highly concentrated markets such as the WEM, by providing a revenue stream to cover fixed costs. Capacity mechanisms de-couple payments for capacity and energy by providing generators with a separate revenue stream for making capacity available. This revenue complements revenue from the sale of electricity and essential system services and reduces the risk to new investment, providing investors with confidence that the market will provide revenue adequacy.[3]

Energy markets with capacity mechanisms can accommodate lower energy price caps and thereby avoid the price volatility that would otherwise be required by facilities that run only occasionally for short periods (generally at times of peak) to recover their costs. Without a separate capacity market, energy price volatility would be exacerbated (and market power concerns increased) in a small isolated system such as the SWIS.

2.1 A new framework for assigning Capacity Credits

2.1.1 The current approach

The RCM uses Capacity Credits as a basis for determining capacity revenue. The Capacity Credit is the capacity product declared to be traded between capacity buyers and sellers in the RCM. Where such a trade does not occur bilaterally, the Australian Energy Market Operator (AEMO) acquires the Capacity Credit at the administered Reserve Capacity Price (RCP) and recovers this cost from electricity consumers (typically through retailers or directly from some large industrial loads).

Electricity consumers are required to secure sufficient capacity, in the form of Capacity Credits, based on AEMO's estimate of how much they contribute to peak demand. This is their Individual Reserve Capacity Requirement (IRCR). The allocation of capacity costs to consumers provides an incentive for consumers to avoid these costs by reducing their consumption during peak times. Electricity consumers may purchase Capacity Credits from AEMO at an administered price; or bilaterally from facilities that have been certified and assigned Capacity Credits by AEMO.

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1 Demand-side capacity is capacity provided by electricity consumers reducing their demand when called upon to do so.

2 Electricity markets aim to achieve reliability up to a defined standard, noting that seeking 100 per cent reliability is prohibitively costly. The reliability standard in the SWIS is defined by the Planning Criterion in the WEM Rules.

3 However, importantly, capacity mechanisms do not completely de-risk investment in capacity but rather incentivise an efficient level of capacity with a capacity price reflective of the demand and supply curve over time. In the RCM, the yearly capacity price is a function of the level of capacity excess for that Capacity Year. Where there is a high excess of capacity, the capacity price falls to incentivise efficient exit of capacity and vice versa at times of looming capacity shortfall.

A Capacity Credit is a notional construct – one Capacity Credit is equal to one megawatt (MW) of physical generation (or demand-side management) capacity that can be provided during peak demand periods. Capacity Credits have performance obligations and expose the Capacity Credit holder to a Capacity Refund regime if the capacity resource does not meet these obligations. A facility's Capacity Credit's may also be reduced if it fails to meet obligations under the RCM to make its certified capacity available to the market.

Each year, AEMO sets a Reserve Capacity Requirement (RCR) based on its estimate of the highest level of electricity demand ('peak demand') that may occur for a given Capacity Year[4] in two years' time. AEMO estimates peak demand assuming a 10 per cent chance of its estimate being exceeded, often referred to as a one-in-ten year, or 10 per cent probability of exceedance (PoE), peak demand forecast. The RCR also includes an allowance for certain essential system services and a reserve margin that is designed to ensure there is enough capacity to cover for a worst-case scenario – that is, failure of the system's largest generator; or, a capacity buffer of up to 7.6% of forecast peak demand (whichever results in the larger capacity requirement).[5]

AEMO assigns Capacity Credits to a facility based on its reasonable expectation of how many MW of capacity the facility can provide at peak times. This expectation is a function of the facility's certified capacity[6] and the network's capability to accept the output of the facility during peak times.

Historically, AEMO has used the level of 'contracted capacity' under a facility's access agreement with Western Power as the basis for determining the amount of network injection capacity available to the facility during peak demand periods. This is based on the practice of requiring new facilities to fund upgrades to the network when there is insufficient network capacity to accommodate their injection without interruption to the access provided to existing facilities. However, in a constrained network, a facility's access to the network may be subject to constraints that are caused by other users. This will have implications for the Capacity Credits that can be assigned to facilities. Changes are therefore required to the way in which Capacity Credits are assigned to ensure the RCM continues to operate efficiently and fulfil its role under a constrained network access regime.

2.1.2 Issues under a model of constrained network access

When the SWIS transitions to a model of constrained network access, facilities will be able to gain access to Western Power's network without necessarily having to fund an augmentation to increase the transfer capability of the shared network to maintain the existing level of access of incumbents.[7]

As a result, under a constrained network access model, facilities will not have an inherent or guaranteed level of access to the network, including during peak demand periods. Instead, the access of facilities to the network is rationed based on their relative real time energy market offers, subject to constraints. Consequently, a given facility might not be able to dispatch to its full capacity during peak periods due to network constraints.

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4 A Capacity Year is the period of 12 months for which the RCR is set, commencing at the start of the trading day commencing on 1 October and ending on the end of the trading day ending on 1 October of the following calendar year.

5 This reliability standard is referred to in the WEM Rules as the 'Planning Criterion'. The Planning Criterion also requires accredited capacity to be sufficient to limit energy supply shortfalls to 0.002 per cent of the total demand forecast. However, historically this part of the Planning Criterion has not set the RCR.

6 For scheduled generators, this is based on an assessment of the facility's maximum output assuming an ambient temperature of 41 degrees Celsius. For intermittent generators, this is determined under the Relevant Level Methodology. Storage facilities will be certified under a new method discussed further in section 4.

7 Alternatively, a new entrant could previously have agreed to have their output curtailed ahead of incumbent facilities, leading to inefficient dispatch outcomes under the previous approach.

This has several implications for the assignment of Capacity Credits under the RCM.

Firstly, existing capacity providers are exposed to an unhedgeable risk arising from the potential decisions of new entrants to locate in congested (rather than uncongested) areas of the network. This is because the output of the new entrants can contribute to constraints at times of peak demand, reducing the availability of existing resources located in the same region during these peak periods and resulting in a reduction in their Capacity Credits (as their value under the RCM in terms of their contribution to reliability is reduced).

This is an inefficient outcome under the RCM as the new capacity does not add any marginal capacity value to the system but is simply displacing an existing and performing capacity resource. This is inconsistent with the purpose of the RCM as existing capacity resources have a value (that should be remunerated) so long as they contribute to reliability. Allowing existing and performing capacity providers to be churned out of the market to be replaced by assets that do not add significantly to the effectiveness of the RCM is inconsistent with this principle. It creates an unhedgeable risk that, if seen as substantial, reduces the incentives for new investment in capacity at least until the RCP increases to a level that allows capacity providers to recover their costs in a significantly shorter period to account for this risk.

Secondly, the introduction of constrained access means that AEMO can no longer assume a level of network access for a specific facility based on the facility's access contract with Western Power and will require a new process and systems to model the transfer capability of the network as part of the Capacity Credit assignment process. This is necessary to ensure that Capacity Credits are assigned based on the available capacity of the network and that the system can meet the RCR.

Changes to the way in which Capacity Credits are assigned are therefore required so that under the new constrained model the RCM continues to achieve its intended purpose of incentivising the investment needed to ensure a reliable power system. This is being addressed through the introduction of the NAQ framework which is discussed in section 3.

2.2 A new framework for integrating storage resources

Storage is a new technology that was not fully accommodated in the WEM Rules' framework for participation in the energy, capacity, and essential system services markets. The WEM Rules only contemplated technologies and devices that either generate or consume electricity. Storage, which both generates and consumes electricity, was unable to participate in these markets and access revenue streams in return for the services it can provide across the electricity value chain.

The Energy Transformation Strategy has implemented measures to overcome the barriers to the participation of storage in order to harness the benefits it can offer to the market, the grid, and consumers. Changes include new arrangements for the registration and connection of storage facilities that enable their certification to provide capacity and compete in energy and essential system services markets.

The new framework to provide for the integration of storage resources in the RCM is discussed in section 4.

2.3 Other changes to the Reserve Capacity Mechanism

Several consequential changes to the RCM to accommodate the new NAQ framework and storage participation under the RCM were required.

The key consequential changes are discussed in section 5.

2.4 WEM Objectives

The Improving Access to the Western Power Network project will deliver outcomes that are consistent with, and promote, the objectives of the WEM.

A constrained model of network access and market dispatch provides for a more economically efficient and secure production and supply of electricity to consumers. There is no longer a need to augment the network every time a new facility seeks to connect, and all facilities are dispatched according to a least cost merit order, subject to network constraints to maintain system security.[8]

The avoided cost of network augmentation and the equitable treatment of all facilities in market dispatch will encourage greater competition, minimising the long-term cost of electricity supplied to consumers in the SWIS. The different treatment of new generating technologies, as was necessary with the Generator Interim Access (GIA) solution, will also be avoided. Generators that connected to the network under the GIA solution will no longer be subject to curtailment ahead of other generators due simply to the terms of their access arrangements with Western Power.

The changes to the way in which Capacity Credits are assigned, through the new NAQ framework, ensures that the RCM will continue to incentivise investment in sufficient capacity when needed, delivering a reliable electricity system. Economic efficiency is promoted through locational signals for new investment, minimising the potential for additional investment in capacity to be made in areas of the grid where it is not needed or where it does not contribute to system reliability but simply displaces existing performing resources.

Finally, the new framework for the integration of storage resources under the RCM removes a significant barrier to the entry of these types of technologies, which can add significantly to the security of the system while providing new opportunities for market participants, promoting greater competition in the WEM.

8 Substantial consultation on the benefits of adopting a constrained model of network access was undertaken by the former Public Utilities Office and can be found here https://www.wa.gov.au/government/document-collections/improving-access-western-powers-network-implementing-constrained-access

3. The Network Access Quantity

3.1 The need for reform

Investment in generation is long-term and requires reasonable certainty over the ability to recover fixed costs. Future loss of Capacity Credits by the inefficient decisions of new entrants to locate in congested areas of the network is an unhedgeable risk that is outside of the direct control of existing facilities located in the same region.

Allowing the Capacity Credits of existing performing capacity resources to be displaced in these circumstances would result in overall inefficiency. It would encourage new entrants to locate in congested parts of the network for the purpose of securing Capacity Credits previously assigned to incumbent capacity, yet contributing little, if anything, to overall system reliability. Not only does this add risk to capacity investment, it would allow new entrants to earn capacity revenue in excess of the marginal contribution to reliability they provide to the system.

The NAQ framework is designed to avoid this inefficient outcome. The NAQ framework protects the Capacity Credits of existing capacity providers that would otherwise be displaced, where the output of a new entrant contributes to network congestion that constrains the availability of an existing resource at peak times.[9] The purpose of this protection is not simply to grandfather investment value but to ensure that existing performing capacity resources are not inefficiently replaced by new capacity that adds no marginal value to system reliability under the RCM.

This protection of Capacity Credits could be perceived to favour incumbency over new entrants seeking access to the network, as the presence of existing capacity providers in a congested region of the network will reduce the ability of lower cost new entrants to gain Capacity Credits until network capacity becomes available.[10]

The Energy Transformation Taskforce, however, considered that assigning Capacity Credits to facilities based on their marginal capacity value is consistent with the function and purpose of the RCM. The RCM rewards capacity resources for their availability and contribution to reliability, specifically during peak demand periods. If the RCM allowed new entrant capacity to displace existing certified capacity, there will be no net improvement in power system reliability and, from a capacity perspective, the new investment would be of little, if any, value.

Furthermore, as the WEM does not have locational pricing for energy and capacity, the NAQ framework aims to reflect the outcomes expected to occur if there were locational energy and capacity prices compelling providers to make investment decisions based on the marginal value they are providing to the market. By limiting the capacity revenue available to new facilities where the capacity of the network is unable to support additional generation capacity, NAQs will send important locational signals to the market about the value of generation capacity across the SWIS. This will discourage new entrants from locating in regions where existing resources are already providing the capacity that the network is able to carry.

Importantly, the NAQ framework does not limit opportunities for new capacity resources to connect in constrained sections of the network if they are able to access value in, and earn enough revenue from, the energy and essential system services markets to cover their costs.

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9 Other jurisdictions have more complicated mechanisms to manage this risk, such as financial transmission rights and more granular pricing, but a simpler, more tailored approach is more appropriate for the WEM.

10 For example, through the retirement of existing capacity or network augmentation.

3.2 Overview

The NAQ framework serves two purposes:

1. it establishes a process for determining the network capacity, in MW, available to a capacity provider for the purpose of determining the Capacity Credits that can be assigned to the facility up to the amount of its Certified Reserve Capacity (CRC) for a Reserve Capacity Cycle; and
2. it provides investment certainty for capacity providers that contribute to the reliability of the system, by establishing a priority order for the assignment of Capacity Credits to facilities, with a facility's priority status subject to adjustment only in specific circumstances.

A capacity provider must be assigned NAQ to receive Capacity Credits.[11] The NAQ serves as a cap on the Capacity Credits that can be assigned in specific regions of the network and as a result NAQ for new facilities will only be determined up to the residual capacity of the network in a region after accounting for NAQ that has already been assigned.[12] This ensures that Capacity Credits are assigned based on the transfer capability of the network for a particular Reserve Capacity Year.

The NAQ is not subject to a specific expiry term. Rather, it is granted for the life of the facility, provided that the performance requirements of the RCM are met.[13] A facility that, for reasons related to its own poor performance, fails to meet its obligations under the RCM to make its certified capacity available will relinquish the NAQ associated with the unreliable portion of its certified capacity. A facility that retires (or is mothballed or removed from service) will also relinquish its NAQ.

