

Review of Essential System Services in the Northern Territory's Regulated Electricity Systems

Issues Paper

June 2020

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1. Introduction

The Northern Territory Government has identified reforms to the arrangements for the provision of Essential System Services (ESS) in its Northern Territory Electricity Market Priority Reform Program¹.

With the growing uptake of utility scale and behind-the-meter solar PV generation and emergence of new technologies capable of providing ESS, it is timely for the Territory's arrangements to be reviewed to ensure that ESS delivery is economically efficient and at least cost but with no compromise to system security.

Reviewing the ESS arrangements will be a complex process and require careful coordination with other reforms being undertaken as part of the Government's Priority Reform Program.

This paper forms the first part of the Design Development Team's consultation for the review and outlines the background to the review, its scope, and identifies a range of issues on which stakeholder feedback and advice is sought.

1.1. Overview of current arrangements

Essential System Services (ESS) (also commonly referred to as Ancillary Services) are required in addition to the supply of energy, to support the power system to produce, transmit and distribute power of acceptable quality to consumers and continuously maintain the demand/supply balance during normal and abnormal system conditions.

ESS can be defined in a number of ways but generally fall into three broad categories.

- *Frequency Management* – to maintain power frequency within acceptable standards at all times.
- *Voltage Management* – to manage voltages at different points of the network, control power flow within the networks' capacity and maintain stability following disturbances.
- *Restart Services* – to re-establish the power system following a significant event that has resulted in complete (or significant partial) system blackout.

Historically these services have been provided as a beneficial, low cost by-product of the supply of electricity using thermal synchronous generation.

As the generation mix changes to include an increasing amount of non-synchronous generation, such as solar, it has become apparent that these so called 'ancillary' services, are in fact 'essential'. Given this and the increasing demand for ESS with the growing production of electricity from solar, ESS is becoming a material portion of the total cost of power supply.

In the Northern Territory, the provision and procurement of ESS are governed by various obligations within the Network Technical Code and Planning Criteria (NTC), the System Control Technical Code (SCTC) and System Secure Guidelines (SSG).

Under these instruments, the magnitude of ESS requirements is specified by the System Controller and provided by Territory Generation as a bundled service via a 'spinning reserve' regime. Third party licenced generators are required to pay Territory Generation for the provision of these services at a fixed rate per megawatt hour (MWh) of electricity sent out.

¹ Northern Territory Government 2020, *Northern Territory Electricity Market Priority Reform Program – Introductory notes on scope and work program*, June.

1.2. Review scope

As identified in the Government's Priority Reform Program, the proposed changes to ESS arrangements are:

- updating the quantum of the rate paid to Territory Generation for ESS by other generators
- codifying the process for reviewing and updating the quantum of the rate to ensure the rate remains up to date
- improving the transparency of costs for individual and categories of services captured in the rate, such as by defining and separately costing each essential system service required

In addition to the implementation of changes to the provision of ESS by Territory Generation, the Northern Territory Government recognises that there may be benefits from contestability in the provision of essential system services.

In reviewing essential system services, the Design Development Team will review potential arrangements for the market provision of ESS in the Territory's regulated electricity systems (Darwin-Katherine, Alice Springs and Tennant Creek).

1.3. Background and context

The Northern Territory Government is committed to producing 50 per cent renewable energy by 2030 for electricity consumed by Territory households and businesses, while at the same time ensuring secure and reliable electricity at least cost to consumers and taxpayers.

The transition to 50 per cent renewable energy by 2030 is well underway with small-scale solar PV generation already providing significant contributions to the energy supply and large-scale solar PV systems beginning to emerge. With current and committed large scale solar projects planned for construction in 2020, and projected residential and commercial rooftop solar system installations, renewable energy is expected to supply up to 16 per cent of electricity consumption by the end of 2020.

The need for change

The increased uptake of solar PV presents two challenges for the maintenance of adequate ESS to maintain system security:

- solar output requires additional ESS to manage its higher level of variability
- solar output displaces the gas-fired synchronous generation plant that inherently provides the ESS needed.

The above challenges will result in a need to maintain higher levels of ESS in the future not associated with or required for energy production.

The challenges posed by the increased solar penetration have exposed shortcomings in the Territory's current ESS arrangements.

- The increased requirements for ESS result in higher costs of maintaining adequate levels of ESS using existing technologies.
 - The historic inherent provision of ESS as a by-product of electricity produced by thermal synchronous generators means that individual ESS have not been adequately defined or specified.
 - The monopoly provision of ESS by Territory Generation forgoes opportunities for the provision of ESS by other, potentially lower cost, providers.
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- The current definitions and specifications of ESS preclude other, potentially lower cost, technologies from providing ESS, including large- and small-scale solar PV and batteries.

Although at present, the Territory's installed gas-fired generation fleet provides sufficient services to provide the required ESS, it does so at a high cost. There will also become a point when the existing generation will not have sufficient capability to maintain system security and reforms of the ESS arrangements will become critical.

Relationship with the Northern Territory Electricity Market Priority Reform Program

The increasing diversity of the Territory's electricity systems, in terms of technologies and participants, is being facilitated by implementation of the Northern Territory Electricity Market Priority Reform Program, of which this review of ESS arrangements forms part. The other key reforms to the current Interim Northern Territory Electricity Market (I-NTEM) which has operated in the Darwin-Katherine system since 2015, are:

- establishing a reliability standard and associated framework for ensuring the standard is met
- changes to dispatch arrangements to improve the efficiency of generator dispatch in the context of significant intermittent solar generation
- introduction of centralised financial settlement for the energy market to accommodate a range of foreseeable types of contractual arrangements between generators and retailers.

