

Northern Territory Government Response to the Independent Investigation of the Alice Springs System Black Incident on 13 October 2019

9 December 2019

Overview

The system black of 13 October 2019 affecting Alice Springs and connected communities resulted in significant inconvenience for residents, disruption to local businesses and most concerning, risk to the wellbeing of vulnerable people including the elderly and those requiring life support equipment. The incident was the third system black affecting Alice Springs since January 2015, and the ninth incident since then resulting in power being disrupted to 5000 or more customers for a period of more than 30 minutes.

Although it is impossible to design a power system to be 100 per cent secure and reliable, Territorians deserve a high quality power supply comparable to that available in other parts of Australia. This is why the Government asked the Utilities Commission to undertake an independent investigation into the Alice Springs system black incident in line with a comprehensive terms of reference.

The transparency of the independent investigation findings and recommendations are also critical to restoring the community's confidence in the power system. For this reason, the Government has chosen to release the investigation reports of the Utilities Commission and its consultant, as well as its response to the investigation recommendations.

The independent investigation found that a number of key failures caused the system black and delayed the restoration of power. The failures are technical, complex and interrelated and involve both equipment failure and human error. However, the clear message from the independent investigation is that there was an unacceptably low level of preparedness by the Power and Water Corporation and Territory Generation to respond to major system events.

The independent investigation report outlines 15 recommendations, considered necessary to prevent a recurrence of a similar incident in the future. Of these, the Government supports 14 recommendations in whole. The Government supports the remaining recommendation in-principle, but requires further information before forming a final position.

The independent review recommendations are to be implemented within four timeframes:

- immediately, for those recommendations that can and should be implemented immediately
- 31 December 2019, for recommendations identified by the review as a high priority and for which the Government is particularly concerned that they be implemented swiftly
- 31 January 2020, for all other recommendations identified in the independent investigation to be of a high priority
- 30 June 2020, for all other recommendations identified in the independent investigation to be of a medium priority or are more complex to implement.

In addition to the numbered recommendations, the independent investigation recommended that until all of its high priority recommendations are implemented, the Ron Goodin power station be maintained in a state that it could black start the entire system. The Government supports this recommendation.

It is important to note that although the independent investigation found that an unforeseen (by those managing the system) reduction in output from the solar generation due to cloud initiated additional demand on Owen Springs Power Station, this was not the root cause of the system black incident. As

stated by the Utilities Commission and its consultant, the Alice Springs power system should be designed to be sufficiently robust to withstand these types of events.

The Government's guiding principles are that the 50% renewable energy target by 2030 is achieved while maintaining the delivery of reliable and secure electricity at least cost to consumers and taxpayers. The Government will continue to carefully manage the implementation of renewable energy consistent with the observations of the Utilities Commission report.

As in other jurisdictions, the Territory's power systems are evolving as traditional generation is increasingly replaced by renewable generation such as solar. This provides opportunities to reduce greenhouse gas emissions and grow the Northern Territory economy, but requires the frameworks governing power systems to change to ensure the security and reliability of power systems is not compromised. The Government is undertaking a suite of reforms to support secure and reliable power for Territorians.

Detailed response to recommendations

Recommendation 1

Modify the System Control operator screens at Hudson Creek control centre to improve their operational awareness:

- add alarms that rapidly bring to their System Control operator's attention that a generator has come out of AGC control
- track spinning reserve and regulating reserve separately so that it can be seen when the two are not equal.

The Northern Territory Government supports this high priority recommendation.

The failure of System Control and Territory Generation operators to notice that Man Unit #1 at Owen Springs Power Station had come out of automatic generator control resulted in a reduced amount of regulating reserve in the system and contributed to the occurrence of the system black.

By 31 January 2020, the Power and Water Corporation is to modify the operator screens at Hudson Creek to add alarms to rapidly bring to their operators' attention that a unit has come out of automatic generator control and to enable tracking of spinning reserve separately from regulating reserve. Completion and details of the changes made are to be reported to the Utilities Commission for advice to Government (see response to recommendation 14).

Recommendation 2

Consider solar forecasting in addition to the existing load forecasting procedures. In particular:

- System Control and TGen collaborate to determine how a solar forecasting system can be used to improve security of the Alice Springs system
- data from the solar forecasting system be held by the party responsible for maintaining spinning reserve.

The Northern Territory Government supports this recommendation.

