Core Grid strategy

Area strategies for Tasmania's electricity network

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Authorisations

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Responsibilities

This document is the responsibility of the Network Planning team, Tasmanian Networks Pty Ltd, ABN 24 167 357 299.

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Minimum requirements

The requirements set out in TasNetworks' documents are minimum requirements that must be complied with by TasNetworks staff, contractors, and other consultants.

The end user is expected to implement any practices which may not be stated but which can be reasonably regarded as good practices relevant to the objective of this document.

Disclaimer

Record of revisions

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Executive summary

The grid backbone of Tasmanian electricity transmission network (Core Grid) generally operates at 220 kV. Some of 110 kV network in Upper Derwent area also plays the role of Core Grid as it forms an alternative path between northern and southern Tasmania.

Due to the flat load forecast over the next five to ten years, the core grid development in Tasmanian electricity transmission network is likely to be driven by new generation development and a second Bass Strait interconnector, as well as the new initiatives such as the “Battery of the Nation”.

The Core Grid development plan presented in Table 1 represents those developments that may be triggered within the next 15 years to support load and generation development scenarios in Tasmania. These projects have not been justified economically or deeply considered against alternative options, but provide a reasonable assessment of the solutions forecast in the medium to long term if met by network development.

Table 1: Network development strategy for the Core Grid

Location	Proposed development	Investment need	Estimated cost ($m)
George Town	±50 MVAr STATCOM	Compliance with NER S5.1a.7 and market benefit	15
North	New double circuit Palmerston–Sheffield 220 kV transmission line	Jurisdictional network performance requirements – Clause 5(1)(a)(ii), 5(1)(a)(iii) and market benefit	120
North West	New double circuit Sheffield–Burnie 220 kV transmission line	Thermal capacity Stability (fault ride through)	80
North West	New double circuit Burnie–Smithton 110 kV transmission line	Thermal capacity Stability (fault ride through)	70
Upper Derwent	New double circuit Tungatinah–Waddamana 110 kV transmission line and 220/110 kV network transformer	Asset condition, security and reliability	118
North Tasmania	Second Bass Strait interconnector	Integrated System Plan	550

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1 General

1.1 Introduction

TasNetworks prepares a suite of eight area strategies for Tasmania. These area strategies drive the development strategies for each of the seven planning areas, based on a geographic breakup of the network, as well as the Core Grid (This document). The development strategies ensure that the network remains adequate under forecast demand, generation and performance scenarios. The Core Grid strategy focuses on the grid backbone of the Tasmanian electricity transmission network, via which either the intra-regional power flow is facilitated such that generators can have adequate access to load centres in Tasmania or the inter-regional power flow is facilitated such that the maximum net market benefit to all the participants in the National Electricity Market (NEM) could be achieved.

1.2 Purpose

The purpose of this document is to identify the development strategy to maintain an adequate core grid transmission network in the Tasmanian electricity transmission network.

1.3 Scope

The Core Grid strategy addresses the issues related with the grid backbone of the Tasmanian electricity transmission network (Core Grid) taking into account the existing and foreseeable generation scenarios as well as prospective load growth or decline.

1.4 Objectives

The objectives of this Core Grid strategy are to:

- provide an overview of the existing Core Grid
- present the most likely generation and demand scenarios based on economic development, government policies and customer connection enquiries taking into account uncertainties
- identify existing and forecast limitations based on generation expansion scenarios, demand forecast, security and reliability requirements
- identify the opportunities to augmenting the Core Grid such that the net market benefit to all the participants in the NEM could be maximised
- present the long term vision for the Core Grid based on generation and demand scenarios
- present proposed developments to address the forecast limitations and other planning considerations such as asset retirements, operational constraints and market benefits

1.5 Strategic context

The TasNetworks vision is to be trusted by our customers to deliver today and create a better tomorrow. The area strategies support this vision by ensuring the network continues to be adequate to cater for the demands on it (generation, load, reliability, performance and so on). The strategies also support the changing operation of the network to integrate more distributed energy resources and identifying opportunities to increase utilisation of the network, ensuring the lowest sustainable prices.

2 Integrated system planning

The Core Grid Strategy considers the national transmission network development plans and analysis.

2.1.1 National Transmission Networks Development Plan

As the national transmission network planner, AEMO produces an annual National Transmission Network Development Plan (NTNDP). AEMO states that the NTNDP is an independent, strategic assessment of, and appropriate course for, efficient transmission grid development in the National Electricity Market over the next 20 years.