Of the other priority electricity market reforms, the dispatch and settlement reforms are key precedents for this review of ESS, as dispatch for energy will need to be coordinated with dispatch for ESS and settlement of ESS payments will also be required.

The announcement of the Government's priority electricity market reform program follows public consultation by the Department of Treasury and Finance on the development of a market design for the Northern Territory Electricity Market².

Generator Performance Standards

New Generator Performance Standards (GPS) approved by the Utilities Commission in March 2020 require that all new licenced generators are predictable and controllable. As a result, new large-scale solar PV systems should not substantially add to the requirement for additional system services, and if required, can be otherwise controlled to avoid compromise to system security.

However, the GPS imposes mandatory ESS (frequency management) capability on generators, subject to energy source availability. This effectively means that large-scale solar PV may be called on to provide contingency lower frequency control services, but would not have their output constrained to provide contingency raise frequency control services. Given new large-scale solar PV will have capability to provide some kinds of ESS, there is added impetus to ensure they can be compensated for this.

² Department of Treasury and Finance 2019, *Northern Territory Electricity Market Consultation Draft Functional Specification*, February.

Large-scale battery for the Darwin-Katherine system

The Northern Territory Government has also recently approved the procurement of a large-scale Battery Energy Storage System (BESS) for the Darwin-Katherine system to more efficiently provide ESS. The BESS is intended to deliver:

- increased stability and reliability of power supply from reduced reliance on gas-fired generation
- reduction in carbon emissions
- reduction in costs for Territory Generation.

Procurement will take place in 2020 with the BESS expected to become operational in 2022.

Notwithstanding the broader scope of this review, the introduction of the BESS will require reform to the existing ESS arrangements.

1.4. Review framework

The Northern Territory has adopted the National Electricity Law (NEL) for the regulated electricity systems of Darwin-Katherine, Alice Springs and Tennant Creek, and its focus on promoting the long-term interests of consumers of electricity. As such, the Design Development Team proposes that its overarching assessment framework for this review be aligned to the National Electricity Objective (NEO) as defined under the NEL, which is:

*“... to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to –
(a) price, quality, safety, reliability and security of supply of electricity ...”³*

Consistent with the NEO, the following principles are proposed to be used to frame the review of the provision of ESS in the Territory's regulated electricity systems.

- Required security standards must be met.
- Services should be acquired at least cost.
- ESS acquisition is to be technology neutral.
- To the extent possible, the proposed arrangements should deliver certainty to industry participants, so as to provide the confidence to invest.
- Arrangements must support the achievement of the Government's 50 per cent renewables by 2030 target and reductions to greenhouse gas emissions.
- Reforms must improve the overall efficiency of electricity supply, putting downward pressure on the combined cost of ESS, wholesale electricity and network services.

1.5. Stakeholder consultation and review timeframes

The Design Development Team intends to consult broadly with stakeholders, including through one-on-one meetings and stakeholder workshops at appropriate times during the review.

The review actions and expected timing are outlined in Table 1.

³ *National Electricity (South Australia) Act 1996 (SA)*, National Electricity Law, sch 1 s 7.

Table 1 – Actions and expected timing

Action	Expected timing
Publish issues paper inviting initial written submissions	June 2020
Submissions on issues paper due	13 July 2020
Publish draft review report setting out draft policy position and recommendations and inviting further written submissions	September 2020
Publish final review report setting out detailed policy position and recommendations	December 2020
Implementation of legislative, regulatory or code changes	Early 2021
Implementation of required procedures and systems	Mid 2021
Commencement of essential system service changes	Late 2021

Question 1

- (a) Are there other context or developments relevant to the review that the Design Development Team should take into consideration?
- (b) Is the approach to the review, which ties ESS market design principles back to the National Electricity Objective, appropriate?
- (c) Are there other relevant matters which should be considered?

2. Categorisation and definition of services

Clear definitions and specifications of discrete ESS components necessarily underpin any reforms to ESS arrangements in the Territory's regulated electricity systems.

Under the three broad categories of ESS referred to in Section 1.1 (Frequency Management, Voltage Management, and Restart Services), a range of more specific electricity system support services have been defined for use in the Territory and other Australian electricity systems.

Appropriately defining ESS for the Territory context is critical, and will be a complex and technical exercise. It is proposed that expert technical advisers will independently advise the Design Development Team on appropriate ESS definitions. Importantly, this work will need to include consultation and input from the System Controller, Network Operator and industry.

2.1. Current arrangements

The ESS currently defined for use in the Territory (referred to as Ancillary Services) are set out in the NTC and SCTC and further specified, to varying degrees, in the SSG (Table 2).

Frequency Management

Notwithstanding the range of frequency-related services recognised in the SCTC, NTC and SSG, in practice the System Controller currently delivers frequency management under a bundled Spinning Reserve policy.⁴

Spinning Reserve is the practice of holding generators online at reduced output to provide reserve capacity to deliver a bundle of frequency management services including for inertia and to accommodate forecasted change in system load and to respond to contingency events.

Voltage Management

Voltage control is managed through balancing the production or absorption of reactive power. The NTC identifies that reactive power control can be provided by a range of different types of facilities, including generators, synchronous condensers and capacitors.

The Network Operator is responsible for arranging sufficient reactive power facilities through contractual arrangements for ancillary services with users, obligations on the part of users or under their connection agreements, or provision of the facilities by the Network Operator itself.⁵

System Restart

Black start capability, in relation to a generating unit, is the ability to start and synchronise without using supply from the power system.⁶

⁴ Power and Water Corporation 2017, *System Secure Guidelines Version No. 4*, March, s. 8.