NAQs will be reduced if available network capacity does not support the NAQ assigned to a facility, even if the facility is meeting the performance requirements of the RCM. This ensures that consumers are only paying for reserve capacity that can be provided when needed by the system. In these circumstances, while the facility's Capacity Credits are not protected, the NAQ framework will preserve a facility's priority status for future RCM cycles as the NAQ reduction is not a performance issue. Available network capacity can be affected by changes in local demand, for example a decline in local demand may cause generators in the region to become constrained if the transfer capability to other regions of the network is limited. Changes in the configuration of the network can also affect available network capacity, for example where network assets are retired.

The NAQ has no role in dispatch or settlement of the energy or essential system services markets, which will operate under the new co-optimised security constrained economic dispatch design that will come into effect on the date of the new market commencement (scheduled for 1 October 2022).

To be clear, any new facility can locate in a constrained area of the network for the purpose of competing in the energy or essential system services markets. These facilities will be dispatched according to their relative real time offers in the energy or essential system services markets, subject to constraints. However, their ability to obtain Capacity Credits (and earn capacity revenue) is dependent on whether they are able to obtain NAQs through the NAQ assignment process – that is, there must be available network capacity to support all or some of their certified capacity for the facility to participate in the RCM.

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11 NAQs are assigned to a precision of 0.001, the same precision as applies to the assignment of Capacity Credits.

12 This represents a similar approach to the existing method of capacity assignment in the WEM where facilities connecting under agreements that grant, or are perceived to grant, unconstrained access are assigned Capacity Credits up to their contracted capacity and facilities connecting under the Generator Interim Access solution are assigned Capacity Credits up to the residual capacity of the network as determined by Western Power in accordance with (the current) Appendix 11 of the WEM Rules.

13 Generally, this would involve facilities continuing to be assigned CRC ≥ NAQ. There is an exception for intermittent facilities as the performance of these facilities depend on weather conditions that are 'external' to the facility. This is discussed in section 3.4.6.

3.3 Reform objectives

The design of the NAQ framework has been informed by the following objectives:

1. Investment certainty should be preserved by allowing existing resources to retain economic value under the RCM as long as facility performance is maintained.
2. Capacity Credits should be assigned based on the available capacity of the network.
3. Available network capacity should be efficiently rationed to maximise the access of parties and therefore the economic benefit of the network.
4. The new regime should contribute to locational signals for new entrants so they can make informed decisions about risk and opportunity.
5. Barriers to entry and exit should be minimised.
6. The new regime should be simple, transparent, and readily implemented in the WEM with minimal changes to existing processes.

3.4 Key design parameters of the NAQ framework

The Taskforce has endorsed key design parameters that represent the policy positions underpinning the design of the NAQ framework and the NAQ assignment process. A discussion of the NAQ assignment process can be found in Appendix A.

3.4.1 Facilities are assigned NAQ based on a priority order

The primary means by which the NAQ framework protects the Capacity Credits of existing performing resources is through the establishment of a priority order for the assignment of NAQ (and thereby Capacity Credits) to facilities.

The fundamental basis of the priority order is that existing facilities will be assessed for and assigned NAQ ahead of new facilities, with new facilities receiving NAQ up to the residual capacity of the network. Once assigned, a facility's NAQ cannot be negatively affected by a facility that has a lower status under the priority order. The set of prioritisation rules that guide the assignment of NAQ to facilities is described in Appendix A.

For the purposes of the NAQ assignment process, an 'existing' facility is a facility that has previously been assigned a non-zero NAQ value. A facility that has not previously been assigned a NAQ value will be considered a 'new' facility, even if that facility is operational in the energy market. An increase in an existing facility's level of CRC that is associated with an upgrade is also treated as 'new' for the purposes of the NAQ assignment process. Facility upgrades is discussed in section 3.4.10.

A facility is still considered an 'existing' facility if it has previously held NAQ but where its NAQ has been reduced, including to zero, in any previous Reserve Capacity Cycle. This could happen, for example, if an existing facility that has been assigned NAQ previously does not apply for certification in a Reserve Capacity Cycle and AEMO therefore reduces its CRC to in the Reserve Capacity Cycle.

3.4.2 Eligibility

All capacity resources are eligible to receive NAQs, including generation, storage, and demand side programs, so long as the certified performance of the facility (as assigned by AEMO in a Reserve Capacity Cycle) supports the NAQ being sought by the facility. That is, a facility must be assigned CRC in a Reserve Capacity Cycle at least more than or equal to its NAQ from the previous cycle.

3.4.3 Duration of NAQs

The NAQ is a performance-based mechanism and is not subject to a specific duration. A facility will retain NAQ for as long as its certified capacity is available to contribute to the reliability of supply. This means that the facility must continue to be assigned CRC and that there is available network capacity to support its NAQ. This is consistent with the fundamental design of the RCM to support investment in reliable supply and the underlying principle of remunerating only capacity that supports the reliability of the system.

The alternative of selecting a time-bound term would introduce an inherently arbitrary process for assigning value to capacity resources under the RCM. Shorter durations may lead to inefficient and wasteful ‘churn’ of resources, incentivising new investments in capacity that do not lead to an increase in the level of power system reliability. Capacity resources should not lose their value under the RCM simply because of the expiry of an arbitrary time period, but because they have failed to perform and meet their availability requirements.

3.4.4 Facility performance must support NAQ

The NAQ is a performance-based mechanism. A facility must demonstrate that it can provide capacity up to its level of NAQ. This will be demonstrated if AEMO has assigned the facility CRC at a level equal to, or greater than, the level of NAQ assigned to the facility. If a facility’s CRC is reduced below its level of NAQ in the capacity certification stage (Year 1) of a Reserve Capacity Cycle, the facility’s NAQ will be reduced to the corresponding level of CRC for that cycle.

Market participants may apply for additional NAQ for their facilities in subsequent Reserve Capacity Cycles subject to the facility’s CRC and the level of available network capacity supporting the NAQ being sought. Different prioritisation rules apply depending on whether the facility is an intermittent resource or not, and the different treatment is discussed below in section 3.4.6.

Linking NAQ to the CRC of a facility provides the necessary incentive for market participants to maintain the performance of their facility to at least a level equal to their NAQ and strikes an appropriate balance between the need to protect existing investments and the need to maintain reliability. Opportunities for new entrants are created where poor performing resources lose their NAQ or exit the market (because the cost of maintaining performance exceeds the capacity revenue under the RCM).

3.4.5 Network capacity must support NAQ

A facility’s NAQ must be supported by available network capacity to ensure that the transfer capability of the network can accommodate the quantity of Capacity Credits assigned to the facility. If available network capacity no longer supports a facility’s level of NAQ, then the facility’s NAQ will be reduced. Available network capacity can be affected by changes in local demand or changes in the configuration of the network and will be modelled through a defined process and a new tool being developed by AEMO.

Facilities that have their NAQ reduced because of insufficient available network capacity retain their priority status under the NAQ framework and will be assessed ahead of other facilities. This would allow these facilities to potentially recover the lost NAQ in a subsequent Reserve Capacity Cycle, subject to the facility’s level of CRC and the level of available network capacity supporting the NAQ being sought in the subsequent Cycle. This is discussed in section 3.4.6.

3.4.6 Accommodating the effect of external factors on a facility's NAQ

An existing facility's NAQ will be adjusted where the facility's performance or the available network capacity no longer supports the NAQ assigned to the facility in a Reserve Capacity Cycle.

There are two general circumstances that a reduction in NAQ is caused by factors that can be regarded as 'external' to the facility:

1. The intermittency of a renewable resource can affect the CRC assigned to an intermittent facility. This is determined using a Rule based method, the Relevant Level Methodology (RLM), that relies in part on the historic performance of the facility.
2. Changes in demand locally or across the network[14] and changes in the configuration of the network[15] can reduce available network capacity that affects a facility's ability to export electricity at times of peak demand.

If the NAQ for an existing facility can be reduced by external factors, then it is appropriate, in the event that demand, network, and weather conditions improve in a subsequent Reserve Capacity Cycle, to assess existing facilities for any increased NAQ ahead of any new facilities and assign NAQ subject to the existing facility's performance and available network capacity.

The priority order under the NAQ framework has been designed to account for this through the concept of a 'Highest NAQ' value. A facility's Highest NAQ is the highest NAQ value that has been assigned to the facility in any Reserve Capacity Cycle, subject to adjustments for poor performance. It allows for an existing facility's NAQ to be adjusted down where this is caused by an external factor while providing the facility with a priority for any additional NAQ (up to its Highest NAQ) in a subsequent Reserve Capacity Cycle, where this is supported by the facility's level of CRC and available network capacity.

The priority afforded to existing facilities through the Highest NAQ is not intended to protect against poor performance. Therefore, if a facility's CRC does not support its Highest NAQ value, then the Highest NAQ value is adjusted down to the corresponding level of CRC in the Reserve Capacity Cycle for which Capacity Credits are being sought. This does not apply to intermittent facilities as the reduction in the facility's CRC is caused by an external factor.

3.4.7 Maximising the access of facilities

NAQ is assigned to maximise the utilisation of available network capacity. Where there is insufficient network capacity to accommodate the NAQ being sought by multiple facilities, NAQs will be assigned in a way that maximises reserve capacity under the RCM. This will be determined through an assessment of a facility's contribution to network congestion. A facility whose output contributes least to network congestion at times of peak demand can transfer more of their output into the network thereby maximising the reserve capacity available in that part of the network. These facilities will therefore receive more NAQ relative to facilities that contribute more to network congestion.

A facility's contribution to network congestion will be determined through the constraint equations developed by AEMO for the purposes of modelling available network capacity and assigning NAQ. See section 3.5 for a discussion on RCM Limit Advice and RCM Constraint Equations.

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[14] For example, a decline in local demand may cause generators in the region to become constrained particularly where the transfer capability to other regions of the network is limited.

[15] For example, the economic retirement of network assets or the replacement of a network asset with a different asset or a non-network solution may result in a reduction in the transfer capability of the network in the affected region.

3.4.8 Network augmentation funded by facilities

Market participants that fund the cost of network augmentation to support the access of their facilities to the network will receive a higher priority status in the NAQ assignment process relative to other new facilities that are not funding network augmentation. The funding must relate to the augmentation of the shared network and not solely to a contribution for connection assets.

Facilities will be classified as a 'Network Augmentation Funding Facility' if:

- the market participant has nominated its facility to be classified as a Network Augmentation Funding Facility as part of the Expressions of Interest process and in its application for CRC;
- the market participant can demonstrate its commitment to fund the augmentation and the augmentation will be completed and in-service before the start of the Capacity Year to which the application for CRC relates; and
- the facility has been assigned a 'committed' status by AEMO.

A Network Augmentation Funding Facility does not have priority over an existing facility in the NAQ assignment process.[16] This ensures that existing facilities are not affected by the entry of the funding facility. Constraint equations that reflect the augmentation will be incorporated into the NAQ Model at the appropriate step in the NAQ assignment process.

A different process applies to Network Augmentation Funding Facilities that have been granted Early Certification of Reserve Capacity. This is discussed in section 3.4.11.

3.4.9 Facility retirement

The WEM Rules require market participants to notify AEMO of the retirement of their facilities at least three years in advance of the expected retirement date.

The NAQ associated with retiring facilities will not be retained beyond the proposed retirement date for the facility, irrespective of whether the facility is then retired or not. Where a market participant withdraws the retirement notice, then the facility will be treated as a 'new' facility in the NAQ assignment process in the Reserve Capacity Cycle that follows the announced retirement date.

AEMO will be required to publish information on facility retirements, including the name of the market participant, the name and location of the retiring facility, and the NAQ that has been assigned to the facility at the time of the notice and for any subsequent Reserve Capacity Cycle. This is intended to enable existing market participants and new investors to determine the expected NAQ that will be available once the facility retires.

3.4.10 Facility upgrades

A facility 'upgrade' will be treated as new capacity and the upgrade will compete with other new facilities for available NAQ. Any increase in an existing facility's level of CRC that is associated with an upgrade will be assessed for available NAQ together with new facilities.

For the purpose of the NAQ assignment process, a facility upgrade means the MW quantity of the increase in the nameplate capacity of an existing facility, being the difference in the quantity that is recorded in the facility's standing data in the current and the immediately preceding Reserve Capacity Cycles.

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16 An existing facility may benefit from the augmentation by receiving more NAQ.

3.4.11 Early Certification of Reserve Capacity

The WEM Rules currently allows new projects with long lead times to secure Capacity Credits in advance of the normal Reserve Capacity Cycle timeframes through Early Certification of Reserve Capacity (Early CRC), with the primary objective of providing greater certainty for investors for these types of projects.

Early CRC is being retained but with several key amendments to the existing process.

