

Review of the Northern Territory Generator Performance Standards



Appendix D Responses to Stakeholder Submissions

**NOTE – THIS DOCUMENT HAS BEEN
AMENDED TO EXCLUDE CONFIDENTIAL
INFORMATION**

APPENDIX D. RESPONSES TO STAKEHOLDER CODE CHANGE SUBMISSIONS

Responses to Power and Water’s Proposed Code Clause Changes and June Consultation Paper

The following table outlines our responses to the issues raised by stakeholders in the second round of consultation.

Please note the issues column are in general our summarised interpretation of the issues raised by stakeholders rather than a verbatim quote from individual submissions. The submissions are available on our website (other than those identified as confidential). The Power and Water Ref# is an internal issue tracking number to ensure all issues raised have been addressed. For confidential submissions containing detailed questions, Power and Water are contacting the stakeholder directly to provide responses. A summary response is provided in the ‘Power and Water response’ column, however further detail on most issues is available within the body of the application. Where further detail is available the relevant section reference has been provided.

The general headings under which comments are grouped in the table below are:

1. Divergence from NEM / WEM models for NT
2. Least cost solutions – assertions regarding costs and benefits
3. Grandfathering, transitioning, staged implementation
4. Centralised (system control) vs decentralised forecasting and firming
5. Insolation vs. capacity
6. Behind the meter arrangements
7. C-FCAS and forecasting interactions (i.e. battery response)
8. Forecast non-compliance
9. Stakeholder initiated rule change process
10. Roadmap to Renewables / NTEM / GPS alignment
11. Other matters raised

NOTE – [REDACTED] indicates a confidential submission.

PWC Ref#	Theme	Stakeholder(s)	Issue / comment	Power and Water response	References
D.1	Why NEM / WEM isn't appropriate				
1	Cost of divergence	Climate Action Darwin	Asserts that costs too high; GPS more onerous than for east coast and WA markets;	Important differences between the NT, NEM and WEM have been documented, and confirmed in other consultation documents.	Sections 2.5 and 7.2.2 in this application.

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		██████████ ██████████ ██████████ ██████████	<p>requirement for variable large scale solar to be fully dispatchable is impractical and anticompetitive.</p> <p>Significant disincentive for renewable investment impedes modernisation and diversification of Territory power supply.</p>	<p>Recognising that divergence from NEM or WEM requirements can create challenges for generators and generator proponents, our GPS development approach has adopted new standards based on the equivalent NER Chapter 5 Schedule 5.2 requirements, except where adoption in the NT would prevent System Control having the necessary levers of predictability and dispatchability to ensure power system security in the NT power systems.</p> <p>These requirements are achievable, but non-standard. However, in terms of system management that aligns with the objective of high renewable penetration up to 100% of demand at some periods, it is definitely a practical requirement.</p> <p>These requirements are not anti-competitive - they facilitate competitive tension by all technologies to compete equally in the energy dispatch arrangements. The alternative is anti-competitive as a portion of energy delivery would have to be reserved for traditional generation.</p>	
50	NT vs. NEM reliability	Proa Analytics	<p>Observation - Power systems of the size of the NT would certainly need greater reliability requirements than a system such as the NEM</p>	<p>Power and Water agrees with this observation.</p>	
39 74	Divergence from NEM/ WEM	NT Solar Futures	<p>Calls for semi-scheduled generator classification to be retained to facilitate intermittent renewable energy generation.</p> <p>Asserts a significant technical and cost burden on (new) intermittent renewable energy to meet the Code.</p> <p>Asserts it makes the NT market more onerous than the NEM and WEM and will stifle investment in the NT.</p>	<p>The NT market is technically different to the NEM and the WEM. The connecting generators are significantly different in relative size when compared to the NEM and WEM. A 30MW generator scaled by DKIS peak demand against the peak demand in the NEM would be a 3,300 MW generator (660 times larger than the NEM small generator exemption threshold). For generators of equivalent relative size on the WEM or the NEM, the generator classification imposed may well be scheduled, so it is not entirely inconsistent as presented. Furthermore, these have markets to manage the intermittency, the GPS provide a framework that allows for appropriate cost allocation and the generator</p>	<p>Sections 2.5 and 7.2.2 in this application.</p> <p>Further transitional derogations included in NTC clause 12.</p>