⁵ Power and Water Corporation 2020, *Network Technical Code and Planning Criteria Version No. 4*, March, s. 4.5.1(f).

⁶ Power and Water Corporation 2020, *System Control Technical Code Version No. 6*, March, p. 65.

Table 2 – Essential System Services referenced, defined or specified for the Northern Territory's regulated electricity systems

System Control Technical Code	Network Technical Code and Planning Criteria	System Secure Guidelines
Frequency management		
Frequency Control	Frequency Control Ancillary Service <ul style="list-style-type: none"> • Regulating Frequency Control Ancillary Service (R-FCAS) • Contingency Frequency Control Ancillary Service (C-FCAS) • Inertia Frequency Control Ancillary Service (I-FCAS) Spinning Reserve	Frequency Control Ancillary Service <ul style="list-style-type: none"> • Regulating Frequency Control Ancillary Service (R-FCAS) • Contingency Frequency Control Ancillary Service (C-FCAS) <ul style="list-style-type: none"> ○ Raise – fast, slow, delayed ○ Lower – fast, slow, delayed • Inertia Frequency Control Ancillary Service (I-FCAS) Spinning Reserve
Voltage management		
Voltage Control	Voltage Control	
Reactive Power Control	Reactive Power Control	
System Restart		
Black start capability	Black start capability	

2.2. Case for change

There is no single, consistent and comprehensive framework for the definition and specification of ESS in the Territory's regulated electricity systems.

The bundled Spinning Reserve service approach which has been adopted is simple and has historically been appropriate for a vertically integrated industry with relatively uniform generation and traditional customer expectations. However, as the distinct business components (for example, generation and retail) become increasingly contestable, including as a result of emerging technologies, the disaggregation of frequency management ESS into discrete and defined components has a number of advantages and provides the opportunity for:

- understanding the required technical capacity and availability of the discrete services to operate the power system in a safe, reliable and secure manner
- greater resolution of each service for more efficient dispatch (compared with a bundled approach)
- transparency as to the volume of services required and associated costs, particularly as any impacts occur due to changing system conditions
- co-optimising costs across multiple ESS streams and energy services
- technology agnostic description of system services to enable emerging technologies to provide services where economically efficient
- a principled approach to services requirement that responds to power system changes
- third party provision of one or more components of power system services providing competitive tension.

These issues are particularly important as the generation mix in the Territory's power systems changes towards higher levels of renewable energy sources that require different levels of system support, and that may also offer services via non-synchronous technology.

The current lack of definition and specification of ESS and responsibility for their provision, particularly for voltage control and reactive power control, also increases the potential for ESS to be mandated on an uncompensated basis. Under the SCTC and NTC, both the Network Operator and System Controller have responsibility for ensuring voltage control, and can achieve this through a variety of ways, including through mandating provision by system participants. The mandated provision of ESS may exacerbate cross-subsidies in the electricity supply industry, and contribute to inefficient system operation and investment.

2.3. Issues

As noted above, an expert technical adviser will be appointed to provide independent advice to the Design Development Team. The expert adviser's analysis and recommendations will be informed by advice from the System Controller, Network Operator and industry.

A key consideration will be the appropriateness of a uniform approach to ESS definition across all three Northern Territory regulated electricity systems (Darwin-Katherine, Alice Springs and Tennant Creek).

Level of specificity for defined ESS

How individual ESS are categorised and defined will need to be considered. Where a broad and high level approach is taken, the legislative and regulatory framework will need to require or empower the System Controller to develop and publish, from time to time, detailed specifications or descriptions of each ESS. This potentially establishes a framework which is more agile and adaptable to technology and power system changes.

More detailed specification or description of each ESS arguably provides greater certainty and transparency for system participants, potentially improving investor confidence and attracting stronger investor interest.

For example, the ESS framework in the National Electricity Market (NEM) requires the Australian Energy Market Operator to:

- develop and publish a detailed description of each kind of Market Ancillary Service and the performance parameters and requirements which must be satisfied in order for a service to qualify as the relevant market ancillary service⁷
- develop and publish detailed descriptions of each type of Network Support and Control Ancillary Service.⁸

The National Electricity Rules also impose requirements for consultation regarding changes to the ESS specifications and descriptions.⁹

A similar arrangement could be adopted in the Territory. However, local institutional and industry arrangements could warrant more robust regulatory prescription and oversight to secure industry confidence in the ESS framework.

Flexibility to procure undefined ESS

Clearly defining ancillary services provides a framework for the efficient provision of ESS in which system participants can be confident to invest. However, given rapidly changing electricity systems, there may be a case for providing flexibility for the System Controller to procure additional categories of ESS to those defined in the regulatory framework.

The Market Rules for the Wholesale Electricity Market (WEM) operating in the South-West Interconnected System in Western Australia, include a catch-all definition of 'Dispatch Support Service' which covers any other service that is needed to maintain power system security and reliability that is not covered in already defined service categories.

A Dispatch Support Service has previously been proposed to be introduced in the Territory to maximise dispatch of large-scale solar PV connected to the Darwin to Katherine 132 kV transmission line at times of high solar irradiance.¹⁰

Without some constraint on the System Controller, the use of undefined ESS would be likely to undermine confidence in the ESS framework. In the WEM, oversight is provided by the independent industry

⁷ Australian Energy Market Commission 2020, *National Electricity Rules Version No. 140*, May, rule 3.11.2(b).