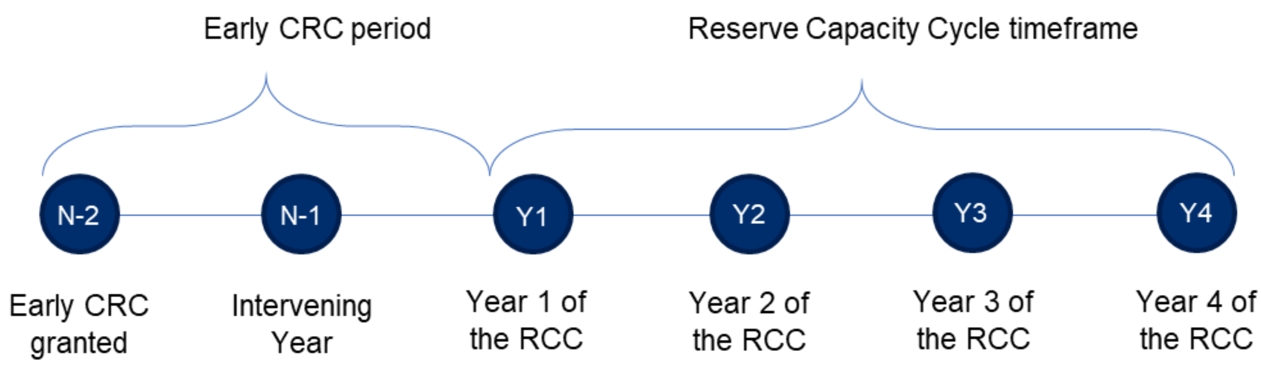
- AEMO can reject applications for Early CRC if it is satisfied that the construction or commissioning of the facility cannot be achieved within the normal timeframes of a Reserve Capacity Cycle.
- Applications for Early CRC cannot be made more than two years before the start of the relevant Reserve Capacity Cycle to which the application relates, this being the cycle for which Capacity Credits are being sought for a facility.
- Applications for Early CRC must be submitted prior to 1 March of Year 1 of a Reserve Capacity Cycle to be processed in that Reserve Capacity Cycle. Applications submitted after this deadline will be processed in the following Reserve Capacity Cycle.
- Capacity Credits will not be assigned to Early CRC facilities until the relevant Reserve Capacity Cycle to which the application relates so that the capacity of the Early CRC facility is not counted towards the RCR until it is expected to be in service.
- Intermittent facilities that are not also classified as a Network Augmentation Funding Facility are not eligible for Early CRC status. This is a new policy position and reflects that intermittent facilities (that are not augmenting the network) can be built within the normal Reserve Capacity Cycle timeframes.

A facility that has been granted Early CRC in a Reserve Capacity Cycle will be considered in the NAQ assignment process in that cycle but in the last step of the process (i.e., after NAQ has been assessed and assigned to existing and other new facilities).

The purpose of including Early CRC facilities in the NAQ assignment process is to provide them with a similar level of certainty provided to other types of facilities that do not require long lead times. It means the already committed Early CRC facility avoids the potential negative impacts of other new facilities entering and receiving NAQ, to the detriment of the Early CRC facility, in the intervening years after the early certification has been granted. Otherwise, the RCM and the NAQ assignment process would unfairly disadvantage facilities that genuinely require longer delivery timeframes.

Early CRC facilities are considered differently in the NAQ assignment process depending on whether the market participant for the facility is funding an augmentation to the shared transmission network.

Figure 3.1: Early CRC example



In the example above, a market participant applies for Early CRC for a facility in the Reserve Capacity Cycle for year N-2. The relevant Reserve Capacity Cycle to which the application relates is year Y1, with the capacity to be delivered in year Y3.

AEMO grants Early CRC to the facility in the Reserve Capacity Cycle for year N-2.

Early CRC facilities that are not associated with a network augmentation

In the Reserve Capacity Cycle for year N-2, the Early CRC facility is considered in the NAQ assignment process in the last step after existing and other new facilities.

If there is available network capacity to support the Early CRC facility's capacity, it will be assigned an 'Indicative NAQ'.

If the Early CRC facility has been assigned an Indicative NAQ in year N-2, then in the Reserve Capacity Cycle for the intervening year N-1, the Early CRC facility is considered together with existing facilities in the NAQ assignment process and is again assigned an Indicative NAQ (which may be different from its Indicative NAQ value in year N-2 due to external factors such as changes in demand and changes in the configuration of the network).

In the relevant Reserve Capacity Cycle (year Y1), the Early CRC facility is considered together with existing facilities in the NAQ assignment process and the facility is assigned a final NAQ value and an equivalent quantity of Capacity Credits at the end of the process.

Early CRC facilities that are associated with a network augmentation

In the Reserve Capacity Cycle for year N-2, the Early CRC facility is considered in the NAQ assignment process in the last step after existing and other new facilities. In this last step, the NAQ Model is updated to include the relevant constraint set associated with the funded augmentation. The NAQ Model is operated and the Early CRC facility will be assigned a 'preliminary NAQ'.

In the intervening year N-1, the Early CRC facility is not considered in the NAQ assignment process. This is because the expected network configuration for the Capacity Year to which the intervening Reserve Capacity Cycle relates will not include the network augmentation that is being funded by the Early CRC facility.[17]

In the relevant Reserve Capacity Cycle (year Y1), the Early CRC facility is treated as an existing facility and will be considered in the NAQ assignment process together with other NAQ facilities based on the network configuration expected for year Y3. In this step, the NAQ Model will include the relevant constraint set associated with the funded augmentation.

3.5 RCM Limit Advice and RCM Constraint Equations

The NAQ framework imposes new requirements on Western Power and AEMO with respect to network limits and constraint equations for the purposes of the NAQ assignment process.

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[17] It is possible that an Early CRC facility relies on both existing network capacity and its funded augmentation for NAQ. For example, a facility that is certified for 100 MW is funding 60 MW of network augmentation and is relying on existing network capacity to provide NAQ for the remaining 40 MW of its certified capacity. In these circumstances, any NAQ that is assigned to the facility that is not associated with the augmentation will be included in the NAQ assignment process for the intervening year N-1.

Western Power will develop thermal network limits assuming an ambient temperature of 41 degrees Celsius (RCM Limit Advice) that represent Western Power's reasonable expectation of the network on 1 October of Year 3 of the relevant Reserve Capacity Cycle. This will include committed augmentations and retirements to the transmission network, new connections (based on responses to the Request for Expressions of Interest), and facility retirements. The limit advice will be developed for assets impacting market participants based on advice from AEMO.

Western Power may not be able to provide non-thermal network limits for facilities that are not yet in-service. In these circumstances, the limit advice in AEMO's possession that most closely represents the expected non-thermal network limit for the facility (i.e. a 'proxy') will be used.

AEMO will then use the RCM Limit Advice to develop constraint equations for use in the NAQ Model (RCM Constraint Equations).

The RCM Limit Advice and RCM Constraint Equations will be published by AEMO in Year 1 of each Reserve Capacity Cycle. The RCM Constraint Equations will be published on 20 May as a set of preliminary equations to enable market participants to form a view on the potential NAQ that may be assigned to their facility as part of their application for CRC, with the final set published as part of the NAQ and Capacity Credit assignment process.[18]

3.6 Matters being deferred

3.6.1 Replacement of capacity

The NAQ is primarily a performance-based mechanism that can only be adjusted in limited circumstances. Linking NAQ to the performance of a facility provides the necessary incentive for market participants to maintain the performance of their facility to at least a level equal to their NAQ.

A question arises, however, where investment results in the original capacity resource being "replaced" by a new and potentially different, capacity resource. Allowing such a facility to retain its NAQ could entrench incumbency and limit opportunities for new competitors to enter the market. This could provide a level of protection for incumbents that goes beyond the original purpose of the NAQ, which is to provide certainty of capacity revenues for a defined facility investment. Protecting incumbents indefinitely may not deliver the efficiencies that can eventuate from NAQ becoming contestable at some point.

In determining when an investment in an existing capacity resource should be treated as a 'new' facility, a reasonable starting point is to consider modifications to a facility that would materially change the facility's underlying characteristics and technical performance, such that new technical standards and/or amendments to the facility's access contract would be required, or cause compliance with Generator Performance Standards to be re-assessed.

The range of modifications that would trigger this requirement are extensive, however, ranging from modifications that are considered to be routine maintenance activities required of any facility to stay in business, to modifications that are considered as brownfield redevelopments. It is therefore difficult to precisely define a threshold at which a modification should no longer be considered as a routine maintenance activity but as a major redevelopment. Appendix D provides examples of potential changes to illustrate this difficulty.

[18] The RCM Constraint Equations published on 20 May are preliminary as they will not incorporate the peak demand forecasts for the Reserve Capacity Cycle that are published by AEMO as part of the Electricity Statement of Opportunities report on 16 June.

As the threshold has significant implications to the capacity revenue a facility can earn, the development of an appropriate threshold requires more extensive consultation with industry. The financial implications of this policy position also mean that the threshold must be defined with sufficient precision to remove the need for AEMO to exercise any discretion when determining whether an investment in a facility turns this facility into a 'new' facility for the purposes of the NAQ process.

In the meantime, the current design of the NAQ framework contains the following features that can be relied on to ensure that an incumbent facility that undertakes major modifications to a facility is subject to some form of competition for NAQ:

- Market participants must ensure that the capacity (to which their NAQ is associated) continues to be made available to the RCM. Major modifications that remove existing capacity from service for extended periods of time may result in AEMO not assigning CRC to the facility, in which case the NAQ associated with that facility will be relinquished and available for reassignment to other facilities in the same Reserve Capacity Cycle.
- Major modifications that result in an increase in the facility's nameplate capacity are treated as an upgrade under the NAQ framework and the NAQ assignment process will require that the facility competes with other new facilities for any NAQ associated with the increase in nameplate capacity.

3.6.2 NAQ transfers

A concept of NAQ reassignment or trading was considered during the development of the high-level design of the NAQ framework. Providing for a formal mechanism for the transfer of NAQs between market participants under commercial arrangements can provide for efficient outcomes, encouraging older facilities to exit the market where the costs of maintaining the facility (to meet obligations under the RCM) is greater than the capacity revenue earned by the facility and allowing for investments in new and more efficient capacity resources to occur in congested regions of the network.

As this was not necessary for the implementation of the NAQ framework, a market mechanism to facilitate the transfer of NAQ was not developed but will be considered as part of a review of the RCM and the NAQ framework in the future.

3.7 Transitioning to the new arrangements

3.7.1 The 2022 Reserve Capacity Cycle

The NAQ framework will commence as part of the 2022 Reserve Capacity Cycle. The process for assigning NAQ to facilities in the 2022 Reserve Capacity Cycle will involve the following steps:

1. An 'initial' NAQ value is determined for existing facilities, the purpose of which is to give existing facilities priority over new facilities and upgrades to existing facilities for the purposes of undertaking the NAQ assignment process for the first time in the 2022 Reserve Capacity Cycle.

   For the 2022 Reserve Capacity Cycle, an 'existing' facility is any facility that has been assigned Capacity Credits in the 2021 Reserve Capacity Cycle. These consist of facilities that connected under Western Power's GIA solution (GIA facilities) and facilities that connected under a non-GIA arrangement (non-GIA facilities).

   The initial NAQ value for non-GIA facilities and for GIA facilities that are non-intermittent generating systems will be equal to the lower of the facility's Capacity Credits assigned in the 2021 Reserve Capacity Cycle and the CRC assigned to the facility in the 2022 Reserve Capacity Cycle.

The initial NAQ value for GIA facilities that are intermittent generating systems is equal to the CRC assigned to the facility in the 2022 Reserve Capacity Cycle.

2. The effects of network constraints on the group of existing facilities' output at peak demand is then modelled using the NAQ Model, with the 'initial' NAQ value used as a starting point to determine the 2022 NAQ value (and the equivalent quantity of Capacity Credits) for each existing facility.

   For the purposes of the 2022 Reserve Capacity Cycle, the NAQ for non-GIA facilities will be determined and assigned in priority to existing GIA facilities.

3. Once NAQ is assigned to existing facilities, the process will consider new facilities seeking Capacity Credits in the 2022 Reserve Capacity Cycle in accordance with the NAQ assignment process (as described in Appendix A**)**.

3.7.2 Capacity Credit Uplift

Available network capacity will be modelled using a new capacity allocation tool, the NAQ Model, that will incorporate a wide range of information and assumptions about the SWIS. This includes, for example, constraint equations based on network thermal limits that assume an ambient temperature of 41 degrees for the Western Power network. The NAQ Model will also incorporate non-thermal constraints in AEMO's possession (to address voltage and stability issues).

There is some risk in the transition to the new constrained access regime that the network capacity modelled under this new process does not support the Capacity Credits allocated to existing facilities that connected on arrangements that granted (or that could be perceived to grant) access to Western Power's network on an unconstrained basis.

To cater for this risk, a transitional mechanism will apply to 'uplift' the Capacity Credits of impacted facilities. The Capacity Credit uplift will only be available to non-GIA facilities, and represents the difference between the final NAQ value assigned to a non-GIA facility in the 2022 Reserve Capacity Cycle and the 'initial' NAQ determined for the facility in the 2022 Reserve Capacity Cycle.

As the amount of MW corresponding to the uplift would not be able to contribute to meeting the RCR, an equivalent amount would be procured by AEMO through the RCM. The uplift will be an enduring arrangement for the life of the impacted facility provided the facility continues to provide certified capacity. For the early years, the Taskforce anticipates that there will be a sufficient level of excess capacity in the RCM from which to procure the uplift. If there is a shortfall of capacity, then AEMO would need to procure an additional amount of capacity to cover the uplift amount. This may result in a higher level of excess capacity than would otherwise have been procured and may result in a lower price for Capacity Credits.

The sum of a facility's NAQ and its uplift must not exceed the facility's CRC. If the sum of the NAQ and the uplift exceeds the CRC for the facility, then the amount of the uplift will be reduced. When an uplift amount is reduced, it cannot then be subsequently increased. Capacity Credits assigned to facilities under this uplift provision will be treated in the same way as any other Capacity Credits, and subject to the same obligations, testing requirements, refunds, payments, and any other provisions applicable to Capacity Credits under the WEM Rules.