PWC Ref#	Theme	Stakeholder(s)	Issue / comment	Power and Water response	References
			Asserts reviews put the NT at a technologically theoretical position, well in advance of the proven approaches of other jurisdictions including the NEM and WEM.	capabilities that would be necessary for operation with 100% of demand supplied by solar PV at some periods of the day. Power and Water recognise that divergence from NEM or WEM requirements can create challenges for generators and generator proponents. Our GPS development approach has therefore been to adopt new standards based on the equivalent NER Chapter 5 Schedule 5.2 requirements, except where adoption in the NT would prevent System Control having the necessary levers of predictability and dispatchability needed to ensure power system security in the NT power systems.	
57	Removal of semi-scheduled generator classification	Territory Generation	Asserts that 'one-size-fits-all' places unnecessary obligations on both thermal and large scale solar PV	The same capabilities have always been necessary from synchronous generation, albeit the form differed. For instance, capacity information is typically provided as a static figure from a synchronous generator, which could be done within the forecasting framework at negligible cost. In these reforms, Power and Water has sought to remain technology agnostic. Application of the NER to the NT must be tailored to the specific conditions here. Generator classification required recognition that the NEM is a much larger electricity market than the NT market, with a larger diversity of fuel sources, generation types, and geographical distribution. The NT's extremely small power systems will rapidly move to the point where renewable generators represent a majority of the generation producing at certain times. The 'semi-scheduled' status in the NEM reflected the historically 'new entrant' and marginal nature of NEM renewables. In a maturing renewable industry, with the central role it is being called on to play in meeting the energy demands of the NT power systems, it is not appropriate to maintain this distinction. The distinction only works when asynchronous renewables are not a material share of the generation pool. In effect the 'semi-scheduled' status pushes the risk of generation not performing in	June Consultation Paper, section 4 Sections 2.5 and 7.2.2 in this application.

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				the manner forecast to the power system as a whole. This outcome would lead the costs of addressing this to be borne by those who are not causing it, whereas our analysis suggests that generators have access to the least cost ways of addressing it and our proposal places the responsibility with them to do so.	
D.2 Least cost solutions – assertions regarding costs and benefits					
█	█ █	█	█ █	The modelling Power and Water undertook sought to maintain current system security levels in the least cost approach. It is Power and Water's view that the proposed amendments achieve the least cost outcomes across all aspects of electricity supply for customers.	Sections 2, 2.4.2 and 2.4.6 in this application.
█	█ █ █	█	█ █ █ █	The wording in the engagement question caused confusion. It should have read "all generators should have the C-FCAS capability necessary as a safety net". As previously advised throughout the consultation process, Territory Generation is the primary provider for ancillary services. In dispatch, this means that where a generator has its energy production curtailed to provide C-FCAS, Territory Generation units are curtailed in preference to other generators. Although the dispatch principles remain unchanged, Power and Water have proposed an amendment to SCTC section 4.3 that clarifies ancillary service dispatch principles.	Sections 2, 2.4.2 and 2.4.6 in this application.
62 (=3)	General comments - transition, exemptions	Tetris Energy	Calls for Power and Water to "[focus] on lowest cost options initially, reviewing the GPS framework as necessary for future connections, in step with technological developments. This facilitates the impending investment and provides transparency and flexibility for future refinements." Wants the code to be started	Power and Water has set out the generator performance standards based on the required capability generators must have when connecting to maintain existing levels of system security in future operating arrangements. Although this is a greater expense to some connecting generators, it is a lower cost to the consumers, who would pay for additional security reserves to accommodate intermittency or reliability issues with new generators as an ongoing expense. Furthermore, the framework specifies the technical requirements to be delivered rather than how these must be delivered. This	Sections 2, 2.4.2 and 2.4.6 in this application.

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			with low requirements and then be increased.	allows technological developments to be accommodated in the connection process for generators connecting into the future.	
63	Increased project costs and grandfathering	Tetris Energy	<p>Considers the anticipated increase in project costs of 20-30% creates a substantial investment risk.</p> <p>Calls to extend grandfathering - for projects that have signed and GUA and Power Purchase Agreement under the Jacana tender process.</p>	<p>The changes are necessary to ensure system security and reliability, and facilitate future renewable energy.</p> <p>All currently in-flight generators were advised of the upcoming GPS in early 2018, and given an early draft of the proposed changes. Grandfathering of these participants is not in the interest of the customers.</p> <p>Nevertheless, Power and Water has proposed modifications to clause 12 of the NTC to assist in-flight connections to achieve compliance</p>	<p>Section 2 and 5 in this application</p> <p>NTC clause 12.3</p>
61 69	Costs vs. benefits / risk mitigation	EDL, Tetris Energy	<p>Assertion that costs of GPS reforms outweigh the benefits, that other (better) options exist, or that costs are not fully understood</p> <p>Assertion that a meaningful assessment of the net costs of the GPS changes doesn't appear to have been undertaken</p>	<p>The security standard in place currently of N-1 for credible contingencies is aligned with international practice. As such, the generator performance standards were assessed on a basis of 'least cost to maintain security' rather than a formal cost benefits analysis where the loss of customer load would be valued.</p> <p>Feasibility and availability of solutions was tested and confirmed.</p>	<p>UC application: Least cost vs. costs benefit - Sections 2, 2.4.2, 2.6</p>
D.3 Grandfathering, transitioning, staged implementation					
3	Staged implementation	Assure Energy,	Advocates amendments for "a commercial, feasible and deliverable framework that can evolve as the system, generation and technology improves" involving a trial, other measures	<p>A trial assumes that there would be a relatively slow take up of PV generation. Considering the existing applications, Power and Water do not think this is feasible. The alternative option that was considered was whether the obligations could be staged, however it was found that this was likely to significantly increase the cost of connecting future generators as the obligations would need to be significantly increased in comparison to those applied to early movers; or if the current obligations applied to all.</p> <p>It is technically and commercially feasible based on Power and Water's analysis of the capabilities of insolation forecasting and</p>	<p>Section 5 in this application</p> <p>Further transitional derogations included in NTC clause 12.</p>