The potential for cloud cover to reduce electricity output from solar generators is a known occurrence and the Territory's power systems should be designed as far as practical to be sufficiently robust to withstand cloud cover events.

As noted by the Utilities Commission, the sudden unforeseen reduction in solar generation in the Alice Springs system as the result of cloud cover initiated additional demand on the Owen Springs Power Station, but was not the root cause of the system black event.

Nonetheless, improved cloud forecasting may have allowed an additional generator to be started earlier and for the spinning reserve requirement to be maintained, avoiding the system black incident.

By 30 June 2020, the Power and Water Corporation and Territory Generation are to jointly report to the Utilities Commission for advice to Government (see response to recommendation 14) on a plan to implement improved solar forecasting and for this information to be held by the party responsible for maintaining spinning reserve (see response to recommendation 6).

Recommendation 3

Clarify and communicate protocols around how System Control is to operate during a system black event. We recommend the following principles:

- prepare a complete plan for who may be in the control room during a major system event
- only the RTOM or the Operations support coordinator should be present. The person who is not present should be making preparations to takeover if the event extends beyond the fatigue limit of the duty person
- modify the operating protocols such that the formal primary path for communication during major system events be directly between System Control and the power stations.

The Northern Territory Government supports this recommendation.

It is clear that during the system black incident, many Power and Water Corporation and Territory Generation officers demonstrated a high level of commitment and attended their workplaces when off-duty to assist with the restoration of power.

However, in the case of System Control the investigation found that communications failures, caused in part by too many advisors being present, contributed to the duration of the system black.

By 31 December 2019, the Power and Water Corporation and Territory Generation are to review and amend their communication protocols to clarify how System Control is to operate during a system black, taking into account the recommendations of the independent investigation. Relevant protocols are to be reported to the Utilities Commission for advice to Government (see response to recommendation 14).

Recommendation 4

Complete a review of the AGC system to determine if it is fit for purpose and if still deemed necessary how to improve its function and reliability.

The Northern Territory Government supports this recommendation.

The independent investigation revealed widely held concerns among interviewees that the current automatic generator control (AGC) system is not fit for purpose. The investigation found that during the system black incident, the AGC system exhibited features which are not those of a well-engineered system.

By 30 June 2020, the Power and Water Corporation is to review and report to the Utilities Commission for advice to Government (see response to recommendation 14) on whether the AGC system is fit for purpose, and if it is still determined to be necessary, how its function and reliability are to be improved.

Recommendation 5

TGen prepare a report considering options to simplify the starting and loading of generators during black start. In particular the report should consider options to reduce the risk of generators tripping due to reverse power during restoration. Options for review should include:

- Switching arrangements that allow the Brewer load to be used to stabilise the operation of the machines
- Any other switching arrangements that allow a stable load block to be formed without energising the 66 kV portions of the network
- Installation of a thyristor controlled load bank at Owen Springs
- Relocation of the BESS from Ron Goodin to OSPS so that it can function as a load bank during restoration
- Determining if the reverse power protection settings are more sensitive than is necessary during a black start.

The Northern Territory Government supports this recommendation.

The independent investigation found that:

- insufficient work has been done to determine if the Alice Springs battery energy storage system (BESS) has a role to play in system restoration
- during restoration, operators faced significant difficulties keeping the load on every generator above zero, causing the generators to ‘reverse power’ trip to protect themselves from damage.

By 30 June 2020, Territory Generation is to complete a study, including modelling of costs and benefits, outlining options to simplify the starting and loading procedures to reduce the risk of generators tripping due to reverse power during restoration, including all of the specific options recommended by the investigation. The outcomes of the study are to be provided to the Utilities Commission for advice to Government (see response to recommendation 14).

Recommendation 6

The apparent confusion between TGen and System Control about who is responsible for dispatch and load following should be resolved. Operating protocols need to be thoroughly consulted upon and communicated. We recommend the following principles:

- System Control should be required to determine the amount of synchronous generation needed to be in service at each point in time taking into account the need for spinning reserve, the state of Uterne and the state of the BESS, because these are system security issues
- TGen and PWC review each other’s operation document and the two documents made consistent and agreed
- TGen could be responsible for determining which machines to place into service to meet that spinning reserve requirement and System Controls other system security requirements.
- Implement measures to avoid spinning reserve falling below 8 MW during the day for even for brief periods.