4. Storage in the RCM

The Energy Transformation Strategy is delivering a new framework to provide for the participation of storage resources in the WEM to harness the benefits that these types of capacity resources can offer the market and the power system.

Under the reforms to the RCM, Electric Storage Resources (ESR) will be able to participate in the RCM and earn capacity revenue for their contribution to reliability. ESR ranges from large-scale storage resources connected to the transmission network, either standalone or co-located with another type of generation technology as part of a 'hybrid' facility, and to small-scale aggregated storage connected to the distribution network.[19]

This section describes the key design parameters endorsed by the Taskforce to enable storage resources to participate in the RCM. This includes how storage capacity will be certified, the obligations on storage facilities to provide their certified capacity into the market, and the obligations on storage facilities that charge during peak demand periods to contribute to the cost of the RCM. As with any capacity resource, storage must be assigned NAQ to receive Capacity Credits.

In the short term, it is more likely that storage facilities will enter the market as part of a 'hybrid' facility, i.e., facilities with different types of capacity resources behind a single connection point, one of which includes ESR. This section also describes how hybrid facilities that include a storage component will be treated under the RCM.

4.1 The capacity value of storage

4.1.1 De-rating factor

For all capacity resources, there is a difference between the maximum potential capacity at a point in time and what the resource can reasonably be expected to contribute to system reliability over a given duration. This difference is commonly referred to as 'de-rating' and may arise due to factors such as the impact of temperature, facility outages, network constraints, fuel constraints or limitations on run time. These limitations on a facility's contribution to reliability over time must be accounted for as part of the capacity accreditation process.

The de-rating method depends on the type of capacity resource. In the SWIS, conventional capacity resources[20] are de-rated based either on historical or probable outage rates and their expected performance at an ambient temperature of 41 degrees Celsius. Intermittent generation is de-rated based on the contribution to reliability of their historical or expected output profiles using the RLM.

Storage facilities are more complex to de-rate since they are both energy limited and time limited resources. They are also fully controllable like conventional generators, but like intermittent generators they cannot be available in every interval during a trading day. It would not be appropriate to de-rate them solely based on their capability to produce energy at 41 degrees Celsius, as storage with different durations will make different contributions to the reliability of the system. Nor would it be appropriate to de-rate storage based on their historical or forecast output due to their high degree of operational flexibility. This flexibility allows them to respond dynamically to changing market signals and therefore their historical behaviour may not be a good indicator of their future behaviour.

19 The policy regarding the integration of Distributed Energy Resources (DER) is subject to ongoing actions under the DER Roadmap. However, the RCM reforms will facilitate distribution connected facilities to participate in the RCM and earn capacity revenue.

20 Typically, resources that are expected to be available all the time, such as thermal plant.

4.1.2 A linear de-rating model for storage

A 'linear' de-rating method will be used to assess the capacity value of ESR in the WEM[21] and assigning CRC to these facilities. Appendix B outlines the options considered by the Taskforce.

The linear de-rating model involves a simple approach that accounts for the energy limited and time limited nature of storage resources by first determining the length of a typical system stress or peak demand event and then de-rating resources on the basis of their contribution to reliability over the duration of this system stress event. A storage resource's contribution to system reliability is therefore a function of both the duration of the stress event and maximum output of the resource in MW that the resource can sustain over that duration.

For the SWIS, the duration of a typical stress event has been set at four hours[22], or eight contiguous trading intervals, this being the ESR Obligation Duration. Thus, a four-hour ESR would be accredited for 100 percent of its maximum output (subject to other technical considerations[23] as part of the certification process), a two-hour ESR would be accredited to 50 percent of its maximum output, and a one-hour ESR would be accredited to 25 percent of its maximum output.

4.1.3 Accounting for an evolving power system

There is a high likelihood that the capacity contribution of storage resources to the reliability of the SWIS will change over time as the characteristics of the electricity system change. For example, as more storage is deployed, the peaking event it serves will become longer with the consequence that storage must sustain its output over a wider part of the demand curve. This would result in a reduction in a storage resource's contribution to servicing peak demand and hence its value and amount of certified capacity under the RCM.

To ensure that the framework for accrediting storage resources remains consistent with the WEM Objectives, the Coordinator of Energy will conduct a review of the effectiveness of the certification of Reserve Capacity for ESR at least once every five years. This will account for the likelihood that the system peak duration may change over time, but also provide participants with some certainty that the method, which will be applied to value the capacity contribution of storage resources to the reliability of the SWIS, will be applied consistently for a fixed period.

4.2 Registration

ESR can be installed as a standalone facility or as a component of a facility that has another type of capacity resource behind the same connection point (a 'hybrid' facility).

4.2.1 Registering standalone ESR

A standalone ESR facility will be registered as a Scheduled Facility unless it is below a specific size threshold (5 MW[24]) in which case it may be registered as a Non-Scheduled Facility.

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21 Different rules apply to ESR registered as a Non-Scheduled Facility, for which the RLM will be applied unless the ESR does not have the required amount of operational data, in which case the linear de-rating method will apply. See section 4.4.1.

22 This is based on preliminary analysis conducted by AEMO on peak event durations in the SWIS. The Taskforce notes that a four-hour duration is also typical in other international jurisdictions.

23 For example, the degradation of the resource. AEMO will be required to document the processes it will follow when assessing the capacity of ESR to account for the degradation of the resource.

24 This is considered as a 10 MW facility under the definition of System Size in the WEM Rules.

4.2.2 Registering hybrid facilities with an ESR component

The new registration taxonomy does not address hybrid facilities as a distinct registration class, although this may be revisited once the detailed design to implement the Distributed Energy Resources (DER) Roadmap policy for the integration of aggregated DER facilities in the WEM has been finalised.

Hybrid facilities with an ESR component may therefore be registered as a Scheduled, Semi-Scheduled, or Non-Scheduled Facility.

- Whether a hybrid facility with an ESR component is registered as a Scheduled or Semi-Scheduled facility will depend on whether it is a 'controllable' facility, as determined by AEMO.
- Whether a hybrid facility with an ESR component is registered as a Non-Scheduled Facility may depend on whether it is below a specific size threshold (currently 5 MW).

It is possible that an existing Semi-Scheduled Facility that subsequently installs an ESR component is deemed to be 'controllable' because the ESR component is larger than the intermittent component of the facility. In these circumstances, the market participant would need to register each of the components of the hybrid facility separately because an intermittent capacity resource is unlikely to be able to reliably respond to a dispatch instruction to increase its output.

4.3 Metering arrangements

A market participant seeking capacity for a facility that contains multiple technologies, each of which are treated under separate certification processes in the RCM, must ensure that it includes adequate sub-metering arrangements capable of calculating the contribution of each component to the output of the facility. This is to facilitate the certification for intermittent and ESR components and testing of an ESR or non-intermittent component, given that different methods may apply for the different technology types comprising the hybrid facility. The sub-metering will not be used for the purposes of settlement and these sub-metering arrangements are distinct from those provided by Western Power at a connection point.

The requirements for the sub-metering and the communication and provision of metering information to AEMO will be documented in a WEM Procedure that will include:

- the characteristics and requirements, including accuracy requirements, for the sub-meter;
- the procedures to be followed by Market Participants for auditing of the sub-meter;
- the communication requirements and protocols between a Market Participant and AEMO; and
- the processes to be followed by a Market Participant for providing meter information to AEMO.

4.4 Certification of storage capacity

4.4.1 Certifying standalone ESR

Standalone ESR facilities that are registered as a Scheduled Facility will be assessed using the linear de-rating method.

Standalone ESR facilities that are registered as a Non-Scheduled Facility will be assessed using the linear de-rating method until there is the required amount of operational data at which point the facility will be assessed under the RLM.

4.4.2 Certifying hybrid facilities with an ESR component

The certified capacity of the ESR component of a hybrid Scheduled or Semi-Scheduled Facility will be assessed using the linear derating method, with the other components of the facility assessed separately under the method applicable to each type of resource.[25]

A hybrid Non-Scheduled Facility containing an ESR component will be assessed under the RLM.

4.4.3 Capacity Credit assignment

Capacity Credits will be assigned to standalone ESR and hybrid ESR facilities up to the amount of CRC assigned to the facility, capped by the NAQ assigned to the facility.

For hybrid facilities seeking capacity for components that are separately certified, if the quantity of Capacity Credits assigned to the facility is lower than the sum of CRC assigned to each of the components of the facility, then the market participant must notify AEMO (on or before 30 October of Year 1 of the Reserve Capacity Cycle) of the number of Capacity Credits that are to be associated with each component (up to the CRC associated with each component).

4.4.4 Availability class

Standalone ESR facilities are classed as Availability Class 2 capacity resources.

Hybrid facilities with an ESR component are classed as Availability Class 1 capacity resources.

4.5 Reserve Capacity Obligations

Facilities with Reserve Capacity Obligations have several obligations: to make the capacity associated with their Capacity Credits (Reserve Capacity Obligation Quantity (RCOQ)) available to the market,[26] to respond if dispatched by AEMO, and to have their planned outages approved by the AEMO. If a facility fails to meet any of these obligations, it must pay capacity refunds.

ESR will be required to be available for a standardised duration.[27] Based on the four-hour ESR Obligation Duration, each ESR would have an obligation to offer energy into the market across that four-hour period. For a 100 MW / 400 MWh facility, this would mean offering 100 MW in every hour for the four-hour ESR Obligation Duration (Facility 1 in Figure 4.1 below). For a 100 MW / 200 MWh ESR, this would mean offering 50 MW in every hour for the ESR Obligation Duration (Facility 2 in Figure 4.1 below). For a 100 MW / 100 MWh ESR, the RCOQ is 25 MW in every hour for the ESR Obligation Duration (Facility 3 in Figure 4.1 below).

The ESR Obligation Duration applying to a Capacity Year will be published in the Electricity Statement of Opportunities. AEMO will also have the flexibility to change the window of time (but not the length of the window) at shorter notice, by 8.30am on the Scheduling Day, to enable AEMO to respond to changing or unexpected market conditions.

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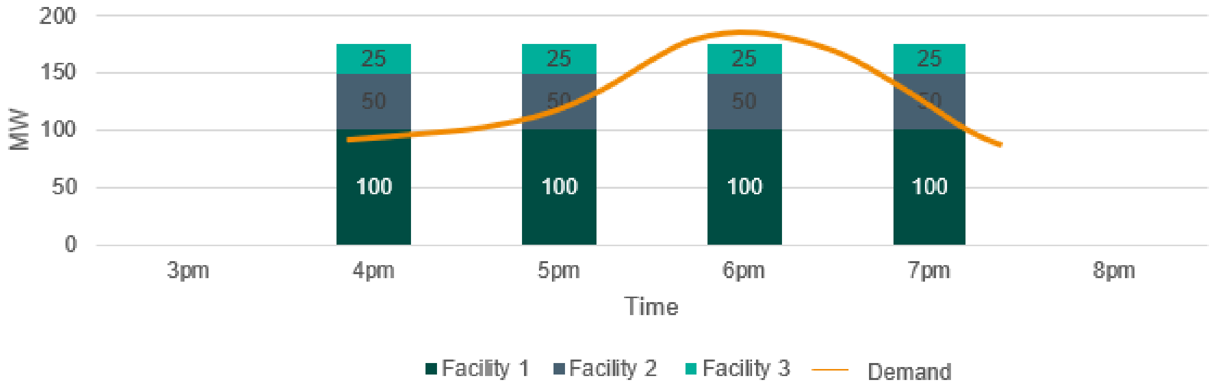
25 The WEM Rules gazetted in December 2020 provide for the separate certification for hybrid facilities with an ESR component. This principle will be expanded to include all hybrid facilities (i.e., including hybrid facilities without an ESR component).

26 In the new co-optimised market design, all facilities will be able to bid into both energy and essential system services markets simultaneously. If a facility with an RCOQ does so and is dispatched for essential system services and not energy, it will be deemed to have met is RCOQ obligations.

27 **Error! Reference source not found.** outlines the alternatives that were considered.

Figure 4.1: Standardised RCOQ



4.5.1 Obligations on standalone ESR

Standalone ESR facilities that are registered as a Scheduled Facility will have a non-zero RCOQ in specific trading intervals (the ESR Obligation Interval) over eight contiguous trading intervals (the ESR Obligation Duration) every day.

Standalone Non-Scheduled Facilities comprising only ESR will have zero RCOQ in all trading intervals.

4.5.2 Obligations on hybrid facilities with an ESR component

The RCOQ for a hybrid facility (except for a hybrid Non-Scheduled Facility) will reflect its different components. Hybrid facilities that contain a storage component will have an RCOQ that changes over the course of a day.

A hybrid Scheduled Facility containing ESR (for example a gas turbine that is co-located with a storage resource) will have an RCOQ that is equal to the sum of the RCOQ for the non-ESR component and the ESR component during the ESR Obligation Duration and an RCOQ that is equal to the RCOQ for the non-ESR component for all other trading intervals.

A hybrid Semi-Scheduled Facility containing ESR (for example, a wind farm that is co-located with a storage resource) would have a zero RCOQ for most intervals but would have a RCOQ associated with the ESR component during the ESR Obligation Duration.

A hybrid Non-Scheduled Facility that contains an ESR will have a zero RCOQ in all trading intervals.

4.5.3 Exemption from RCOQ obligations

On occasion, it may be necessary for AEMO to intervene in the operation of the WEM to maintain or re-establish a secure and reliable power system. In such cases, AEMO may direct[28] a standalone ESR facility or a hybrid facility with an ESR component to operate the ESR in a certain way or to provide Essential System Services.