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				<p>storage technologies to meet the proposed forecasting requirements. This was supported by Entura in their report attached to the consultation documents.</p> <p>Nevertheless, transitional derogations for in-flight generators have been reviewed, and new provisions added to enable a transition to full compliance.</p>	
12	Grandfathering - interpretation	Darwin International Airport	<p>States its understanding to be that:</p> <ul style="list-style-type: none"> - all installations currently grid connected at the time of enactment will be grandfathered with no additional requirements for the life of the plant; and - connection applications submitted before the time of enactment will also be grandfathered 	<p>The interpretation is not correct.</p> <p>Grandfathering applies only to existing connected generating systems that were connected to the Power and Water network prior to 1 April 2019.</p> <p>Generators connecting after 1 April 2019 will need to meet the new NTC once approved by the Utilities Commission. However, new provisions have been added to NTC 12.3 to provide a grace period for certain technical requirements, for connections that occur between 1 April 2019 and the date when code amendments commence.</p> <p>In general, modifications or alterations to generating systems fall under Chapter 5 of the NT NER require that the modification or alteration results in the generating system meeting or exceeding the technical standards that are referred to in the connection agreement between the Network Operator and the generator.</p>	<p>Section 5 in this application</p> <p>Further transitional derogations included in NTC clause 12.</p>
15 █ 63	Grandfathering/ staged implementation	<p>Tetris Energy, Darwin International Airport</p> <p>█ █ █ █</p>	<p>Call to further extend grandfathering - for projects with signed agreements.</p> <p>Advocates a phased approach to implementing forecasting for dispatch in both forecast length and accuracy to lessen the compliance burden of such a significant change/rollout</p>	<p>Transitional derogations for in-flight generators have been reviewed.</p>	<p>Section 5 in this application</p> <p>Further transitional derogations included in NTC clause 12.</p>

PWC Ref#	Theme	Stakeholder(s)	Issue / comment	Power and Water response	References
34	Transitioning and sequencing	NT Solar Futures	Suggests that the long term perspective adopted in the codes is premature.	<p>The code changes leverage robust engineering work that is in practice with respect to active power management and forecasting. Although this is cutting edge work with respect to the extent of the obligations, the tools and combinations of technologies such as insolation forecasting and energy storage are both established, proven technologies.</p> <p>An isolated regulated power system operating with the levels of highly variable renewable energy that are currently in application for the DKIS is theoretical and significantly beyond the experience of other jurisdictions. Power and Water are ahead of other jurisdictions in this regard, and cannot wait for them to resolve the challenges. Inaction will impact our security and reliability of supply.</p>	Section 2.5 and in 7.2.2 in this application
70	Process to demonstrate compliance	EDL	<p>Noted T-Gen's concern in earlier consultation re lack of detail on the process to demonstrate compliance of plant modifications.</p> <p>Supports codification in the NTC of the process described in the workshop.</p>	<p>NT NER provisions (notably clause 5.7.3) now set out the process. A separate process has also been added for transitional derogations and compliance following a grace period in NTC clause 12.</p>	Section 6.2 in this application NT NER clause 5.7.3
55	Grandfathering and SCTC	Territory Generation	Advocates adding grandfathering provisions to SCTC - to cover all changes that affect existing generators	<p>The SCTC covers operational matters relating to market operations and system security. It would not be appropriate or consistent with the code change requirements to grandfather other provisions of the SCTC.</p> <p>An exception was made with regards to the cost allocation for the nomenclature changes, as those are discretionary arrangements made by the Network Operator.</p>	Section 5 in this application Code change processes in clause 1.8.2 of the SCTC