The Northern Territory Government in-principle supports this recommendation.

The investigation found that the manual system of generator dispatch resulted in a significant spinning reserve deficit at the moment of the initiating event and likely contributed to the occurrence of the system black incident.

Further, the investigation found that there was a lack of clarity, agreement and common interpretation of the System Control Technical Code over who is responsible for dispatching machines in real time, with protocols held by System Control and Territory Generation being in disagreement.

The investigation has recommended that System Control should determine the amount of synchronous generation needed to be in service at each point in time taking into account the need for spinning reserve, the state of the Uterne solar farm, and the state of the battery energy storage system. The investigation has suggested that Territory Generation could be responsible for determining which machines to place into service to meet that spinning reserve requirement and System Control's other system security requirements.

By 31 December 2019, the Power and Water Corporation and Territory Generation are to report to the Utilities Commission for advice to Government on the ramifications of Territory Generation being responsible for determining which machines to place into service to meet the spinning reserve requirement and System Control's other system security requirements.

By 31 January 2020, the Power and Water Corporation and Territory Generation are to agree and submit to the Utilities Commission for advice to Government (see response to recommendation 14) consistent operating protocols.

Although the independent investigation found that the policy to maintain 8 MW of spinning reserve in the Alice Springs system during daylight hours should be sufficient to maintain system security for a range of credible events, including a severe reduction of solar output as occurred on 13 October 2019, at the time of the initiating event the power system did not have 8 MW of spinning reserve available. The Secure System guidelines allow spinning reserve to fall below 8 MW for up to 30 minutes without registering as a system security breach, to allow an additional machine to be started.

The independent investigation recommended that measures be taken to avoid spinning reserve falling below 8 MW even for brief periods and if this cannot be achieved, it should be considered a system security breach. The Utilities Commission's consultant has suggested that 8MW of spinning reserve could be achieved at all times through either:

- forecasting that a breach will occur (due to either solar fluctuation or load increase) with sufficient time to put an additional generator into service
- placing an additional generator into service whenever reserve falls below 10MW and load is expected to continue to increase (introducing a new de facto 10 MW spinning reserve requirement).

The independent investigation acknowledged that maintaining a de facto spinning reserve of 10 MW would necessarily increase the cost of operating the system. Although the Government in-principle supports this recommendation, it requires further advice on the likely costs of implementation.

By 31 January 2020, Territory Generation and the Power and Water Corporation are to provide advice on the likely cost implications of this recommendation, and recommended solution for implementation to the Utilities Commission for advice to Government (see response to recommendation 14).

Recommendation 7

Other procedural recommendations include:

- A System Control Black System Restart Procedure be prepared
- PWC amend the PUG procedure to require that the PUC be convened within 90 minutes of system black for any future event
- make changes to provide that during restoration the current split of responsibilities between System Control and OSPS should be at the station 66 kV busbars
- a formal set of black start procedures to be updated, harmonised, printed and stored prominently at all control room and power station sites
- system black procedure be amended to give the station operator more autonomy
- various system black procedures should be rehearsed at regular intervals, both individually and in coordination
- all technical staff (operators, electricians, engineers) should have a simple training record based on the Engineers Australia CPD model (for example) with targets for each type of training and mode of delivery including technical classroom training.

The Northern Territory Government supports this recommendation.

The independent investigation has identified a number of procedural issues that contributed to delays in the restoration of power and made recommendations to address these.

These recommendations are to be implemented by Territory Generation and the Power and Water Corporation as follows.

As of immediately, the Public Utilities Group is to be convened within 90 minutes for any future system black event on any of the regulated systems, to address the potential for extended power outages to significantly impact the community and to allow for a coordinated response from government.

By 31 December 2019:

- a System Control black start procedure is to be prepared, to address the current non-compliance with the System Control Technical Code
- a formal set of black start procedures is to be updated, harmonised, printed and stored prominently at all control room and power station sites, to address the deficiencies in the availability, validity or currency of the procedures for the Owen Springs and Ron Goodin Power Stations during the system black incident.

By 31 January 2020:

- various system black procedures should be rehearsed and a schedule of rehearsals should be established to occur at regular intervals, both individually and in coordination
- the Owen Springs Power Station operator is to be provided a higher level of autonomy to implement the Station's black start procedure.