In the circumstances where AEMO has directed a facility comprising only, or containing, ESR to operate at a value higher than its RCOQ for a trading interval, then the RCOQ for the ESR will be reduced to zero for all subsequent ESR Obligation Intervals for that trading day.

[28] In accordance with clause 7.7.5.

4.6 Reserve Capacity Testing

ESR, either as a standalone facility or as a component of a hybrid facility, will be subject to Reserve Capacity Testing and must demonstrate operation at the required level for the ESR Obligation Duration (i.e., across the eight contiguous ESR Obligation Intervals) once in each of the summer and winter testing periods.

A market participant may provide meter data for the ESR within a hybrid facility to demonstrate operation at the required level as part of normal market operations (by 31 January for the summer test, and by 31 July for the winter test), otherwise a test for the ESR will be scheduled by AEMO.

AEMO will schedule a re-test if the ESR has failed to demonstrate operation at the required level under the first test. If a test (including a re-test) for ESR is scheduled, meter data for the ESR must be provided within five business days of the test or the Capacity Credits for the ESR component will be reduced to zero.

A market participant may request a final re-test if the ESR has failed both the first test and the re-test.

4.6.1 Testing for standalone ESR

The Capacity Credits for a standalone ESR facility that fails to demonstrate operation at the required level will be reduced to reflect the highest average performance achieved by the facility over the ESR Obligation Duration in either the first test or the re-test.

If a market participant requests a final re-test, then the Capacity Credits for the facility will be set at the average performance achieved by the facility in the final re-test (but not exceeding the Capacity Credits originally assigned to the facility in the Reserve Capacity Cycle).

A standalone Non-Scheduled ESR facility is not subject to testing as these types of facilities have a zero RCOQ.

4.6.2 Testing for hybrid facilities with an ESR component

Hybrid facilities with an ESR component will be subject to Reserve Capacity Testing on a component level and only the Capacity Credits that are associated with the component that fails to demonstrate operation at the required level will be reduced.

Thus, the Capacity Credits of an ESR component of a hybrid facility that has failed the first test and the re-test will be reduced to reflect the higher average performance across either test. If a final re-test is requested, then the Capacity Credits will be set at the average performance achieved by the ESR component in that final re-test.

For a hybrid Scheduled Facility, the non-intermittent generating system component of a hybrid Scheduled Facility that fails to demonstrate operation at the required level will have its Capacity Credits reduced to reflect the maximum capabilities achieved across either the first test and the re-test (or a final re-test if that is requested). For a hybrid Semi-Scheduled facility, the intermittent component is not subject to testing as it has no Reserve Capacity Obligations.

A hybrid Non-Scheduled Facility containing ESR is not subject to testing as these types of facilities have a zero RCOQ.

4.7 Reserve Capacity refunds

Facilities that do not meet their Reserve Capacity Obligations are required to pay capacity refunds. Refunds are dynamic, changing each interval to reflect the relative value of capacity during different intervals. When capacity reserves are low, refunds are higher and vice versa. Refunds also differ between facility types – they are relatively higher for demand side programs compared to scheduled generators to reflect that these types of facilities are not always required to be available.

ESR (including hybrid facilities containing ESR) will be subject to dynamic refunds if the resource does not meet its Reserve Capacity Obligations. The refunds are adjusted to reflect the shorter availability requirements that ESR has in comparison to other facility types.

4.7.1 Refunds for hybrid facilities

For a Scheduled Facility that contains ESR, the refund rate for the facility is based on a 'blended' formula that applies the refund rate corresponding to each component of the facility as a proportion of the facility's total capacity.

For example, a hybrid Scheduled Facility comprising a gas turbine that has been assigned 90 Capacity Credits and a ESR that has been assigned 30 Capacity Credits will have a refund rate that is equal to the refund rate applicable for the ESR multiplied by 0.25 plus the refund rate applicable to the gas turbine multiplied by 0.75.

A Semi-Scheduled Facility that contains an ESR will only be required to pay a refund in the following circumstances:

- If the facility as a 'whole' has not operated at its Required Level. This level is the lower of its Declared Sent Out Capacity and the sum of the Capacity Credits associated with the ESR and the value, expressed in MW, that equals the five percent PoE of expected generation output for the intermittent generating system as described in its expert report.
- If the ESR component of the facility has not met its Reserve Capacity Obligations, then the refund rate corresponds to the refund rate for the ESR component only.

A Non-Scheduled Facility containing ESR will only be required to pay a refund if the facility as a 'whole' has not operated at its Required Level as part of its commissioning.

4.7.2 Outages for hybrid facilities

In circumstances where an ESR component of a hybrid facility is on a planned or forced outage, the market participant responsible for the hybrid facility must inform AEMO of the available remaining MW for the ESR as well as the facility as a whole. This will allow the RCOQ to be adjusted down for planned outages so that the facility does not have to pay refunds when it has an approved planned outage for the storage component, while allowing for refunds to still be applied during forced outages.

4.8 Individual Reserve Capacity requirements

To fund the Capacity Credits procured through the RCM, customers (generally retailers and large industrial loads) incur an IRCR obligation based on their contribution to system peak demand.

The new registration taxonomy will not differentiate between Market Customers and Market Generators and will instead place obligations on Market Participants based on whether they consume or produce energy in a trading interval.

As such, IRCR obligations will be placed on any Market Participant, including ESR, that consumes electricity during the relevant peak demand intervals except where the ESR is responding to a direction from AEMO that requires it to charge during a peak interval.

4.9 Distribution connected storage resources

The participation of small distribution connected facilities (including ESR) in the market will be captured by future amendments to the WEM Rules associated with the DER Roadmap. DER are smaller scale devices that can either use, generate, or store electricity, and are connected to the local distribution system, serving homes and businesses.

The policy regarding the integration of DER in the WEM is subject to ongoing actions under the DER Roadmap. While this is being progressed, distribution connected ESR, including aggregated ESR, may participate in the market as Non-Scheduled facilities. The new registration taxonomy provides for facilities with capacity below 10 MW (5 MW for ESR) to be registered as Non-Scheduled facilities. These facilities will not be subject to directions by AEMO (except in emergencies) but will still be able to participate in the energy market and the RCM.

The WEM Rules provide for the participation of Non-Scheduled facilities on the following basis:

- Aggregated DER will have to be connected behind a single transmission node (or in the same ‘electrical location’). Aggregated DER is captured under the Small Aggregation Facility Technology Type in the WEM Rules.
- Non-Scheduled facilities will not be subject to constraints when modelling available network capacity for the purposes of assigning NAQ, at least until constraint equations have been developed for these facilities and are able to be integrated in the modelling process.
- The certified capacity of Non-Scheduled facilities, excluding facilities with ESR only, will be assessed via the RLM. Non-Scheduled facilities comprising only standalone or aggregated ESR will be assessed using the linear de-rating method until there is sufficient operational data to assess the facility under the RLM.
- Market participants with Non-Scheduled facilities with ESR only will be required to demonstrate to AEMO, as part of the Reserve Capacity certification process, that their facilities will be discharging during the period to which storage Reserve Capacity Obligations apply (i.e. the four-hour ESR Obligation Duration period).
- The RCOQ for all Non-Scheduled facilities will be zero.

5. Other changes relevant to the RCM

5.1 The Expression of Interest process

It is now mandatory for proponents of new capacity (new facilities and upgrades to existing facilities) to submit a response to a Request for Expressions of Interest in a Reserve Capacity Cycle for which they are seeking Capacity Credits for the new capacity.

A mandatory requirement to submit a response to a Request for Expressions of Interest is necessary so that Western Power and AEMO have some indication about the new capacity that will be seeking to participate in the NAQ assignment process. This is because Western Power will need to develop limit advice taking the new capacity into account and AEMO will need to develop constraint equations that reflect the new capacity in the NAQ Model.

5.2 Indicative Facility Classes and Technology Types

Proponents of new capacity (new facilities and upgrades to existing facilities) seeking Capacity Credits in a Reserve Capacity Cycle will be assigned an indicative Facility Class and indicative Facility Technology Type.

The purpose of assigning an indicative Facility Class and indicative Facility Technology Type is to enable proponents of new capacity to identify the information required to support their application for CRC. The processes for determining and assigning an Indicative Facility Class and indicative Facility Technology Type will be documented in a WEM Procedure to be developed by AEMO.

5.3 Changes to the Reserve Capacity Cycle timetable

Several changes are being made to the Reserve Capacity Cycle timeframes and processes to accommodate the introduction of the NAQ framework. The changes primarily relate to the bringing forward of several key dates to accommodate the preparation of limit advice and constraint equations to be used in the NAQ assignment process, noting that these may be different to those used for security constrained economic dispatch.[29]

Table 5.1: Key changes to the Reserve Capacity Cycle timetable

Process	Current	New
Expressions of Interest open	31 January	15 January
Expressions of Interest close	15 May	1 March
Expression of Interest summary published	15 May	1 April
CRC applications open	1 May	14 April
ESOO published	17 June	17 June
CRC applications close	1 July	24 June
AEMO notifies CRC assigned	19 August	12 August
Reserve Capacity Security required	2 September	25 August

[29] RCM Limit Advice and RCM Constraint Equations will be prepared by Western Power and AEMO for use in the NAQ assignment process.

Process	Current	New
Provide bilateral trade declarations to AEMO	2 September	25 August
AEMO confirms CRC that can be traded bilaterally	3 September	26 August
AEMO publishes • **CRC for each facility** • **The Reserve Capacity Requirement**	4 September	27 August
AEMO • **Assigns NAQ to facilities** • **Assigns Capacity Credits to facilities** • **Notifies NAQ assigned to facilities** • **Publishes NAQ related information** • **Publishes Capacity Credit information**	 • Not applicable • 5 September • Not applicable • Not applicable • 5 September	 • 30 September • 30 September • 30 September • 30 September • 30 September

5.4 Information about the network

As part of the introduction of the new security constrained market design, new requirements have been placed on AEMO and Western Power to publish information to enable market participants (and other interested stakeholders) to understand the patterns and market impacts of network congestion.

Congestion Information Resource

AEMO must prepare a Congestion Information Resource that will include a library of constraint equations that were used as part of the NAQ assignment process[30] as well as an annual congestion report that includes an analysis of the duration and frequency of constraints and an assessment of the market impact of network congestion. The congestion report will also include information that is known to AEMO that is likely to affect, or result in, network congestion such as new connections and changes to the configuration of the network.

Network Opportunity Map

Western Power currently develops an Annual Planning Report and Network Capacity Mapping Tool which provides users with some insight into the forward-looking network capacity based on all planned network changes and growth plans. However, information on distribution network constraints and planned timeframes for investment to alleviate constraints are not currently included.

As part of changes to the Access Code made in 18 September 2020, Western Power must publish and update a 'Network Opportunity Map' by 1 October each year.[31] A Network Opportunity Map provides greater transparency and consolidates information on network constraints, planned investments and the potential value of providing services to resolve constraints. Requiring Western Power to produce a Network Opportunity Map seeks to build the market for distributed energy resources and reduce costs for all customers by making it easier for networks and non-network service providers to gain a common understanding of the potential value of alleviating constraints in different parts of the network.

[30] The constraint equations used in the NAQ Model may be different to the constraint equations used for dispatch. See section 3.5.

[31] Chapter 6A, Access Code.

The Network Opportunity Map will include a range of information, including:

- Load forecasts for existing zone substations and forecasts of future zone substations including their location and proposed commissioning time.
- Description of any factors that may have a material impact on the network, including factors affecting fault levels, voltage levels, and power system security requirements.
- Descriptions of all network asset retirements and de-ratings that would result in transmission and distribution constraints that are planned over the forward planning period.
- High-level summary of each major augmentation (for which the regulatory test has been completed or is in progress) and each priority project.
- A summary of all committed investments to be carried out within the forward planning period worth $2 million or more (to address a network issue), including a description of the investment (including its purpose, cost, and expected in-service date), and description of any alternative options.
- Information on Western Power's asset management approach, including a summary of issues that may impact on transmission and distribution constraints identified in the map.

Whole of System Plan

Western Australia has lacked a single view of the power system, with network and generation planning completed separately. The Whole of System Plan was developed to fill this gap by providing an assessment of electricity demand trends and forecasts and presenting a view on the required capacity mix and network configuration to meet those needs.

The inaugural Whole of System Plan for the SWIS was published on 12 October 2020, providing a 20-year outlook on the future of the SWIS. The plan models four scenarios detailing how changes in demand, technology, and the economy could shape the way consumers use electricity, guiding the generation, storage and network investments required to meet electricity demand while keeping the power system reliable and secure.

From 1 July 2021, the WEM Rules impose obligations on the Coordinator of Energy to prepare and deliver future Whole of System Plans in collaboration with AEMO and Western Power, in consultation with industry. A Whole of System Plan must be published at least once every five years, with the Coordinator of Energy required to publish the scenarios to be modelled, the modelling methodology and undertake public consultation on a draft report before a Final Report is provided to the Minister for Energy and published.

New requirements under the NAQ framework

The NAQ framework will require AEMO, as part of the Electricity Statement of Opportunities, to include information about planned augmentations and changes to the SWIS. AEMO will also be required to include any expected or anticipated network limitations identified through the NAQ process in the immediately preceding Reserve Capacity Cycle.

Proposed requirements for the publication of information relating to projects

New information provisions are proposed as part of changes to Western Power's Applications and Queuing Policy to provide more visibility of generation projects, and in particular, information relating to an applicant's proposed or upgraded connection point. The rationale for the change is to facilitate transparency and greater coordination between connecting parties.