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D.4 Centralised (system control) vs decentralised forecasting and firming					
10	Centralised (system control) vs decentralised forecasting and firming	Darwin International Airport	<p>Cost of battery installation within a solar field.</p> <p>Whether cost of cooling has been included using NT meteorological data.</p> <p>Challenges assumption that all existing solar inverters can be used as battery inverters, and that this functionality comes at no cost</p>	<p>The intent is to allow for innovation and least cost outcomes with obligations that can be met under multiple technical solutions. The obligations are technology agnostic.</p> <p>The GPS does not include a battery requirement, it has a capacity forecasting accuracy requirement that could be achieved by use of a battery (amongst other options).</p> <p>Our cost estimates for achieving this on a solar PV site are well based conventional approaches, but are only indicative estimates.</p> <p>No statement was made that existing solar inverters can be used as battery inverters. It was mentioned that (with the correct selection of inverter) the same inverter could be used for solar PV battery combinations and that this comes at less cost than two separate inverters.</p>	Section 6.2 in this application
33	Renewable Energy Roadmap - alignment	NT Solar Futures	<p>GPS proposal is not least cost for NT electricity customers - lower cost alternative solutions exist</p> <p>Asserts the Roadmap "suggested that solar generators move towards dispatchability based on market signals (and not have this forced upon them now by the NTC)".</p> <p>Several of the proposed changes do not support a renewable future at least cost.</p>	<p>If there are lower cost alternatives to active power management (capacity forecasting/firming at the point of connection) they are not prohibited by the GPS framework. The rule changes provide a framework for entrant renewable energy generators to invest in the least cost options that maintain existing levels of system security (rather than at the detriment of system security).</p>	See comments regarding least cost solutions in section 2 of this application
40	Centralised (system control) vs decentralised forecasting and firming		<p>System Control are best placed to manage this risk on behalf of all generators and loads. Placing all the onus onto generators will lead to high cost RE generation and considerable over-build in</p>	<p>System operators are not best placed to manage the intermittency on behalf of all generators. In fact, there is significant pressure in the NEM with the trial of self forecasting for participants to have this responsibility as they have the best information on their plant. Furthermore, a central management balancing requirement could</p>	Section 6.2 in this application

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			capacity vs central provision of solutions	be proposed by entrant generators if it were a more efficient means of meeting the forecasting obligations.	
41	General comment - assumptions relied on	NT Solar Futures	Challenges Entura analysis, availability of DC-DC converters, assertions re cost of batteries installed centrally	If there are lower cost alternatives to active power management (capacity forecasting/firming at the point of connection) they are not prohibited by the GPS framework. The rule changes provide a framework for entrant renewable energy generators to invest in the least cost options that maintain existing levels of system security (rather than at the detriment of system security).	Section 6.2.2 in this application
56	Capacity firming or balancing services	Territory Generation	Challenges expectation on generators to find innovative solutions. Seeks listed clarifications from Power and Water including related actions by Power and Water, how technical implementation would occur, impacts on ancillary service arrangements, handling within control system, and more.	Power and Water considers that the approach is appropriate and aligned with relevant statutory objectives. The generator performance standards provide an outcome that is expected to be delivered for automatic compliance, alternatives require negotiation. The ability to negotiate an access standard enables innovation and least cost outcomes and the obligations can therefore be met under multiple technical solutions. These would require a specific proposal from the generator proponent put forward in the generator connection process.	
█ █ █ █ █	█ █ █	█	█ █ █	A generator that may be considered small in the NEM (e.g. the 5MW generator classification threshold used in the NEM to exempt small generators that have no significant impact to power system security) represents a significant percentage of the daytime demand in the DKIS. A 30MW generator scaled by DKIS peak demand against the peak demand in the NEM would be a 3,300 MW generator (660 times larger than the NEM small generator exemption threshold). It would also be approximately 4.4 times larger than the largest individual generator in the NEM. One such generator sized at 30MW would meet 30% of the minimum daytime demand in the DKIS. Geographical dispersion clearly does not minimise risks for generators of this size; when an individual variation of	

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				approximately 80% of output could have similar impact to a generator trip event. Geographic dispersion is also limited in effect when generators are concentrated in the area of greatest solar resource and co-incident cloud cover events are not independent.	
D.5 Insolation vs. Capacity					
2	Forecasting feasibility	Assure Energy	<p>Accuracy and forecasting is not achievable - While, the technology of forecasting remains nascent and will improve over time with greater experience and implementation, the physics, technology and systems currently available to provide this forecasting accuracy 30 minutes out from dispatch is not available at this time.</p> <p>Power and Water should lead the aggregate modelling on longer forecasts.</p>	<p>This concern appears to relate to insolation forecasting providing the entirety of the forecast, rather than in combination with any other technology. Insolation forecasts are only able to predict (to a reasonably high level of accuracy) the incoming energy, not the capacity (which is the power that can be continuously delivered over a period of time).</p> <p>It is technically and commercially feasible based on Power and Water's analysis of the capabilities of insolation forecasting and storage technologies to meet the proposed forecasting requirements. This was supported by Entura in their report attached to the consultation documents.</p> <p>Forecasting involves knowledge of individual sites that Power and Water are not privy to, and Power and Water will never be able to provide forecasts better than individual proponents.</p>	Section 6.2.4 in this application
49	Forecasting feasibility	Proa Analytics	<p>Observations:</p> <p>Commercially available state-of-the-art forecasts will substantially assist generators to meet requirements</p> <p>Even perfect forecasts would not remove the need for dispatchable compensating technology</p>	Noted, this aligns with our modelling and the report by Entura, where some firming support (battery or otherwise) was considered likely to be required.	
64	Forecasting feasibility	Tetris Energy	Disparity between available forecasting technology and GPS forecasting requirements	Power and Water note our modelling undertaken and outlined in the main consultation paper, which showed that a 50% POE	June 2019 Consultation