⁸ Australian Energy Market Commission 2020, *National Electricity Rules Version No. 140*, May, rule 3.11.4(a1).

⁹ Australian Energy Market Commission 2020, *National Electricity Rules Version No. 140*, May, rules 3.11.2(d), 3.11.4(d).

¹⁰ Department of Treasury and Finance 2019, *Northern Territory Electricity Market Consultation Draft Functional Specification*, February, p. 21.

regulator, the Economic Regulation Authority, from which the System Controller must obtain approval before entering into a contract for a Dispatch Support Service.

Inertia and system strength

The transition to non-synchronous renewables generation has raised the issue of how to preserve levels of ESS historically provided as a by-product of electricity generation from thermal synchronous generators.

Two key system characteristics being affected by the transition are inertia and system strength.

- Inertia is the tendency of the rotating mass of a thermal synchronous generator (the alternator rotor and any other directly coupled mass) to maintain uniform motion and resist change. For example, if the generator experiences a sudden event, such as the addition of a large load, its speed will slow gradually as it adjusts to the new load and it is inertia that dictates the rate of gradual change. More inertia results in a slower change, while less inertia results in a faster change. When this mechanical response is reflected onto the electrical power system it is called the inertial response and it limits the rate of change of frequency (RoCoF) of the power system.
- System strength covers a number of technical aspects that contribute to the system's ability to return to a stable condition following a disturbance. System strength is local and indicates the robustness of a particular point in the power system. At a point on the network with high system strength, the voltage will change less for a given change in load compared with a point on the network with low system strength.

The displacement of thermal synchronous generation by non-synchronous generation like solar has contributed to decreases in inertia and system strength in both the NEM and WEM.

In the NEM, new rules commenced in 2018 requiring Transmission Network Service Providers (TNSP) to ensure minimum levels of system strength and inertia. An obligation was also introduced for connecting generators to 'do no harm' to the level of system strength necessary to maintain the security of the power system.

TNSPs were chosen for the obligation because, under the National Electricity Rules economic regulatory framework, they have an incentive to coordinate the least-cost approach to meeting the inertia and system strength obligations with oversight provided by the Australian Energy Regulator.¹¹

Although the Territory has applied the National Electricity Law and Rules, including the framework for economic regulation of distribution services modified for the Territory's circumstances and to cover transmission assets, to date the Territory has not adopted the national arrangements for inertia and system strength.

In the WEM, the Energy Transformation Taskforce has proposed the development of a new RoCoF ESS to provide an inertial (or equivalent) response to immediately slow RoCoF following an event or disturbance.¹²

¹¹ Australian Energy Market Commission 2017, *Managing power system fault levels - information sheet*, September; *Managing the rate of change of power system frequency - information sheet*, 19 September.

¹² Energy Transformation Taskforce 2019, *Essential System Services - Scheduling and Dispatch*, December.

Question 2

- (a) The Design Development Team is seeking initial stakeholder views on appropriate ESS categories and definitions for the Territory's regulated electricity systems, to inform a draft proposal to be presented in the review draft report.
- (b) Is there a need to apply different ESS categories for Alice Springs and Tennant Creek than for the Darwin-Katherine system?
- (c) Should the Territory's ESS framework require and empower the System Controller to develop and publish detailed specification/descriptions for each category of ESS? What, if any, regulatory prescription or oversight should apply?
- (d) Should the ESS framework provide for flexibility for the System Controller to procure other undefined categories of ESS? What, if any, regulatory prescription or oversight should apply?
- (e) What mechanisms are most appropriate for the Territory to preserve inertia and system strength? Should these be defined as ESS? Where would responsibility for their provision more appropriately reside – the Network Operator or the System Controller?

3. Service requirements

Once the services are categorised and defined, it will be possible to more accurately determine combinations and levels of ESS required to meet the system need.

Further, it will be desirable for long-term efficiency of ESS procurement and provision to forecast the future need for individual ESS over a longer horizon (relative to real-time).

3.1. Current arrangements

ESS requirements in the Territory's regulated electricity systems are determined by the System Controller in the context of a mix of system standards and service standards.

There is no requirement in the technical codes for the System Controller to publish information about the ESS dispatched or to forecast ESS requirements.

System standards

System standards define the technical parameters for the Territory's regulated electricity systems.

The SCTC requires the System Controller to arrange the required ancillary services to maintain power system security, defined as:¹³

- maintenance of an adequate power system frequency
- maintaining power system voltages within the declared standards and limits
- maintaining the stability of a power system
- ensuring that under credible contingency events, that the components of a power system are not overloaded
- carrying out all appropriate actions to restore a power system to a secure condition following either a minor or major disruptive event.

The SSG defines the technical levels of frequency and voltage that are deemed to be adequate.¹⁴

Service standards

In the Territory's regulated electricity systems, standards for the provision of ESS serve as a guide for system participants regarding service requirements to maintain the system within the system standards.

The SSG outlines minimum Service Standards for Regulating Reserve (R-FCAS) and contingency Spinning Reserve for each of the Territory's three regulated electricity systems as follows.

- Darwin-Katherine – minimum Regulating Reserve equivalent to the larger of 5 megawatts (MW) or anticipated change in system load over 30 minutes; and minimum contingency Spinning Reserve at all times of 25 MW, including a minimum of two Frame 6 machines.

¹³ Power and Water Corporation 2020, *System Control Technical Code Version No. 6*, March, s. 3.3.2.