The NTNDP's analysis focuses on the adequacy of the main transmission network and national transmission flow paths over a 20-year study period (to 2036). In Tasmania, the main transmission network is the 220 kV bulk transmission network and the portion of 110 kV transmission networks that operate in parallel to and supports the 220 kV network. National transmission flow paths support major power transfers between zones of generation and demand centres in the NEM. Tasmania is considered a single zone and therefore there are no national transmission flow paths in Tasmania, however Basslink is a national transmission flow path linking the Tasmania and Latrobe Valley (in Victoria) zones.

The NTNDP also reports on AEMO's assessment of the needs for Network Support and Control Ancillary Services (NSCAS) in a five-year period. NSCAS relate to the capability to control active and reactive power flow into or out of the transmission network.

This section details the manner in which our proposed augmentations to the transmission network relate to the NTNDP and the development strategies for national transmission flow paths specified in the NTNDP. The most recent NTNDP was published in December 2016[1].

We propose to install dynamic reactive support device, in the form of a new ±50 MVAr STATCOM, at George Town Substation in 2021, as detailed in Section 6.3. This will address the voltage imbalance compliance issues as stated in NER S5.1a.7 as well as the voltage control issues at George Town Substation, identified in the 2016 NTNDP[2]. They include:

- Voltage collapse at George Town caused by high export from Tasmania to Victoria; and
- Temporary over-voltage at George Town caused by trip of Basslink when on high export from Tasmania to Victoria.

We propose to construct new double circuit Palmerston–Sheffield 220 kV transmission line, as detailed in Section 7.1.2. This will address the transmission limitations on the Palmerston–Sheffield 220 kV line, identified in the 2016 NTNDP[2].

2.1.2 Integrated System Plan

This year AEMO is preparing an inaugural Integrated System Plan (ISP) for the National Electricity Market (NEM), and will replace the NTNDP for the 2018 year. The ISP was recommended by the Independent Review into the Future Security of the NEM (Finkel Review). Recommendation 5.1 from the Finkel Review stated:

> *"By mid-2018, the Australian Energy Market Operator, supported by transmission network service providers and relevant stakeholders, should develop an integrated grid plan to facilitate the efficient development and connection of renewable energy zones across the National Electricity Market".*

[1] National Transmission Network Development Plan
[2] AEMO 2016 NTNDP, Table 9.

The first ISP in June 2018 will deliver a strategic infrastructure development plan, based on sound engineering and economics, which can facilitate an orderly energy system transition under a range of scenarios.

TasNetworks, with the other TNSP and stakeholders, have supported AEMO in the development of their ISP. In Tasmania, a number of Renewable Energy Zones are proposed, including North West and Central Tasmania, where there is a significant amount of wind abundance and developer interest. TasNetworks anticipates the ISP will highlight the need for additional regional interconnection to access Tasmania's abundant renewable energy resources.

2.1.3 Battery of the nation

Australia's energy fleet is aging and the late 2020s will see the start of an unprecedented sustained and rapid retirement schedule. The size of the challenge means that there is no single solution and a combined response is needed. Wind and solar are likely to be the low cost energy sources of the future and will need services to support their variability. This will also mean that energy sources with different characteristics will be more valuable.

The Battery of the Nation (BotN) initiative by the Tasmanian government, supported by Hydro Tasmania and TasNetworks will study Tasmanian options that result in more reliable national energy production as a cost effective "Battery of the Nation" for supporting the NEM in its transition to a low emission energy future. As part of the process, Hydro Tasmania has worked closely with TasNetworks on the systems operations and transmission requirements as well as engaging Ernst & Young as our specialist consultant and Oakley Greenwood as independent reviewer of the assumptions and modelling design.