PWC Ref#	Theme	Stakeholder(s)	Issue / comment	Power and Water response	References
			Solar forecasting - Power and Water should modify the proposed forecast to 50% probability of exceedance (POE) forecasts, with a pre-determined maximum and minimum bound.	forecast with tight error bounds causes large errors that would result in significant additional security reserve being held.	Paper section 3.1.3, also p37
D.6 Behind the meter arrangements					
4	Specific questions on detail	Assure Energy	<p>Q1. If Embedded Generators are not exporting to the grid, since only a net load will be visible to the Power and Water System what are expected to be the dispatching arrangements in this regard (noting an embedded generator that is not exporting to the grid can only dispatch up to the total load)?</p> <p>Q2. Also – Clarification sought re ramp rate controls under Class 4 embedded generator requirements</p>	<p>As stated at the workshop, all generators greater than 2 MW even if ‘behind the meter’ will be required to meet the GPS and as such will be classified as scheduled generators and need to meet capacity forecasting requirements. Dispatch arrangements will be the same regardless of the load. The complexity is introduced in the capacity forecasting where an export limiter is in place.</p> <p>The forecast will be assessed on the capability of the generating system to continuously deliver active power up to the forecast capacity (gross production capability). As such, if it is under any practical restriction as part of the connection arrangements (such as an export restriction or plant thermal limits), this must be taken into account in the forecast. Power and Water believe that export limit arrangements are unlikely to be adopted by GPS scale generators in the future.</p> <p>Power and Water will consider other specific proposals in-line with the objectives of the forecasting requirements.</p> <p>Ramp Rate Controls are not required for plant under the GPS, this is included in the forecasting arrangements.</p>	Section 6.2 in this application
█	█ █	█ █	█ █ █	<p>See comments in row above.</p> <p>Addressed in discussions directly with stakeholder, and through greater clarity on transitional derogations and negotiated access standards.</p>	<p>Section 5 in this application</p> <p>NTC clause 12</p> <p>NT NER Chapter 5</p>

PWC Ref#	Theme	Stakeholder(s)	Issue / comment	Power and Water response	References
11	Embedded loads	Darwin International Airport	Asserts that Codes do not address installations with embedded loads, particularly sites with large variable loads, in relation to forecasting accuracy and export/import at connection point.	Power and Water believes that the arrangements do provide sufficient flexibility for such installations, noting the firming opportunity with control system and non-critical loads (e.g. HVAC short term cycling) See comments in the two rows above.	
D.7 C-FCAS and forecasting interactions (i.e. battery response)					
█	█ █	█	█ █ █ █	For all generator non-compliance instances, Power and Water will proactively work with the generator to minimise the level of constraint whilst maintaining system security. Codifying constraint arrangements for non-compliance would likely result in less efficient outcomes for all parties. A capacity forecast will not be constrained in a punitive manner, rather it will be to the level required to meet the GPS requirements. Specific detail cannot be given without specific information with respect to the nature of the error. Noting the maximum allowable error of 5%, a forecast that was 15% out would likely trigger a constraint process; without any knowledge of the cause the constraint would likely be to operate to 10% below the received forecast. Information received from the participant regarding the nature of the error and mitigating actions could likely result in removal of the constraint or less conservative constraint.	
5	Other specific questions – C-FCAS droop	Assure Energy	If a battery normally operated to firm the dispatch from a PV generator to meet its capacity offer / dispatch target is drained through providing C-FCAS, it will no longer have the floor room needed to provide this firming service. How would any failure to meet dispatch accuracy	The C-FCAS capabilities can be achieved subject to plant operational limits. It is clearly an operational limit that the battery state of charge remains within appropriate bounds to support any firming and forecasting requirements in 3.3.5.17. Therefore, with appropriate control of the battery it would maintain adequate state of charge to deliver the forecast capacity at all times.	

PWC Ref#	Theme	Stakeholder(s)	Issue / comment	Power and Water response	References
			requirements be treated in this scenario where C-FCAS has drained the battery to the detriment of firming capacity?		
8	C-FCAS - from battery and solar PV	Assure Energy	The current framework for capacity forecasts does not appear complete to enable recognition of C-FCAS capacity availability from both battery and solar PV elements. Can the intention be clarified going forward?	The requirement for C-FCAS capability is that the generating system (which can be comprised of a battery and solar PV elements or anything else), must be capable of providing a level of C-FCAS subject to the capacity of the plant at the time. The C-FCAS accreditation for each generating system is a function of the operating level of the generating system as a whole and its available capacity at that point in time. As both of these quantities are known the C-FCAS capability is also known.	June Consultation Paper, section 5
67	C-FCAS/inertia safety net	Tetris Energy	Treat different generators differently. Suggest that conventional generators provide FCAS and C-FCAS raise services in the market as a cost pass-through and renewable generator provide C-FCAS lower services.	The wording in the engagement question caused confusion. It should have read "all generators should have the C-FCAS capability necessary as a safety net". As previously advised throughout the consultation process, Territory Generation is the primary provider for ancillary services. In dispatch, this means that where a generator has its energy production curtailed to provide C-FCAS, Territory Generation units are curtailed in preference to other generators. Although the dispatch principles remain unchanged, Power and Water have proposed an amendment to SCTC section 4.3 that clarifies ancillary service dispatch principles. Power and Water agrees that the least cost sourcing of energy and all ancillary services (provision) is appropriate. This is consistent with the long term NTEM design objective for least total cost of electricity inclusive of energy and ancillary services.	
D.8 Forecast non-compliance					
72	Ancillary services	EDL	If the System Controller can derate a generator's dispatch where it has failed to meet the required capacity forecasting accuracy, in	This consultation does address the design of the NTEM and possible future capacity markets. However, in terms of how decisions will be made around derating, Power and Water note as follows.	