¹⁴ Power and Water Corporation 2017, *System Secure Guidelines Version No. 4*, March, s. 5, 12.

- Alice Springs – minimum Regulating Reserve equivalent to the larger of 2 MW or anticipated change in system load over 10 minutes; and minimum contingency Spinning Reserve of the larger of either 8 MW during the day or 5MW at night or the largest machine's output in MW.
- Tennant Creek – minimum Regulating Reserve equivalent to the larger of 0.5 MW or anticipated change in system load over 10 minutes; and minimum contingency Spinning Reserve of 0.8 MW at all times.

In practice, the System Controller maintains higher combined levels of Regulating Reserve and contingency Spinning Reserve in the Darwin-Katherine system than specified due to the size of the generators in the system and their minimum safe loadings (and other constraints on operation). The system is actually generally operated with a higher level of reserve capacity – at an average level of around 40 MW.

There are no service standards for Voltage Management.

Notwithstanding reference to it in the SCTC¹⁵, a system restart standard has not been developed by the System Controller.

3.2. Case for change

Under any future arrangement, there will continue to be a requirement for the System Controller to determine and dispatch ESS to meet system standards.

Service requirements are a key driver of the costs of ESS provision and have been a contentious issue for system participants in the Territory.

System participants and the System Controller may have different incentives regarding the dispatch of ESS. The System Controller, whose role is to maintain system security, is likely to hold a different view on appropriate service requirements, than system participants which supply ESS or from whom ESS costs are recovered.

Transparency of the decisions of the System Controller will be critical to providing system participants with confidence in the ESS framework. Under the Territory's current ESS arrangements there is not the same level of transparency and oversight of ESS service requirements and costs as exist in other Australian electricity markets, potentially contributing to scope for contention and disagreements regarding the dispatch of ESS in the Territory.

3.3. Issues

Service standards

Transparent and contemporary service standards – that define system standards in terms of the ESS required to maintain them – provide a benchmark against which to compare the ESS dispatched by the System Controller and are likely to increase the confidence of market participants in the ESS framework.

In the WEM, service standards are set out in the Market Rules for each ESS – Load Following Ancillary Service (frequency regulation), Spinning Reserve Service (contingency frequency raise) and Load Rejection Reserve Service (contingency frequency lower).¹⁶ The WEM Market Rules specify that the standard for the

¹⁵ Power and Water Corporation 2020, *System Control Technical Code Version No. 6*, March, clause 3.2.10(c)(4).

¹⁶ Electricity Industry (Wholesale Electricity Market) Regulations 2004, *Wholesale Electricity Market Rules*, 30 March 2020, rule 3.10.

System Restart Service must be a level which is sufficient to meet the operational plans developed by System Management – a standard has been published setting out the amount of time within which System Restart Services are required to restore supply to a specified level and how this is to be achieved.¹⁷

In the NEM, the Reliability Panel determines a System Restart Standard which sets out the requirements that are to be met by the Australian Energy Market Operator (AEMO) in acquiring sufficient System Restart ESS.¹⁸

Transparency and oversight

The opaqueness of the Territory's current arrangements for the determination of ESS requirements are in contrast to those in the NEM and WEM, which have defined transparency and oversight mechanisms.

In the NEM, the National Electricity Rules require that:¹⁹

- the Australian Energy Market Operator publishes quarterly reports on the volume and cost of Market Ancillary Services dispatched by AEMO
- AEMO publishes the total estimated annual costs and quantities of each type of Network Support and Control Ancillary Service acquired by it under ancillary services agreements
- at least once each year, AEMO prepares and publishes a report detailing the total estimated annual cost for the provision of System Restart Ancillary Service, broken down by charges for availability and use.

In the WEM, AEMO must submit ESS requirements for the coming year to the Economic Regulation Authority for approval. The Economic Regulation Authority must audit AEMO's determination of the ESS requirements and may require AEMO to redetermine the requirements.²⁰

Given the importance of service requirement forecasts to overall costs, and the scope for contention and disagreement regarding ESS requirements, there could be benefit from introducing transparency and oversight arrangements for the Territory's ESS service requirements.

Question 3

- (a) What issues or concerns do current arrangements for the determination of system service requirements raise? How do these influence investment decisions made by power system participants and is reform warranted?
- (b) Should the ESS framework incorporate service standards, in addition to system standards? Should ESS standards be applied in a regulatory instrument, or in a System Controller instrument?
- (c) Should the System Controller's determination of service requirements be subject to transparency and oversight mechanisms? If so, what arrangements are appropriate?

¹⁷ Western Power System Management 2014, *System Restart Standard*, October.

¹⁸ Australian Energy Market Commission 2020, *National Electricity Rules Version No. 140*, May, rules 3.11.7, 8.8.1(1a).

¹⁹ Australian Energy Market Commission 2020, *National Electricity Rules Version No. 140*, May, rules 3.11.2A(b), 3.11.5(k), 3.11.10(a).

²⁰ Electricity Industry (Wholesale Electricity Market) Regulations 2004, *Wholesale Electricity Market Rules*, 30 March 2020, rules 3.11.6; 3.11.2.

4. Service provision framework

The service provision framework will govern how the System Controller procures the ESS required to maintain system security.

At a high level, there are three broad potential frameworks for procurement of ESS:

- regulation (including regulated tariffs and mandated provision)
- bilateral contracts
- pricing and dispatch through a spot market.

The appropriate service provision framework for the Territory's regulated electricity systems will depend on their specific characteristics and may vary by system.

4.1. Current arrangements

The Territory's current ESS framework is characterised by regulation with a mix of regulated tariff and mandated provision elements.