By 30 June 2020:

- the Owen Springs Power Station to be responsible for energising the 66 kV busbars, for technical reasons

- all Power and Water Corporation and Territory Generation technical staff should have a simple training record, potentially based on the Engineers Australia Continuing Professional Development Model, to address views expressed in interviews that training for operational staff is limited.

Territory Generation and the Power and Water Corporation are to report the details of the procedural changes to the Utilities Commission for advice to Government (see response to recommendation 14).

Recommendation 8

Make engineering changes to avoid the Jenbacher units becoming overloaded during power system events:

- modify OSPS control system so that AGC raise signals are not passed to Jenbacher machines that are operating above their de-rate limit.
- do not add a further power control loop outside of an existing power control loop.
- consider designing the outer control loop so that it automatically suspends its own operation, when the system frequency is a small margin below the UFLS stage 3 setpoint.

The Northern Territory Government supports this recommendation.

During the system black incident, the Jenbacher machines at the Owen Springs Power Station increased their output to such an extent that they exceeded their capability and most of the machines tripped because of high cooling water temperature.

The independent investigation found that the operation of the Jenbacher machines at the Owen Springs Power Station are not currently operating consistently with the principle that control systems should limit machine output under all control modes so that the cooling water temperature does not exceed the trip setpoint.

By 31 January 2020, Territory Generation is to make the engineering changes recommended by the investigation and report this to the Utilities Commission (see the response for recommendation 14).

Recommendation 9

Make further control changes and investigations of the performance of the Jenbacher units:

- investigate and address issues in relation to the need for Di.ane control system reboot after a unit trip
- remove all power factor limiters and replace them with limiters that reflect likely mechanisms of damage to the machines
- review and adjust the under frequency settings to ensure that they are no more sensitive than is necessary to protect the machines from damage
- determine and address the source of an apparent inability of the Jenbacher machines to respond to sudden application of load exceeding 10% of their rating

The Northern Territory Government supports this recommendation.

Following the system black, between 16:30 and 18:35 there were three failed attempts at the Owen Springs Power Station to black start the system using the Jenbacher machines. The independent investigation found that the four issues with the Jenbacher machines identified in the recommendation combined to lower the likelihood of a successful and timely black start.

By 31 January 2020, Territory Generation is to investigate and rectify the issues identified by the independent investigation with the Jenbacher units and report the details to the Utilities Commission for advice to Government (see response to recommendation 14).

Recommendation 10

Make engineering changes to avoid the BESS becoming overloaded during power system events:

- check and adjust the limiter settings to ensure that the BESS does not trip during power system disturbances
- Determine the inrush current of the BESS to determine how it should be used during a system black event

The Northern Territory Government supports this recommendation.

The independent investigation identified that the aggressive intervention of the Alice Springs battery energy storage system (BESS) during the incident may have been counterproductive by impeding the operation of under frequency load shedding (UFLS) and then ultimately exceeding its capability and tripping from service.

The BESS was subsequently shut off as part of the restoration, a decision which was warranted given the then understanding of the BESS' technical characteristics (specifically, its inrush current). The independent investigation has recommended studies be undertaken to determine the BESS' actual inrush current and to determine how it should be used during a system black event.

The Territory has made a significant investment in the BESS and it should be operated to support system security to its full potential.

By 31 January 2020, Territory Generation is to make the required changes to ensure the BESS does not become overloaded during power system events and undertake studies to determine how it should be used during a system black event. The details are to be reported to the Utilities Commission for advice to Government (see response to recommendation 14).

Recommendation 11

Address issues adversely affecting system security. In particular:

- investigate and implement modifications to stop the Man units (or any other unit) coming out of AGC control without an operator command or unforeseeable fault condition
- add alarms that rapidly bring to the ROC operator's attention that a generator has come out of AGC control
- Track spinning reserve and regulating reserve separately

The Northern Territory Government supports this recommendation.

The event of the Man Unit #1 at Owen Springs Power Station coming out of automatic generator control without an operator command and the failure of operators to notice that event, resulted in a reduced amount of regulating reserve in the system and contributed to the occurrence of the system black incident.

By 31 January 2020, Territory Generation is to implement the recommended actions. Completion and details of the system changes are to be reported to the Utilities Commission for advice to Government (see response to recommendation 14).