PWC Ref#	Theme	Stakeholder(s)	Issue / comment	Power and Water response	References
			the absence of details of the specific trigger for that decision or nature of the derating process, are provided, concern is that this may serve as a disincentive to generators offering capacity contracts.	A capacity forecast will not be constrained in a punitive manner, rather it will be to the level required to meet the GPS requirements. Specific detail cannot be given without specific information with respect to the nature of the error. For example: noting the maximum allowable error of 5%, a forecast that was 15% out would likely trigger a constraint process; without any knowledge of the cause the constraint would likely be to operate to 10% below the received forecast.	
D.9 Stakeholder initiated rule change process					
54	SC forecasting obligations	Territory Generation	(Repeated) - Proposes extension of forecasting obligations on Power System Controller (drafting set out in their Attachment A)	Future code changes will be considered. A streamlined approach for addressing future code changes is set out in attachment to the UC application. Power and Water will request further information on this proposed change to cover the specified SCTC content (i.e. impact on participants). This will be collated in a consultation package with the other proposals for further code reviews.	Section 2.3.2 and Attachment A to this application
D.10 Roadmap to Renewables / NTEM / GPS alignment					
36	NTEM integration	NT Solar Futures	Asserts that NTEM and GPS reviews not co-ordinated - co-operation is necessary for a coherent NT electricity industry	The majority of the generator performance standards are unrelated to market reform as they relate to the adequate performance and capabilities of generators. This ensures plant operates in a stable manner and there are appropriate security reserves to call upon. However, Power and Water continues to work with the Department of Treasury and Finance in the GPS development to ensure alignment with the NTEM design.	
73	NTEM integration	EDL	Crucial that the GPS and NTEM processes deliver a well-integrated set of market arrangements to help secure the Government's policy objectives.	See response in the row above.	

PWC Ref#	Theme	Stakeholder(s)	Issue / comment	Power and Water response	References
68	Renewable Energy Roadmap - alignment	Tetris Energy	The roll out of the new GPS should integrate with the Road Map to Renewables Policy	The Roadmap to Renewables report is a plan on how to deliver high penetration of renewables, not the objective. The generator performance standards as proposed facilitate high penetration of renewable energy generators into the energy supply industry at the least cost to consumers.	
71	Forecasting	EDL	We "strongly encourage PWC to consider the proposed changes to the forecasting framework together with the proposed changes to the NTEM dispatch arrangements. It would be inefficient and potentially costly to require two systems and/or having them misaligned."	The forecasting framework aligns with the proposed NTEM dispatch arrangements.	
45	Forecasting	NT Solar Futures	<p>Too onerous on intermittent renewable energy generators. Without precedent, without operational experience to draw on. Practical workability uncertain.</p> <p>Adverse effect on investor certainty.</p> <p>Concerns with high probability of exceedance values, that will lead to significant under forecasting of actual renewable production, at times, in order to comply.</p> <p>Advocates NEM-type arrangement instead</p>	<p>A 15 minute ahead forecast is not adequate for system control purposes. Capacity forecasting is not simply solar forecasting, and cannot be accurately done by System Control.</p> <p>The trade-off on under forecasting or investment in firming arrangements (such as storage) is best situated with the generator as they have both the best information with knowledge of their plant and the incentive to optimise for lowest expense.</p>	