Notwithstanding an SCTC requirement that a regulatory mechanism for the procurement and responsibility for ESS be developed²¹, and for system participants to be remunerated for ESS based on the type and amount of service provided²², no arrangements have been developed to date.

Instead, the SCTC makes provision for generators to pay Territory Generation for provision of ESS at a rate of \$5.40/MWh of electricity sent out.²³

Other generators may be called on by the System Controller to provide ESS, but there is no formal mechanism to compensate them for this. There is also no incentive, other than through sub-contracting by Territory Generation, for third parties to provide ESS voluntarily.

New Generator Performance Standards approved by the Utilities Commission in March 2020 mandate ESS (frequency management) capability for generators, subject to energy source availability. This effectively means that large-scale solar PV may be called on to provide contingency lower frequency control service, but would not have their output constrained to provide contingency raise frequency control service.²⁴

4.2. Case for change

The current framework excludes private proponents from providing potentially cheaper and more innovative ESS. Market provision of ESS would expose Territory Generation to competitive tension and promote provision of more cost and technology competitive supply, putting downward pressure on electricity costs for the benefit of consumers.

²¹ Power and Water Corporation 2020, *System Control Technical Code Version No. 6*, March, section 5.1.

²² Power and Water Corporation 2020, *System Control Technical Code Version No. 6*, March, section 5.

²³ Power and Water Corporation 2020, *System Control Technical Code Version No. 6*, March, section A6.11(b).

²⁴ Power and Water Corporation 2020, *Network Technical Code and Planning Criteria Version No. 4*, March, clauses 3.3.5.11, 3.3.5.15.

In addition, in the context of the Generator Performance Standards approved in March 2020 which may require connecting solar farms to install or contract for battery capacity, the market provision of ESS may:

- increase revenue opportunities for solar farms, because batteries required to deliver firming requirements could also be deployed to provide ESS under competitive arrangements; and/or
- reduce the cost of contracting battery capacity, as a centralised provider would have opportunity to also benefit from potential ESS revenue streams.

4.3. Issues

Trade-offs between costs and benefits from competition

There is a trade-off between the cost of developing and administering the service framework and the benefits of competition. Wholesale spot market systems are complex and costly to develop and administer but enable frequent market testing and generate high levels of competitive tension. At the other end of the spectrum, price regulation and mandated provision are relatively simple to implement, but forgo benefits from market testing and competitive tension.

Depending on the type of ESS, different service provision frameworks may be appropriate. In the NEM, for example, there are eight separate spot markets for Frequency Control Ancillary Services, but Network Support and Control Ancillary Services and System Restart Ancillary Services are procured by the Australian Energy Market Operator under contract. In the WEM, Load Following Ancillary Service (related to frequency management) is procured via a spot market, but all other ESS not provided by the default provider are procured under contract arrangements.

Although some ESS may be appropriately procured by the System Controller through an open market process, such as where the System Controller can be confident that providers other than Territory Generation exist, there could also be instances where open market procurement has adverse consequences, such as where Territory Generation is clearly the lowest cost provider and a market approach is inefficient and costly for both the System Controller and private sector service providers.

Coordination with energy dispatch

Another important consideration for the market provision of ESS, are the processes to manage the co-optimisation of dispatch of machines for ESS and electricity production.

As the mix of generation technologies and variability in system facing demand (i.e. demand after accounting for behind-the-meter roof top solar PV and associated batteries) becomes more complex and changes over time, decisions about which units to have on line and how to dispatch energy and ESS economically will become more complex.

Changes to the current I-NTEM arrangements for dispatch which also form part of the Northern Territory Electricity Market Priority Reform Program, are an important precedent for this review of ESS arrangements.

Question 4

- (a) What types of ESS are most suitable for market provision and in which systems? Are there certain categories of ESS which would benefit from continued Territory Generation delivery and why?
- (b) What are the likely costs and benefits of spot market procurement of certain types of ESS in any of the Territory's electricity systems?
- (c) What service provision framework would deliver the most appropriate balance between costs and benefits for each category of ESS in each regulated electricity system?

5. Administered pricing arrangements and market power mitigation

The Territory's current I-NTEM arrangements include an administered price for ESS provided by Territory Generation in the Darwin-Katherine system. The administered price is necessary because there is no market to determine prices for ESS.

However, even under market arrangements for the provision of ESS, some form of administered pricing and/or other market power mitigation measure for ESS provided by Territory Generation may be required due to its dominance of the generation sector and potential ability or incentive to exercise market power.

This review will specifically address administered pricing for the provision of ESS by Territory Generation under the current monopoly provision arrangements, and also investigate appropriate pricing and/or other market power mitigation arrangements that would be appropriate under a potential competitive market framework.

5.1. Current arrangements

The SCTC makes provision for generators in the Darwin-Katherine system to pay Territory Generation for provision of ESS at a rate of \$5.40/MWh of electricity sent out.

There are no specific arrangements for pricing or recovery of ESS in the Alice Springs and Tennant Creek systems under the SCTC or any code, and to date, the monopoly provision of generation in these systems by or under contract to Territory Generation has meant these arrangements have not been required.

5.2. Case for change

The current administered price of ESS for the Darwin-Katherine system was included in amendments to the SCTC in 2015 that introduced the I-NTEM. It is understood the price of \$5.40 was based on a high-level assessment of costs to Territory Generation of providing ESS at that time. However, in the instrument approving the SCTC amendments, the Utilities Commission stated that the Power and Water Corporation should commence a review of ESS within six months, and subsequent to the completion of the review, it would make a determination relating to prices for providing ESS.²⁵ To date, no review of ESS by the Power and Water Corporation or determination on ESS pricing by the Utilities Commission has been made.