As a result, where a connection application is related to generation (including connecting a new facility, modifying an existing facility, or amending the contracted capacity), the following information will be made available to all generation applicants:

- the contracted capacity sought in the generation application (and if applicable, the existing contracted capacity relevant to that generating plant);
- the location, voltage, and arrangement of the proposed (of if applicable, upgraded) connection point;
- the fuel type of the generating plant; and
- the priority date of the generation application.

It is not proposed that the identity of the applicant is revealed in addition to the above information (as is the case in the National Electricity Market).

5.5 Removal of the Reserve Capacity Auction

Previously, the Reserve Capacity Auction would be held if AEMO had not procured sufficient reserve capacity to meet the RCR. There were several shortcomings in the design of the auction that limited its usefulness.

- The auction process is only triggered if there is a capacity shortfall *and* there are facilities that had nominated to trade their capacity through the auction process. Capacity that is nominated to be traded in the auction process cannot be traded bilaterally, creating a risk for facilities that offer into the auction if the auction process is not triggered.
- The auction process relies on having certified capacity that is not being bilaterally traded. If the amount of certified capacity is less than the RCR, then running the auction will not address the capacity shortfall, as only certified capacity may participate in the auction and be counted to meet the RCR.
- The auction may incentivise facilities to artificially inflate the RCP by withholding capacity and nominating to participate in the auction process in the event of shortfall.

The Supplementary Reserve Capacity mechanism will be used to procure shortfall capacity. The process currently allows AEMO to procure capacity shortfalls for the expected shortfall period rather than the entire Capacity Year.

Shortfall capacity procured through the Supplementary Reserve Capacity mechanism will not be assigned NAQ; however, AEMO will still be required to ensure that providers of supplementary capacity have adequate network access to provide their capacity at peak demand periods.

5.6 Treatment of new small generators

The ability for small facilities (less than one MW in nameplate capacity) to apply for Capacity Credits outside of the normal Reserve Capacity Cycle process and timeframes is being removed. These facilities will need to apply as part of the normal process and timeframes from the 2022 Reserve Capacity Cycle.

Principally, to ensure that all capacity resources are modelled together and their impact on network congestion is understood, the NAQ assignment process cannot accommodate the assignment of Capacity Credits outside of a standard process.[32]

Unlike Early CRC facilities, there is nothing that would prevent small generators from applying for Capacity Credits as part of the normal Reserve Capacity Cycle process and timeframes. Allowing small generators to be assigned Capacity Credits outside of the NAQ assignment process may exacerbate an existing capacity surplus while creating uncertainty as to whether the capacity provided by small generators can be transferred into the network at times of peak demand.

5.7 Nomination to use the Relevant Level Methodology

The ability for a Scheduled Facility to nominate to have its capacity certified under the RLM is being removed. This opportunity has not been used in the past and its removal will minimise complexity in the capacity certification process.

The RLM is a method for valuing the capacity contribution of a resource to meeting system reliability. The RLM predicts future performance based on historical performance at periods of peak demand and is used to estimate the capacity contribution of intermittent resources because their output is variable and dependent on weather patterns.

While the RLM can be used to value the capacity contribution of a dispatchable resource, this is more complex due to the operational flexibility for these types of resources. That is, the past performance of a dispatchable resource is not indicative of its future performance as there are other incentives for its participation in the market.

5.8 New requirement for proposed facilities

The NAQ framework introduces a new requirement for facilities with a proposed status to nominate a 'Minimum Capacity Credits Quantity' as part of their bilateral trade declaration. This is the minimum quantity of Capacity Credits a market participant requires to be assigned to its facility for it to participate in the RCM.

The purpose of this requirement is to allow participants to indicate that they would be financially unviable if they were to receive NAQs below a certain level.

Proposed facilities are only considered in the NAQ assignment process if the RCR is not met through the aggregate amount of NAQ assigned to existing facilities, Network Augmentation Funding Facilities, and committed facilities in earlier steps.[33] While proposed facilities are modelled as a group, they will only be selected to be counted towards the capacity requirement if they have been assigned a preliminary NAQ value greater than their nominated Minimum Capacity Credits Quantity. If the aggregate NAQ calculated for the selected proposed facilities exceeds the capacity requirement of each Availability Class, proposed facilities will then be selected based on a set of 'tiebreaking' rules[34] up to the amount necessary to achieve the requirement.[35]

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32 A key design parameter of the NAQ framework is that network capacity must support the NAQ assigned to facilities.

33 Note that different processes apply for selecting committed facilities depending on whether there are new facilities seeking Capacity Credits in a Reserve Capacity Cycle that have chosen to fix their Reserve Capacity Price.

34 These 'tiebreaking rules' are outlined in Appendix A, section A.1.2.

35 This is different, for example, to new committed market price facilities where all facilities in this category are selected and counted towards the Reserve Capacity Requirement even if there is a surplus (provided the facilities are assigned a NAQ).

5.9 Demand side resources

Demand Side Management (DSM) includes the operation of loads to reduce or shift consumption, the use of embedded generation to reduce consumption from the SWIS, and other forms of load control.

DSM is a source of flexibility that is becoming increasingly valuable in managing uncertainty in the increasingly complex and diverse energy system and has been recognised in the RCM for its ability to contribute to reliability (by lowering peak demand) since the start of the WEM. This contribution to reliability has been recognised under the RCM, albeit with some change in the eligibility of DSM for Capacity Credits over the years.

DSM will continue to be eligible for Capacity Credits under the RCM and will be eligible to receive NAQ. The reforms will introduce a locational aspect as part of the DSM accreditation process. Demand Side Programmes will be required to provide AEMO with the Transmission Node Identifier that relates to its associated loads for which it is seeking CRC. Aggregated DSM will only receive NAQ for associated loads that are aggregated behind the same Transmission Node. This will improve AEMO's ability to dispatch DSM in a manner that contributes to the reliability of the power system and will facilitate the NAQ assignment process by ensuring the impact of aggregated DSM on the transmission system can be accurately determined.

The effect of DSM on network loading must be considered when available network capacity is modelled for the purposes of assigning NAQ. This means that capacity resources associated with Availability Class 1 and Availability Class 2 (such as DSM) will be included in the NAQ Model and modelled together, but only if all facilities in a group are to be counted towards the capacity requirement (subject to the facility being assigned NAQ).[36]

[36] See section A.1.4 in Appendix A.

Appendix A

NAQ Assignment Process

Wholesale Electricity Market Rules, Appendix 3

A.1 Overview

The NAQ assignment process is an ordered process for determining the NAQ that is available for assignment to facilities. It represents a sequence of 'steps' in which a capacity allocation tool, the NAQ Model, is operated at each step to determine a facility's NAQ.

Facilities are added as a 'group' to the NAQ Model at each step. The order in which each group is added is based on the following design parameters:

- NAQ is assigned to existing facilities ahead of new facilities. An 'existing' facility is one that has been assigned NAQ in a previous Reserve Capacity Cycle.
- Existing facilities that have had NAQ reduced in a previous Reserve Capacity Cycle because of 'external' factors[37] will be prioritised ahead of other facilities.
- Existing facilities with more CRC than NAQ will be prioritised ahead of new facilities.[38]
- NAQ enabled by augmentation funded by market participants will be prioritised to the funding facility ahead of new facilities, but not other existing capacity resources.
- New committed facilities are prioritised ahead of new proposed facilities.
- New facilities that do not opt to fix their capacity price are prioritised ahead of facilities that do.

A.1.1 Preliminary and Final NAQ values

As facilities are added in each step, the NAQ Model is operated (under a set of defined parameters) and a preliminary NAQ value is assigned to each facility. Preliminary NAQ values determined for facilities in each step cannot be reduced in a subsequent step, however the value can be increased.[39] This ensures that facilities with a lower priority status cannot reduce the NAQ assigned to facilities with a higher priority status.

The final NAQ value that is determined for a facility after all required steps in the NAQ assignment process have been conducted represents the facility's 'final' NAQ for that Reserve Capacity Cycle and Capacity Credits are assigned to a facility equal to its final NAQ value. A facility's final NAQ value cannot exceed the amount of CRC assigned to the facility in the Reserve Capacity Cycle.

A.1.2 Meeting the capacity requirement

Capacity provided by existing facilities, Network Augmentation Funding Facilities, and new facilities with a committed status that have chosen not to fix their reserve capacity price (new committed market price facilities) will always be selected and counted towards the RCR (subject to the facility being assigned NAQ), even if the aggregate quantity of capacity from these facilities exceeds the requirement.

The process and order for selecting other new facilities to meet the RCR differs depending on whether (or not) there are new facilities seeking Capacity Credits in a Reserve Capacity Cycle that wish to receive a fixed RCP.

37 These are discussed in section 3.4.6 and consist of changes in demand, changes in network configuration, and the impact of weather variability on the Certified Reserve Capacity of intermittent facilities.

38 Although this does not apply to facility upgrades.

39 Available network capacity is influenced by several factors. Facilities can have a negative as well as a positive impact in alleviating network constraints, which would then influence the amount of NAQ available to facilities.

If there are facilities that wish to receive a fixed price, then a three percent margin is added to the Reserve Capacity Requirement (RCR+3%)[40] and, subject to being assigned NAQ, all committed fixed price facilities will be selected if this target has not been met through NAQ assigned to existing facilities, Network Augmentation Funding Facilities, and new committed market price facilities.

In all other circumstances, facilities will be selected only to the extent necessary to meet the RCR using a set of 'tiebreaking' rules[41]:

1. the ratio of a facility's NAQ to its CRC, from highest to lowest; then
2. the combination of facilities that will minimise the excess of the total NAQ to be assigned to the facilities to achieve the capacity requirement for the Availability Class; then
3. in the order of the time Expression Of Interest submissions were received by AEMO, from earliest to latest; then
4. in the order of the time the applications for CRC were received by AEMO, from earliest to latest.

A.1.3 Modelling iterations

Facilities are added as a group at each step of the NAQ assignment process and the NAQ Model is operated to determine the NAQ available to facilities.

In the circumstances where not all facilities in a group are selected and counted towards the RCR, then the NAQ Model must be run again with the selected facilities and all other facilities that have been assigned a preliminary NAQ in previous steps.

This is because of the different effects that different groups of facilities may have on network congestion and available network capacity. That is, a whole group of facilities may have a different impact than a smaller subset (of the same group) on network congestion and hence the NAQ that has been assigned to facilities earlier in the NAQ modelling process.

A.1.4 Availability Class 1 and Availability Class 2

Capacity associated with Availability Class 1 (typically generation capacity) and Availability Class 2 (typically demand side resources) will be added to, and modelled together in, the NAQ Model if all facilities in a group are to be counted towards the capacity requirement (subject to the facility being assigned NAQ).

This will apply to capacity associated with existing facilities, new committed market price facilities, and new committed fixed price facilities (but only where the RCR+3% margin has not been achieved through the NAQ assigned to facilities in previous steps).

For all other groups of facilities (including new committed fixed price facilities where the RCR+3% margin has been achieved through the NAQ assigned to facilities in previous steps), capacity associated with Availability Class 1 and Availability Class 2 will be added to the NAQ Model separately and modelled separately. Capacity associated with Availability Class 1 can count towards the capacity requirement for Availability Class 2 (but not vice versa).

[40] The RCR+3% is used solely for the purpose of accepting offers from committed fixed price facilities. It is not reflected as an increase in peak demand in the NAQ Model. Note also that the prioritisation order differs depending on whether (or not) RCR+3% has been met by existing facilities, Network Augmentation Funding Facilities, and new committed market price facilities.

[41] This is referred to as the 'prioritisation order' in Appendix 3 of the WEM Rules.

A.2 The NAQ Assignment Process

A.2.1 Existing facilities

The first group of facilities for which NAQ is determined are existing facilities. NAQ is determined for existing facilities in three separate and sequential steps (Steps 3A to 3C Parts A and B, Appendix 3). Capacity associated with Availability Class 1 and 2 is modelled together as a single group in each of these steps.

The first step determines if an existing facility's NAQ (assigned in the previous Reserve Capacity Cycle) may be affected by a lower level of available network capacity caused by projected changes in the level of demand across the network, changes in the network, and/or facility retirements for the Reserve Capacity Cycle. The NAQ available to an existing facility in this step is capped at a specified value that is equal to the lower of the facility's CRC in the current cycle (i.e., for which it is seeking Capacity Credits) and its NAQ from the immediately preceding cycle. This ensures that the facility's performance can support its NAQ.

The second step prioritises the assignment of available NAQ to existing facilities that have had NAQ reduced in a previous Reserve Capacity Cycle because of factors that were beyond their control.[42] The NAQ that is available for assignment to existing facilities in this step is capped at a specified value that is equal to the higher of the facility's CRC and its 'Highest NAQ' value.

The third step determines if there is available NAQ that can be assigned to existing facilities with more CRC than their NAQ (including the preliminary NAQ values determined in the previous two steps).[43] For the avoidance of doubt, facility upgrades that increase the certified capacity of an existing facility are not considered in this step and are considered with new facilities (either as a committed or proposed facility depending on development status of the upgrade).

A.2.2 Network Augmentation Funding Facilities

The second group of facilities for which NAQ is determined are 'Network Augmentation Funding Facilities' that are seeking Capacity Credits in a Reserve Capacity Cycle (Step 4 Parts A and B, Appendix 3). These facilities are added to the NAQ Model together with existing facilities and the NAQ Model is updated with the set of constraint equations relating to the augmentation. The NAQ Model is then operated to determine the NAQ available to Network Augmentation Funding Facilities and existing facilities, which is capped at their level of CRC. The NAQ available for existing facilities cannot be reduced below the value determined for the facility in the previous step.