PWC Ref#	Theme	Stakeholder(s)	Issue / comment	Power and Water response	References
D.11 Other matters raised					
53	Role allocation	Territory Generation	Not generator's role to report against revised GPS Onus should be on Power and Water, not TGen, to determine what gaps exists	It is currently a generator's responsibility to undertake regular performance tests to demonstrate compliance with the Network Technical Code. This remains unchanged, however in the interest of transparency Power and Water has indicated that the results of this testing will be used for the documentation of the grandfathered compliance.	
37	New obligations on System Control	NT Solar Futures	(Repeated comment) - Seeks obligation on System Control to maximise renewable energy Comment repeated in relation to dispatch under cl 4.3 - seeking that focus not be on system security and reliability to the detriment of renewable energy	The Codes must reflect the underlying legislative framework, including the rights, obligations and objectives of market entities. This proposal is inconsistent with the framework governing the system control function, and paramouncy of the system security requirements. Power and Water believes that the proposed inclusion would require government policy and legislative changes. Round 1 response flagged that this was an issue that would need to be taken up with government.	June Consultation Paper, Appendix A.4
38	New obligations on Network Operator	NT Solar Futures	(Repeated comment) - Seeks obligation on Network Operator to maximise renewable energy	As above	
9	General comments - transition, exemptions	Darwin International Airport	Solar installations spread over multiple buildings and over a wide area, giving inherent diversity to clouding, appear to be negatively impacted by the cost of multiple forecasting systems being required. A relaxation of forecasting accuracy is suggested for mitigation.	If multiple forecasting systems are required, it suggests that multiple sites are different. There is no automatic reason for assuming that the diversification will work in their favour. Assuming the diversification factor did flatten out the peaks and troughs in PV production, this would assist in the process of converting an insolation forecast to a capacity forecast which may offset the costs in multiple forecasting systems.	

PWC Ref#	Theme	Stakeholder(s)	Issue / comment	Power and Water response	References
13	Evidence relied on	Darwin International Airport	Asks Power and Water to publish solar forecasting data and approved vendors/systems which were tested during Power and Water's evaluation of vendors. Additionally, request time to review and evaluate such systems.	<p>The underlying data is commercial in confidence and Power and Water does not have authority to publicly distribute it.</p> <p>However, Power and Water had the analysis independently verified by Entura and is willing to share this with the UC if required.</p> <p>There are a number of insolation forecasting providers that are available to contract, Power and Water reviewed data from two of these providers and would recommend that industry participants undertake their own due diligence when selecting their preferred solution and vendors.</p> <p>Note, Power and Water has added 'grace period' provisions in NTC clause 12</p>	Revisions to NTC clause 12.3
14	Technical assumptions	Darwin International Airport	Seeks "recognition that the requirement for 39.5% of nameplate active power to be available for reactive power support comes at the cost of active power capability and for a mechanism to be remunerated upon the establishment of a market for such services".	<p>This requirement is consistent with the NEM. The requirement maintains the balance of reactive power support between generators and network. There is not a market framework in the NEM to remunerate for this and it is reasonable to expect that the NT will not adopt more complex market arrangements than the NEM.</p> <p>Further information from AEMO regarding the application of reactive power requirements is available on AEMO's website</p>	https://www.aemo.com.au/-/media/Files/Electricity/NEM/Network_Connections/Transmission-and-Distribution/Clarification-of-S525-Technical-requirements.pdf
52	Consultation	Territory Generation	Process criticism – Asserts issues raised not tracked; justification for proposed changes not clear	<p>In developing the consultation material for the second round of consultation, the response to all issues were tracked internally. Any issue without a specific reference in an appendix was addressed in the body of the main consultation document as a consolidated response to common themes was more appropriate than individual comments to repeat issues.</p> <p>Power and Water have adjusted our approach to improve readability in this round.</p>	

PWC Ref#	Theme	Stakeholder(s)	Issue / comment	Power and Water response	References
				If further clarification is sought, Power and Water can provide references offline.	
46	Active Power Control - ramp rates	NT Solar Futures	(Repeated comment) - Ramp rates should be set on a MW basis or % of name plate rating per minute basis for semi-scheduled and/or non-scheduled generation. The present minimum ramp rate of 5% per minute is onerous for intermittent renewable energy generation. Minimum ramp rates will be taken into account when determining the solar farm yield and hence will increase energy prices or decrease financial viability. More appropriate minimum ramp rates should be specified.	<p>The comments suggests some misunderstanding, implying that GPS set operational arrangements, rather than the minimum capability.</p> <p>Within the GPS, the ramp rate specified is the <u>minimum (slowest)</u> technical capability on the inverter; it does not specify how the plant will be operated. All inverters can achieve this capability out of the box; the requirement is not considered onerous for intermittent renewable energy generation. If the plant has faster capability it can be operated to that level subject to system requirements. This obligation is intended to ensure that generators who have very slow response capabilities must meet a minimum capability to connect.</p>	
16	Classification - batteries	Darwin International Airport	<p>Must recognise different modes of operation for batteries so the functions used for ancillary services can be realised in the electricity market.</p> <p>By classifying a battery as a generator only, this reduces the incentive to invest in the installation of batteries; making solar generator output reductions from forecasting systems more likely. This is counter to the accepted knowledge that more storage on the grid will enhance system security and stability</p>	<p>The generator performance standards were never set out to be the connection standards that facilitate entry of any and all equipment onto the power system. Power and Water have not yet set out to develop performance standards for equipment that is not performing the traditional role of a generator; provision of energy. However, as Power and Water have not provided a specific framework for batteries, under the existing framework a battery would be held to the relevant connection requirements for both generators and loads.</p> <p>The NEM are currently working through rule change proposals for battery connection requirements. The outcomes of this will be followed and considered by Power and Water.</p>	Table only