There has been substantial activity in the Darwin-Katherine system since 2015 likely to have impacted on the provision of ESS and thus Territory Generation's costs. The administered price is now regarded a 'placeholder' in lieu of any other alternative and needs to be reviewed.

Other deficiencies in the current administered pricing arrangements include that:

- the single bundled price does not provide system participants with an understanding of the costs of individual or categories of ESS captured by the rate, and introducing this further degree of transparency would provide for a better understanding by government and industry of the cost of key services required to support power system security
- there is no mechanism for the administered price to change over time with changing conditions, such as the introduction of substantial new solar energy generation and emerging technologies for

²⁵ Utilities Commission 2015, *Approval of Amendments to the System Control Technical Code*, May.

providing ESS, and formalising arrangements for the price to remain up to date on an ongoing basis would enhance certainty for system participants.

The lack of any arrangement for pricing or cost recovery of ESS provision in Alice Springs and Tennant Creek has not posed significant difficulties to date while Territory Generation has provided all generation directly or under contract from private providers. However, the Alice Springs and Tennant Creek power systems are subject to open access arrangements, and this situation may change in the future. An application by a private retailer to generate electricity in Alice Springs is currently under consideration by the Utilities Commission²⁶ and highlights the need to plan for competition in generation in these systems.

5.3. Issues

For the above-mentioned reasons, administered pricing for Territory Generation and/or some other form of market power mitigation measures may be required in the future, under either monopoly or market provision of ESS.

Depending on the service provision framework chosen, options for market power mitigation measures applying to Territory Generation could include:

- administered prices for the provision of ESS
- limits on revenue that can be earned from providing ESS
- constraints on offer prices in any market mechanism
- an obligation to supply required volumes of ESS, such as a default provider arrangement.

In the NEM, in response to concerns about Hydro Tasmania's dominance of the Tasmanian energy generation market and the spot market for FCAS, in 2011 the Tasmanian Economic Regulator (TER) decided to implement pricing regulation. Under the TER's determination, Hydro Tasmania was required to offer a 'safety net' FCAS hedge contract to other generators to meet their market liabilities and for which the price was based on Hydro Tasmania's costs of physically delivering to the spot market the amount of FCAS nominated.²⁷ The pricing regulation was revoked by the TER in 2015.

In the WEM, where the government-owned generator-retailer Synergy has a considerable market share, arrangements to mitigate market power include:

- a requirement in the market rules for Synergy to make ESS available to the System Controller on request as the default provider; and
- regulation of payments received by Synergy for the provision of non-market ESS, according to market rules and parameters approved by the Economic Regulation Authority of Western Australia.

As noted previously, any future administered pricing arrangement and/or other market power mitigation measures for the Territory would need to provide greater transparency to system participants about the cost of providing ESS and have provide flexibility to accommodate changes in the characteristics of the system and the costs of providing ESS.

²⁶ Utilities Commission 2020, *Generation licence application – RPS1101 Pty Ltd*, <https://utilicom.nt.gov.au/projects/projects/Generation-licence-application-RPS1101-Pty-Ltd> (accessed 29 May).

²⁷ Tasmanian Economic Regulator 2020, *2010 Frequency Control Ancillary Services (FCAS) Investigation*, [https://www.economicregulator.tas.gov.au/electricity/pricing/wholesale-pricing/frequency-control-ancillary-services-fcas/2010-frequency-control-ancillary-services-\(fcas\)-investigation](https://www.economicregulator.tas.gov.au/electricity/pricing/wholesale-pricing/frequency-control-ancillary-services-fcas/2010-frequency-control-ancillary-services-(fcas)-investigation) (accessed 1 June).

Question 5

- (a) What changes should be made to the current administered pricing arrangements for the provision of ESS provided by Territory Generation?
 - (1) What methodology should be used to determine prices for each of the ESS categories?
 - (2) What processes should be put in place to ensure the administered prices remain up to date?
- (b) What market power mitigation measures would be appropriate for the provision of different ESS by Territory Generation under a market provision framework?

6. Cost allocation and settlement

The categorisation and definition of ESS would enable the costs of procuring these services to be unbundled and allocated on a 'causer pays' basis.

6.1. Current arrangements

Under the SCTC, Territory Generation is the mandated provider of ESS and is entitled to receive payment from other licenced generators of \$5.40/MWh of electricity they send out in each settlement period (one calendar month).

Settlement of ESS is facilitated by the Market Operator, which calculates the ESS quantity for each generator and issues a settlement statement. Territory Generation then issues invoices to other generators, which are required to be paid within 30 days.

Islanding events

Under certain circumstances, such as when Pine Creek is islanded, the generator at Pine Creek (EDL) is required by the System Controller to provide ESS. The System Controller reduces the ESS price for EDL in proportion to the period within each market interval (30 minutes) that EDL was required to provide ESS (this is a workaround required because the SCTC does not permit the System Controller to amend ESS quantities).²⁸

6.2. Case for change

The current cost allocation method under the SCTC allocates all ESS costs to licenced generators based on their proportion of total energy sent out.

This arrangement is inequitable because it does not allocate costs between system participants on the basis of the benefits received from the ESS provided. Although licenced generators benefit from the provision of ESS, all other system participants also benefit, including unlicensed generators such as small-scale solar PV and consumers.