Note that Early CRC facilities that are also funding network augmentation are treated differently to Network Augmentation Funding Facilities in the NAQ assignment process and are not included in this step. For the Reserve Capacity Cycle in which the facility has been granted Early CRC status, NAQ is determined for the facility once the NAQ assignment process has been conducted for all other facilities. The Early CRC Network Augmentation Funding Facility will be excluded from the NAQ assignment process in an intervening year. For the Reserve Capacity Cycle in which the facility is seeking Capacity Credits, then the Early CRC facility will be treated as an existing facility in the NAQ assignment process.

42 Refer to section 3.4.6 for a discussion on external factors.

43 There are several reasons why a facility's CRC may be greater than its NAQ, for example, available network capacity may not initially have supported the assignment of NAQ to the facility up to its CRC, or an intermittent facility may experience an increase in its relevant level beyond its current NAQ (or Highest NAQ).

A.2.3 New Committed Market Price Facilities

The third group of facilities for which NAQ is determined are new 'Committed Market Price Facilities' (Step 5 Parts A and B, Appendix 3). These are new committed facilities that have chosen not to fix their RCP and includes facility upgrades with a committed status.

These facilities are added to the NAQ Model together with facilities from previous steps and the NAQ Model is operated to determine the NAQ available to all facilities, which is capped at the level of each facility's CRC. For the group of new Committed Market Price Facilities, capacity associated with Availability Class 1 and 2 is modelled together as a single group in this step, and NAQ assigned to facilities that is surplus to the Availability Class 1 requirement will be counted towards the Availability Class 2 requirement.

A.2.4 Scenario 1: There are no Fixed Price Facilities

If there are no new facilities that have chosen to fix their RCP (Fixed Price Facilities), then the fourth group of facilities for which NAQ is determined are new 'Proposed Market Price Facilities'. These are new proposed facilities that have chosen not to fix their reserve capacity price and includes facility upgrades with a proposed status.

Proposed Market Price Facilities are only considered if the RCR has not been achieved through the assignment of NAQ to facilities in previous steps. These facilities are added to the NAQ Model together with the facilities from previous steps and the NAQ Model is operated to determine the NAQ available to all facilities (capped at the level of each facility's CRC).

Proposed Market Price Facilities are only selected and counted towards the RCR if they have been assigned a preliminary NAQ value greater than their nominated Minimum Capacity Credits Quantity.[44] If the aggregate NAQ calculated for the selected proposed facilities exceeds the capacity requirement of each Availability Class, then proposed facilities will be selected based on the set of tiebreaking rules[45] up to the amount necessary to achieve the target.

If all the facilities in the group of Proposed Market Price Facilities were not selected to meet the requirement for each Availability Class, the NAQ Model is operated again with the selected proposed facilities and all other facilities that have been assigned a preliminary NAQ in previous steps.[46]

For the group of Proposed Market Price Facilities, capacity associated with Availability Class 1 and 2 is modelled separately (Steps 6 and 9 respectively in Part A, Appendix 3). Facilities that were not selected to meet the capacity requirement for Availability Class 1 will be considered for the Availability Class 2 target (provided they are assigned a preliminary NAQ value that is greater than their Minimum Capacity Credit Quantity).

A.2.5 Scenario 2: There are Fixed Price Facilities

If one or more new Fixed Price Facilities are seeking Capacity Credits in a Reserve Capacity Cycle, then AEMO must determine whether the NAQ assigned to facilities in the previous steps meet or exceed the Reserve Capacity Requirement plus a three percent margin (RCR+3%).[47]

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44 Refer to section 5.8 for a discussion on the Minimum Capacity Credit Requirement.

45 Refer to Appendix A, section A.1.2 for the set of tiebreaking rules.

46 Refer to Appendix A, section A.1.3 for a discussion on modelling iterations.

47 The RCR+3% is used for the sole purpose of determining whether to accept all Committed Fixed Price Facilities (subject to the facility being assigned NAQ) or whether these facilities are selected up to the amount necessary to cover the capacity requirement..

RCR+3% is not achieved

If the RCR+3% target is not achieved through the NAQ assigned to facilities from the previous steps, then all new Committed Fixed Price Facilities are added to the NAQ Model together with the facilities from previous steps and the NAQ Model is operated to determine the NAQ available to all facilities, which is capped at the level of each facility's CRC. For the group of new Committed Fixed Price Facilities, capacity associated with Availability Class 1 and 2 is modelled together as a single group (Step 6A Part B, Appendix 3). NAQ assigned to facilities that is surplus to the Availability Class 1 requirement will be counted towards the Availability Class 2 requirement.

If, after considering all new Committed Fixed Price Facilities, there is a shortfall in the capacity requirement for Availability Class 1, then NAQ is calculated and assigned (where available) in a sequenced order to Proposed Market Price Facilities and Proposed Fixed Price Facilities (Step 6B Part B, Appendix 3). Only capacity associated with Availability Class 1 is added to the NAQ Model in these steps. Proposed facilities are only selected if they are assigned a preliminary NAQ greater than their Minimum Capacity Credit Requirement and then only up to the amount necessary to achieve the Availability Class 1 requirement using the set of tiebreaking rules.[48] NAQ assigned to facilities that is surplus to the Availability Class 1 requirement will be counted towards the Availability Class 2 requirement.

If there is still a shortfall in the capacity requirement for Availability Class 2, then NAQ is calculated and assigned in a sequenced order to facilities in the following order (Step 9B Part B, Appendix 3), with proposed facilities selected if they are assigned a preliminary NAQ greater than their Minimum Capacity Credit Requirement and then only up to the amount necessary to achieve the Availability Class 2 requirement using the set of tiebreaking rules:

- Proposed Market Price Facilities associated with Availability Class 1 that were not selected or counted towards the Availability Class 1 requirement,[49] then
- Proposed Market Price Facilities associated with Availability Class 2, then
- Proposed Fixed Price Facilities associated with Availability Class 1 that were not selected or counted towards the Availability Class 1 requirement, then
- Proposed Fixed Price Facilities associated with Availability Class 2.

RCR+3% is achieved

If the RCR+3% target is achieved through the NAQ assigned to facilities from the previous steps but the Availability Class 1 requirement has not been achieved, then NAQ is calculated and assigned (where available) in a sequenced order to Proposed Market Price Facilities, Committed Fixed Price Facilities, and Proposed Fixed Price Facilities (Step 6C Part B, Appendix 3).

Only capacity associated with Availability Class 1 is added to the NAQ Model. Facilities (including those in the group of Committed Fixed Price Facilities) are only selected up to the amount necessary to achieve the Availability Class 1 requirement using the set of tiebreaking rules. Proposed facilities are only selected if they are assigned a preliminary NAQ greater than their Minimum Capacity Credit Requirement and then only up to the amount necessary to achieve the Availability Class 1 requirement using the set of tiebreaking rules. NAQ assigned to facilities that is surplus to the Availability Class 1 requirement will be counted towards the Availability Class 2 requirement.

48 Refer to Appendix A, section A.1.2 for the set of tiebreaking rules.

49 Because they received less preliminary NAQ than their Minimum Capacity Credit Requirement or were surplus to requirements.

If there is still a shortfall in the capacity requirement for Availability Class 2, then NAQ is calculated and assigned in a sequenced order to facilities in the following order (Step 9A Part B, Appendix 3) up to the amount necessary to achieve the Availability Class 2 requirement using the set of tiebreaking rules:

- Committed Fixed Price Facilities associated with Availability Class 1, then
- Committed Fixed Price Facilities associated with Availability Class 2, then
- Proposed Market Price Facilities associated with Availability Class 1 that were not selected or counted towards the Availability Class 1 requirement, then
- Proposed Market Price Facilities associated with Availability Class 2, then
- Proposed Fixed Price Facilities associated with Availability Class 1 that were not selected or counted towards the Availability Class 1 requirement, then
- Proposed Fixed Price Facilities associated with Availability Class 2.

A.2.6 Early CRC facilities

Facilities that have been granted Early Certification of Reserve Capacity (Early CRC facility) in a Reserve Capacity Cycle are considered at the end of the NAQ assignment process once final NAQ values have been determined for existing and other new facilities.

Early CRC facilities are assigned either an Indicative NAQ (if the facility is not a Network Augmentation Funding Facility) or a preliminary NAQ (if the facility is also a Network Augmentation Funding Facility).

An Early CRC facility with an Indicative NAQ will be modelled together with existing facilities in an intervening year.[50] An Early CRC with a preliminary NAQ is not included in the NAQ assignment process in an intervening year.

[50] An intervening year is the Reserve Capacity Cycle that falls between the Reserve Capacity Cycle in which the facility has been granted Early CRC status and the Reserve Capacity Cycle in which the Early CRC facility will be assigned Capacity Credits (subject to being assigned NAQ).

Appendix B

Valuing the capacity contribution of storage

Options for de-rating resources and setting reserve capacity obligations

B.1 Options for de-rating storage facilities

B.1.1 Linear

This approach involves a simple rule based maximum typical length of system stress event, and storage resources are de-rated accordingly as a fraction of this stress event. For example, if the maximum typical stress event on the system was four hours, then under a linear method a one-hour duration storage device will be de-rated to 25% of its capacity, a two-hour device will be de-rated to 50% of its capacity, and so on.

The advantages and disadvantages of this approach are shown Table B.1 below.

Table B.1: Advantages and disadvantages of a linear de-rating method

Advantages	Disadvantages
Minimises complexity for market participants and AEMO.	Creates a need to define the parameters of a peak event.
Avoids any non-linearity in scaling or aggregation (two 30-minute batteries receive the same as a one-hour battery).	Assuming a linear relationship may not accurately value a facilities contribution to system reliability, particularly for shorter duration resources.
Changes in length of a peak event over time will capture the change in relative value of facilities of differing durations, ensuring capacity is appropriately valued as the characteristics of the load profile changes.	Derating factors will change as the length of a typical peak event changes - therefore doesn't provide certainty on capacity quantity (with a potential effect on investment certainty).
Relatively simple to implement.	
Transparent for market participants.	

B.1.2 Equivalent Firm Capacity and Effective Load Carrying Capability

Each of these methods are reliability based in that they focus on the contribution of the addition or removal of a resource on reliability (typically measured by impact on loss of load expectation (LOLE)).

Effective Load Carrying Capability (ELCC)

The ELCC method values the capacity of a resource as equivalent to the quantity of additional system load that can be served by adding the resource to the system whilst maintaining the existing reliability risk of the system. The steps involved in calculating the ELCC of a resource would be:

1. calculate the LOLE of the existing system without the resource;
2. add the resource and recalculate the LOLE;
3. increase load until the LOLE with the resource equals the original LOLE without the resource; then
4. the additional load is the ELCC of the resource.

Equivalent Firm Capacity (EFC)

The EFC approach, used in the United Kingdom to de-rate storage resources, values the capacity of a resource as equivalent to the quantity of additional system load that can be served by adding the resource to the system whilst maintaining the existing reliability risk of the system. The required steps for calculating the EFC are similar to those of the ELCC:

1. calculate the LOLE of the system with the resource included present;
2. remove the resources and begin adding output from a fully reliable conventional generator (assume outage rate of 0%);
3. increase the size of this conventional generator until the LOLE of the system with added fully reliable conventional generation capacity is the same as the LOLE of the system with the storage added; then
4. the nameplate capacity of the added generation is the EFC.

The advantages and disadvantages of these two approaches are shown in Table B.2 below.

Table B.2: Advantages and disadvantages of the ELCC and EFC de-rating methods

Advantages	Disadvantages
Can be calculated using standard tools and frameworks (used in other jurisdictions).	Must determine how to model the contribution of storage facilities across the year (i.e. the operating profile)
Captures the changes in capacity value as the peak load hours change.	Capacity value for a technology type decreases as the penetration of the technology increases – therefore doesn't provide certainty on capacity quantity and is likely to change year on year.
ELCC aligns with the proposed ERA method for valuing intermittent generation capacity and would result in consistency across non-firm resources in the SWIS	Slightly more complex to understand and implement than the linear model.
More accurately measures the contribution of resources of different durations than the linear model	

B.1.3 Least worst regrets model

This derating approach derates storage facilities based on both their size and duration and is used in Ireland.[51]

This approach requires a range of demand scenarios to be developed and generates a derating factor for a generation unit based on the impact on system adequacy of adding a notional generator of a specific size and technology class to each different demand scenario.

The demand scenarios and associated derating factors that are used are selected by applying a least-worst case analysis (i.e., selecting the demand scenario with the lowest maximum total regret cost).

51 https://www.semcommittee.com/sites/semc/files/media-files/SEM-18-030%20CRM%20T-1%20CY201920%20Parameters%20%26%20Enduring%20De-rating%20Methodology%20Decision%20Paper.pdf

The advantages and disadvantages of this approach are shown in Table B.3 below.

Table B.3: Advantages and disadvantages of the least worst regrets de-rating method

Pros	Cons
The use of demand scenarios incorporates the uncertainty inherent with demand forecasts.	Requires the calculation of VOLL, which can be a lengthy and costly process
More accurately measure the contribution of resources of different durations than the linear model	Works best if applied across all capacity providers.
	More complexity and subjectivity in developing scenarios and portfolios

B.1.4 Assessment of options

The criteria for assessment of the options for derating, and the Taskforce's assessment of each option against the criteria, is shown in Table B.4 below.