PWC Ref#	Theme	Stakeholder(s)	Issue / comment	Power and Water response	References
44	Classification - none for batteries/ storage	NT Solar Futures	Should be considered, as for NEM	<p>As clarified in the first consultation, batteries will be considered as both a load and a generator at this point in time. This is consistent with the NEM.</p> <p>Power and Water will monitor how this unfolds in the NEM in regards to a special class of connection.</p>	
59	Classification - ancillary service provision	Territory Generation	Specific examples given of assets used in provision of ancillary services that should not be captured by GPS obligations	<p>The code changes to introduce the GPS did not set out to resolve every issue with the technical codes. For technologies operating in different arrangements such as batteries or flywheels for ancillary services, it would have to be considered against the generator and load connection requirements as it both consumes and delivers power. If there is a provision that is not relevant negotiation is appropriate or if there is another technical matter needed to be coordinated, this will also be highlighted in the connection process.</p> <p>Additionally, Power and Water are monitoring the outcomes of the NER changes for battery classifications.</p>	
47	Definitions / nomenclature	NT Solar Futures	<p>The inertia definitions are restricted to electro-magnetically coupled equipment. These narrow definitions exclude Synthetic Inertia (also known as Virtual or Digital Inertia). The definition should be expanded to include equivalent system services that can be provided by synthetic inertia such as battery inverters. This service has been available and provided by battery inverters for several years now. ...The inclusion of synthetic inertia into the code will enable new generators to meet the grid code requirements more cost effectively.</p>	<p>The inertia definitions are restricted (by default) to electro-magnetically coupled equipment as that is the only equipment that does provide the same service. In the DKIS, the fast response from inverters described as 'synthetic or digital inertia' as presented in the reference material would be accredited towards achieving the performance standards as C-FCAS not inertia.</p> <p>However, NTC 3.3.5.15 (a) (2) provides the ability for 'emulated' inertia sources to be considered: "Inertia offered or provided from non-synchronous (emulated) sources needs to be assessed and accepted by the Power System Controller and Network Operator."</p> <p>The reference material provided to support the points that synthetic inertia is equivalent are not applicable for various reasons:</p> <ul style="list-style-type: none"> - Alinta is a common bus scenario and therefore not subject to the complex control interactions from multiple separately located generation sources on a regulated network. This performance is 	

PWC Ref#	Theme	Stakeholder(s)	Issue / comment	Power and Water response	References
				<p>not achievable on a regulated system.</p> <p>- The Everoze study explained the key differences in a regulated power system: the inverters required a detuned response to mitigate control interactions, and thus for the 'synthetic inertia' to deliver any power it must leverage actual inertia for the first 0.1 to 0.2 seconds. Synthetic/virtual/digital Inertia is not the same as inertia as it required actual inertia to manage the RoCoF for the first 0.2 seconds before supporting.</p>	
35	General comment - Evidence relied on	NT Solar Futures	<p>Asserts that in the absence of a static and dynamic model (anticipated end 2019), it is not possible to look in detail at potential network, generation and load scenarios for what the system will look like in the future. Makes it difficult to plan for the future and set the Codes appropriately.</p>	<p>The development of the dynamic system model will assist in the management of significant penetration of renewables, primarily with respect to the dynamic electromagnetic transient responses of equipment. Although this work is an important tool for network planning and operational constraints, it does not prohibit the connection of renewable generators as scheduled over the next 12 months. Based on the experience of other jurisdictions it will have no material impact on the proposed generator performance standards.</p>	TO
█	█	█	█	<p>These proposals are at odds with the principles of open access arrangements and connection applicant rights underpinning the NT NER</p>	
█	█	█	█	<p>Power and Water agrees with the importance of inertia in the management of power system security. Future modelling work will need to be done here to guide future reforms as a matter of priority.</p>	

PWC Ref#	Theme	Stakeholder(s)	Issue / comment	Power and Water response	References
51	Other comments - Rooftop PV forecasting	Proa Analytics	May help to increase the number of monitored rooftop PV systems in the NT networks	Power and Water agree with this comment and advise we are already investigating and investing in ways to improve forecasting of distributed energy.	
48	Test schedule	NT Solar Futures	Instead of a test schedule for inverter coupled solar generation, asserts it is better to have a starting point in the Code to reduce risk and costs to generators.	System control is currently working to provide a guideline for developing test plans, however due to the bespoke nature of every facility, it has to be with the generator to provide the test plan for their equipment.	
6	Power factor voltage control	Assure Energy	Seeking clarification of the intended operating mode for a behind the meter generator of > 2 MW (operating to supply a large customer).	Power and Water confirm that all generators including behind the meter >2 MW will be required to meet the GPS. The PV classification document is a subsidiary of the Network Technical Code. It will require an update following these proposed changes to the code.	