Recommendation 12

Improve the under frequency load shedding scheme (UFLS). In particular a review and report should be prepared by System Control that addresses:

- UFLS scheme optimised setpoints and time delays
- coordinated changes to the BESS droop settings
- coordination of the settings of the UFLS system with the spinning reserve policy
- failure of UFLS stage #3 during the system black
- whether the BESS output should be capped at its long term rating (5MW) until after UFLS stages #1 and #2 have operated for system security purposes.

The Northern Territory Government supports this recommendation.

The independent investigation found that the under frequency load shedding (UFLS) scheme in place for the Alice Springs system was not optimised for the event that occurred and recommended that a complete review of the UFLS scheme be undertaken taking into account the Alice Springs battery energy storage system.

By 30 June 2020, the Power and Water Corporation is to undertake the recommended review into the UFLS scheme and provide the review report to the Utilities Commission for advice to Government (see response to recommendation 14).

Recommendation 13

System Control prepare a tracking spreadsheet to the satisfaction of the Commission incorporating all recommendations from all system black events back until January 2015.

The Northern Territory Government supports this recommendation.

The independent investigation found significant deficiencies in System Control's reporting of major incidents and expressed concern that this indicates remedial actions will not be implemented in a timely manner, if they are adequately tracked or implemented at all.

The Government shares these concerns and is particularly concerned that outstanding major incident reports be completed and that their recommendations are tracked and followed through to implementation.

By 31 December 2019, the Power and Water Corporation is to prepare a spreadsheet tracking the recommendations from this independent investigation and the recommendations of any completed major incident reports since January 2015. The tracking spreadsheet is to be provided to, and its adequacy assessed by, the Utilities Commission.

By 30 June 2020, the Power and Water Corporation is to complete all outstanding major incident reports and incorporate all recommendations into the tracking document.

The tracking document is to be updated and provided to the Utilities Commission following each major incident to inform the Commission's annual Power System Performance Report.

Recommendation 14

The Utilities Commission place a focus on determining if the recommendations of this report and other major event reports have been tracked and implemented during their annual power system reviews.

Government consider developing a documented process for the reporting and implementation of the recommendations of this and other major event reports by System Control and TGen, with a potential role for the Commission or another independent body.

The Northern Territory Government supports this recommendation.

The Government considers it is essential that the recommendations of this independent investigation and recommendations resulting from other major incident investigations are implemented, the recommended further investigations are undertaken and the recommendations subsequent to these investigations are also implemented. Public reporting of implementation is also necessary to restore confidence in the Alice Springs (and Darwin-Katherine and Tenant Creek) power systems.

The Utilities Commission, as the Territory's independent electricity supply industry regulator, has the relevant expertise to assess implementation and compliance with the independent investigation and major incident report recommendations.

Immediately. The Government has requested the Utilities Commission to publish a report on the implementation of the recommendations of the independent review and other major incident reports every six months for a period of two years. The first report is to be published by the end of February 2020 and will include a report on the progress of implementation of all recommendations of the independent investigation.

Recommendation 15

Government consider allocating explicit responsibility to an appropriate party to advise vulnerable customers, such as those requiring life support equipment at home, to implement their emergency action plans in the case of a system black or other unplanned interruption.

The Northern Territory Government supports this recommendation.

The independent investigation reported that discussions with stakeholders indicate that there may be a gap in relation to allocating explicit responsibility to a party, such as the Power and Water Corporation or Department of Health, to advise customers, including those requiring life support equipment at home and aged care facilities, to implement their emergency action plans in the case of a system black or other unplanned interruption.

The Government considers that it is critical that consideration be given to the welfare of elderly people living in retirement facilities; prioritising the return of supply to locations such as shopping centres where vulnerable people may choose to seek respite from the heat; providing direct communication and/or advice to the many customers known to have medical needs for electricity; and providing communications in a form accessible by all community members including those who are not familiar with new media such as Twitter and Facebook.

By 31 December 2019, the Power and Water Corporation, in collaboration with relevant stakeholders, is to update communications protocols, response plans and procedures for the protection of vulnerable customers in the event of electricity supply interruptions.

By 31 January 2020, the Power and Water Corporation is to liaise with the Department of Health and provide the portfolio Minister, Treasurer, Minister for Health and Utilities Commission with advice on jointly agreed responsibilities for advising vulnerable customers, including those requiring life support equipment in their homes, on emergency action and remedial plans in the event of any unplanned electricity supply interruptions.