The current arrangement is also inefficient as it does not provide incentives for system participants to manage their contribution to, or assist with the correction of, frequency deviations which are the primary drivers of service requirements and costs of Regulation ESS.

6.3. Issues

In mature markets, such as the NEM, ESS costs are typically allocated to parties who are deemed to have caused the need for the services and have capacity to take action to reduce the need. In the NEM, this has resulted in the following cost allocations.²⁹

- Contingency raise ESS, which are required to manage the loss of the largest generator on the system, are recovered from generators based on their proportion of total energy production.

²⁸ Power and Water Corporation 2020, *Market-related network information*, <https://www.powerwater.com.au/market-operator/market-related-network-information> (accessed 29 May).

²⁹ Australian Energy Market Operator 2020, *Settlements Guide to Ancillary Services Payment and Recovery*, February.

- Contingency lower ESS, which are required to manage the loss of the largest load or transmission element, are recovered from customers based on their proportion of total energy consumption.
- Regulation ESS, which are required to correct frequency deviations, are recovered from generators and customers which contribute to frequency deviations. Generators whose production and customers whose consumption cause frequency deviations or that do not contribute to their correction are allocated higher contribution factors than those that do not cause or assist to correct frequency deviations.
- Network Support ESS or System Restart ESS, which are required to assist with voltage control or restoration of the system, and which benefit all system participants, are recovered from all system participants in proportion to their energy production and consumption.

Introducing a causer pays approach in the Territory would have equity and efficiency benefits by allocating costs fairly on the basis of benefits received (for contingency, network support and system restart ESS) and incentivising system participants to manage output to correct or minimise their contribution to frequency deviations (Regulation ESS).

A causer pays framework would need to consider roles and responsibilities, payment methods and processes including potential prudential requirements for participants with suitable 'checks-and-balances' to provide assurance of procedural fairness, and best value for the consumer. Changes to the current I-NTEM settlement arrangements which also form part of the Northern Territory Electricity Market Priority Reform Program, are an important precedent for this review of ESS.

Question 6

- (a) What are the appropriate bases for the allocation of ESS costs?
- (b) Are there alternatives to a causer pays approach for the recovery of the ESS costs?
- (c) Are there any technical barriers to the adoption of a causer pays or alternative approaches to ESS cost recovery in the Territory?
- (d) What issues would the transition to a causer pays or alternative basis of ESS cost allocation present for system participants?
- (e) What oversight or regulatory arrangements should accompany any causer pays cost allocation or alternative arrangements?

7. Other issues

7.1. Legislative and regulatory framework

The revision of the existing ESS framework or the implementation of a new framework would require changes to regulatory instruments and, potentially, legislation.

The Territory currently operates under two electricity frameworks:

- *Industry Act*

The *Electricity Reform Act 2001* (NT), provides an overarching framework for regulation of the Territory's electricity supply industry, declaring it to be a regulated industry, and setting out licencing requirements for electricity entities.

The *Electricity Reform Act* and Regulations provide the head of power for the Power and Water Corporation, as the licenced System Controller and Network Operator for the Darwin-Katherine, Alice Springs and Tennant Creek power systems, to manage the systems in accordance with the SCTC and NTC approved by the Utilities Commission.

- *Northern Territory National Electricity Rules*

The *National Electricity (Northern Territory) (National Uniform Legislation) Act 2015* (NT) provides for the adoption of the National Electricity Law and the National Electricity Rules (NER) in the Territory from 1 July 2016.

The Northern Territory NER, a version of the NER modified by regulations to suit the Territory's circumstances, govern the arrangements for metering, economic regulation and network connection in the regulated electricity systems.

The Territory has not applied a number of components of the NER, including those governing the operation of wholesale markets and power system security, which continue to be governed by the SCTC and NTC.

It may be feasible to implement a revised or new ESS framework either through amendment to the technical codes under the *Electricity Reform Act* (SCTC, NTC) or through a Territory specific chapter of the Northern Territory NER.

Modification of the technical codes would be likely to offer the quickest implementation pathway for any new ESS framework. However, a continuing role for the Power and Water Corporation in the administration of the regulatory framework for ESS may not reflect best practice.

In the longer term, appropriate independent governance arrangements for the Territory's ESS framework, in addition to network technical characteristics, system control and market operation, are required.

Further incorporation of the Territory's network, system control and market operation technical codes into the Northern Territory NER and changes to legislative and institutional arrangements to expand the scope of independent rule making, could improve the Territory's electricity governance framework. However, consideration of governance arrangements beyond those applicable to the ESS framework are outside the scope of this review.

Question 7

- (a) What are the issues which need to be considered in determining which legislative and regulatory framework would best accommodate changes to the Territory's ESS framework?
- (b) What improvements can be made to the governance of the ESS framework?

8. Making a submission

Interested parties are invited to email submissions on this Issues Paper to the Design Development Team at electricityreform@nt.gov.au by 13 July 2020.

Submissions should be provided in Adobe Acrobat or Microsoft Word format. On receipt of a submission a confirmation of receipt will be provided, however, it is the submitter's responsibility to ensure successful delivery of their submission.

Any questions regarding the consultation should be directed to Matthew Sargeant, Director Office of Sustainable Energy on (08) 8999 5305 or electricityreform@nt.gov.au.

The Design Development Team will publish submissions on its website, with the exclusion of confidential information. Submissions must clearly identify any confidential information and a version suitable for publication with the confidential information removed should be provided.

The Design Development Team may also exercise its discretion not to publish any submission based on content, such as submissions containing material that is offensive or defamatory.