Table B.4: Assessment of de-rating options

	Linear	ELCC	EFC	Least worst regrets
Minimises complexity for market participants and AEMO				
Alignment with existing approaches to de-rating.		(Once new RLM introduced)		
Not overly volatile.				
Compatible with other aspects of the RCM.		(Once new RLM introduced)		
Transparent				
Accurately measures the contribution of resources of different durations				

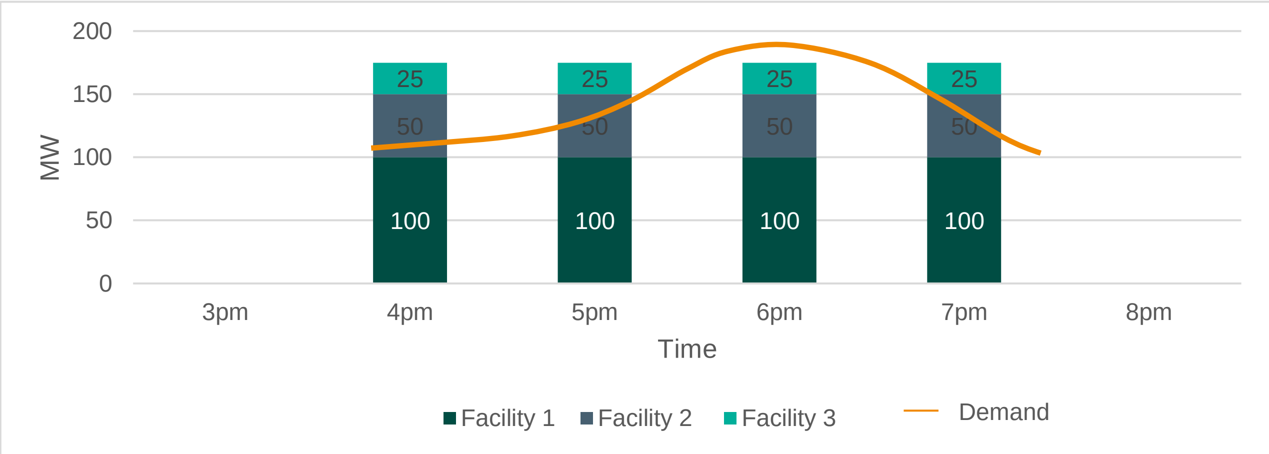
A linear de-rating approach was considered most suitable for the WEM at this stage. While it has some trade-offs in terms of accuracy in comparison to the other models it offers simplicity and transparency for the market and will reduce the risk that arrangements cannot be put in place for storage participation in the RCM in time for the 2021 Capacity Cycle.

The method for valuing the capacity contribution of storage resources will be reviewed periodically by the Coordinator for Energy.

B.2 Options for setting reserve capacity obligations

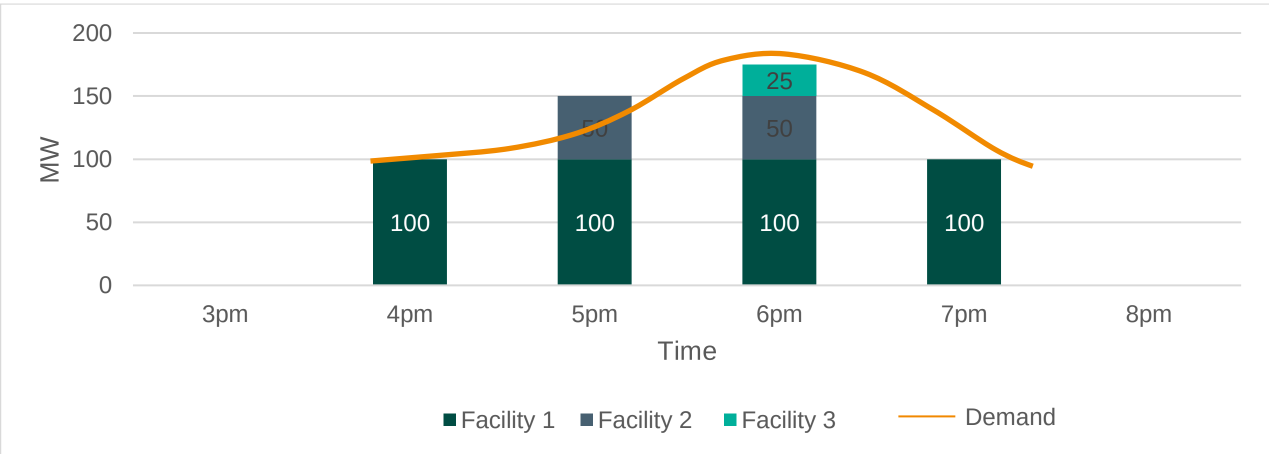
B.2.1 Standardised duration

A requirement for all types of storage resources to be available for a standardised duration. For example, if the benchmark duration of a peak event is four hours, then all storage resources would have an obligation to offer energy into the market across that four-hour period. For a 100 MW / 400 MWh resource, this would mean offering 100MW in every hour for the full four-hour duration. For a 100 MW / 200 MWh resource, this would mean making 50 MW available in every hour for the full period, and for a 100 MW / 100 MWh resource, 25 MW.



B.2.2 A flexible approach

A requirement to be available for the natural duration of the storage resource (i.e., the amount of time it can run for at its full output). For example, a 100 MW / 400 MWh storage resource would have to make energy available for the full four hours. For a 100 MW / 200 MWh storage resource, this would mean offering in 50 MW for a two-hour period. For a 100 MW / 100 MWh storage resource, this would mean offering in 25 MW for one-hour.



B.2.3 Assessment of options

A standardised duration (Option 1) was considered most suitable for the South West Interconnected System at this stage due to its simplicity and ease of implementation.

Option 2 has the advantage of being able to stack resources to best meet peak demand with more minimal obligation on facilities. However, in practice this would require AEMO to change the timing for the obligation more often and on a shorter-term basis than Option 1 to ensure that the energy being made available by shorter duration resources was aligned with the expected peak. This would add more complexity for market participants and AEMO which may not be warranted over the coming years given the small amounts of storage expected to enter the market in the short term.

The WEM Rules will be drafted such to allow AEMO to set the daily period (i.e., the time of day that the obligations will apply) as a part of a certification each Capacity Year, and to alter the daily period on a shorter-term basis should they expect a low reserve or peak demand event outside of the pre-determined window. In this scenario, AEMO will be required to advise participants of their updated obligations at least one day in advance and prior to the STEM submission for the relevant time-period closing.

Appendix C

WEM Rules Appendix 3 Flow Chart

A step-by-step guide

C.1 NAQ Assignment Process

Step 1 and 2

Calculate AC1 requirement.

Add to the NAQ Model:

- NAQ Facilities (AC1, AC2).
- Indicative NAQ Facilities.
- Early CRC NAFF facilities (if applicable).

Step 3A

Run NAQ Model and assign preliminary NAQ to lower of a facility's:

- NAQ from the last RCC and
- CRC from current RCC

Step 3B

Run NAQ Model and assign preliminary NAQ up to a facility's Highest NAQ.

Step 3C

Run NAQ Model and assign preliminary NAQ up to a facility's CRC.

Step 4

Add NAFF facilities.

Run NAQ Model and assign preliminary NAQ.

Step 5

Add new committed market price facilities (AC1, AC2).

Run NAQ Model and assign preliminary NAQ.

If the RCR has not been met and there are no Fixed Price Facilities

Step 6

If AC1 requirement not met, add proposed market price facilities (AC1).

Run NAQ Model and assign preliminary NAQ up to AC1 requirement.

Step 7 and 8

Record AC1 shortfall (if any).

Calculate AC2 requirement.

Go to step 9 if there is a AC2 shortfall.

Step 9

Add proposed market price facilities (AC2).

Run NAQ Model and assign preliminary NAQ up to AC2 requirement.

Step 10 - 12

Record AC2 shortfall (if any).

Record Final NAQ and any adjusted Indicative NAQ.

Report capacity shortfalls.

Step 13

Add new Early CRC facilities.

Run NAQ Model and assign preliminary NAQ or Indicative NAQ as applicable.

If the RCR has not been met and there are Fixed Price Facilities

Step 6 – is preliminary NAQ < RCR+3%?

Yes → **Step 6A**

Add committed fixed price facilities (AC1, AC2).

Run NAQ Model and assign preliminary NAQ up to AC1 requirement.

Go to Step 6B if AC1 requirement not met.

Step 6B

Run NAQ Model and assign preliminary NAQ up to AC1 requirement. Add facilities to NAQ Model in this order:

- Proposed market price facilities (AC1).
- Proposed fixed price facilities (AC1).

No → **Step 6C**

If AC1 requirement not met, run NAQ Model and assign preliminary NAQ up to AC1 requirement, adding facilities to NAQ Model in this order:

- Proposed market price facilities (AC1).
- Committed fixed price facilities (AC1).
- Proposed fixed price facilities (AC1).

Step 7 and 8

Record AC1 shortfall (if any).

Calculate AC2 requirement.

Go to Step 9 if there is a AC2 shortfall.

Step 9 – was preliminary NAQ < RCR+3%?

No → **Step 9A**

Run NAQ Model and assign preliminary NAQ up to AC2 requirement. Add facilities to NAQ Model in this order:

- Committed fixed price facilities (AC1).
- Committed fixed price facilities (AC2).
- Proposed market price facilities (AC1) not previously selected.
- Proposed market price facilities (AC2).
- Proposed fixed price facilities (AC1) not previously selected.
- Proposed fixed price facilities (AC2)

Yes → **Step 9B**

Run NAQ Model and assign preliminary NAQ up to AC2 requirement. Add facilities to NAQ Model in this order:

- Proposed market price facilities (AC1) not previously selected.
- Proposed market price facilities (AC2).
- Proposed fixed price facilities (AC1) not previously selected.
- Proposed fixed price facilities (AC2)

Step 10 - 12

Record AC2 shortfall (if any).

Record Final NAQ and any adjusted Indicative NAQ.

Report capacity shortfalls.

Step 13

Add new Early CRC facilities.

Run NAQ Model and assign preliminary NAQ or Indicative NAQ as applicable.

Appendix D

Replacement of Capacity

Examples of modifications to generating facilities

D.1 Examples of modifications to generating facilities

Type of change	Description	Type of change	Comments
1. Open cycle gas turbine (OCGT) is converted to a combined cycle gas plant (CCGT).	Gas turbine adds a waste heat recovery boiler and modifies gas turbine settings. New control system is required.	Brownfield development.	The conversion of the OCGT to a CCGT is a change in generation technology. This is a type of investment that the ETIU considers could be considered as creating a 'new and different' facility that requires the Market Participant to relinquish its NAQ.
2. Windfarm upgrades turbines with larger turbines	Existing 3 MW turbines are progressively replaced with 5 MW units. The larger turbines require new towers, changed locations, new collection wiring and new control system. New connection assets are required.	Brownfield development.	The installation of larger wind turbines does not change the underlying generation technology, and so would not be the type of investment that the ETIU considers as creating a 'different' facility that requires the Market Participant to relinquish its NAQ. However, the modification requires wholesale changes to the facility and so it could be considered as a 'new' facility that would require the Market Participant to relinquish its NAQ. Note that if the modification results in an increased nameplate capacity for the facility, then the facility is required to compete with new facilities for any increased NAQ to support the higher nameplate capacity.
3. Plant replaced with similar plant. No increased output.	Gas turbine plant is replaced similar sized but new gas turbine unit(s). Depending on the magnitude of the change, new equipment and control systems may or may not be required. If the entire facility is replaced, it may also be necessary for new connection assets to be installed.	Brownfield development and/or maintenance.	Gas generation plants typically have several gas turbines. It may be more efficient for the Market Participant to replace a single gas turbine with a unit of equivalent performance and characteristics rather than undertake repairs to the turbine. Where all the turbines are replaced, then the facility could be considered as a 'new' facility that would require the Market Participant to relinquish its NAQ. However, there is no change in the underlying generation technology of the type that the ETIU considers as creating a 'different' facility that would require the Market Participant to relinquish its NAQ.

Type of change	Description	Type of change	Comments
4. Gas turbine adds steam or water injection	Gas turbine adds water injection facilities and upgrades control system.	Output increase without technical change. Routine upgrade / maintenance activities.	Summer output is increased, requiring modelling but no change to underlying technology. Also improves environmental performance as emissions (SOx and NOx) reduced. This is the type of investment in a plant that is efficient and encouraged. These investments not only improve performance but reduce emissions. Where the nameplate capacity has increased, however, then the facility is required to compete with new facilities for any increased NAQ to support the higher nameplate capacity.
5. Large Thermal plant does a major overhaul.	Full unit shutdown with replacement of all worn parts, minor upgrades and replacements.	Maintenance activities.	Major turbine/boiler checks are typically done every seven years or so. These investments are required to ensure that the technical and economic life of the original facility is optimised, as opposed to extending the life of the facility beyond its original investment planned life.
6. Gas turbine realigns blades for increased performance	Blades realigned to improve exhaust flow and therefore power output.	Routine upgrades.	A facility's performance (i.e. its CRC) can degrade over time without proper maintenance. This type of investment would ensure that the facility's CRC is maintained to a level that is equal to its assigned level of NAQ.
7. Additional Wind turbines installed	An existing wind farm gains additional land and adds turbines as part of an existing facility	Greenfield development.	Any increase in the facility's nameplate capacity will require the facility to compete with new facilities for any increased NAQ to support the higher nameplate capacity.