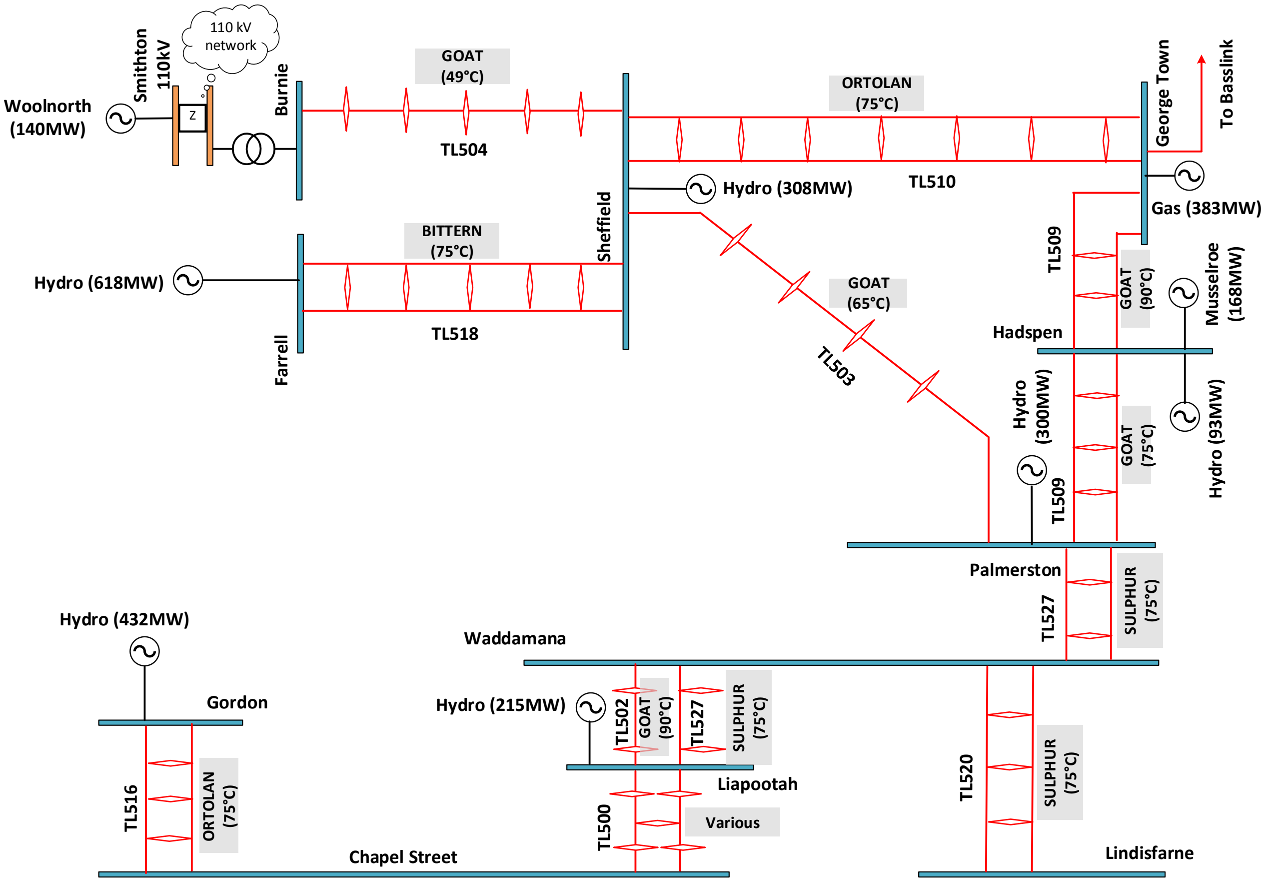
During the course of this work the concepts of Renewable Energy Zones (REZs) and AEMO's Integrated System Planning have come to the fore and it has eventuated that this analysis was the first step on the process of identifying Tasmania as a major opportunity to develop a significant renewable energy zone(s).

3 Core Grid overview

3.1 220 kV core grid

The existing 220 kV core grid of the Tasmanian electricity transmission network as well as the generation installed capacities under each leading node are presented in Figure 1 below:

Figure 1: Existing 220 kV core grid of the Tasmanian electricity transmission network



The existing 220 kV core grid was mostly constructed from 30 to 60 years ago to facilitate either the delivery of hydro generation from remote locations to load centres, such as the Gordon–Chapel Street and Sheffield–Farrell 220 kV transmission lines, or the supply of major load centres, such as the Sheffield–George Town and Palmerston–Hadspen–George Town transmission lines. These circuits also play the key roles in enabling Basslink export of up to 630 MW when required. This was made possible by implementing a Network Control System Protection Scheme (NCSPS) which allows the relevant network elements to operate non-firm during normal operation. Potential overload on the remaining circuit is avoided by either de-loading or tripping of the relevant generator groups should a contingency occur on the parallel circuit. The NCSPS is however not available when Basslink is on import.

The single circuit 220 kV transmission lines TL503 (Palmerston–Sheffield) and TL504 (Sheffield–Burnie) are the oldest 220 kV transmission lines (1957 built) currently still operating in Tasmanian transmission network. These circuits are however lightly loaded compared with the other 220 kV circuits under the existing generation and load patterns. Condition assessment suggests that these assets are in relatively good and serviceable condition in the next 10 years taking into account their age.

The double circuit 220 kV transmission line TL527 was constructed in 1999, which interconnects the transmission network of the northern Tasmanian (north to Palmerston) with that of the southern Tasmania (south to Waddamana). The two circuits of TL527 are however the only 220 kV circuits which link the north and south of Tasmania and hence are very important core grid elements, particularly during bush fire season as the transmission corridor of TL527 is prone to bush fires.

3.2 Other elements of the core grid

The transmission elements other than what are presented in Figure 1 which form part of Core Grid are the 110 kV transmission lines in the Upper Derwent area. These lines were constructed between 1930s and 1950s with the major purpose of servicing the older hydro power stations in the area. They are:

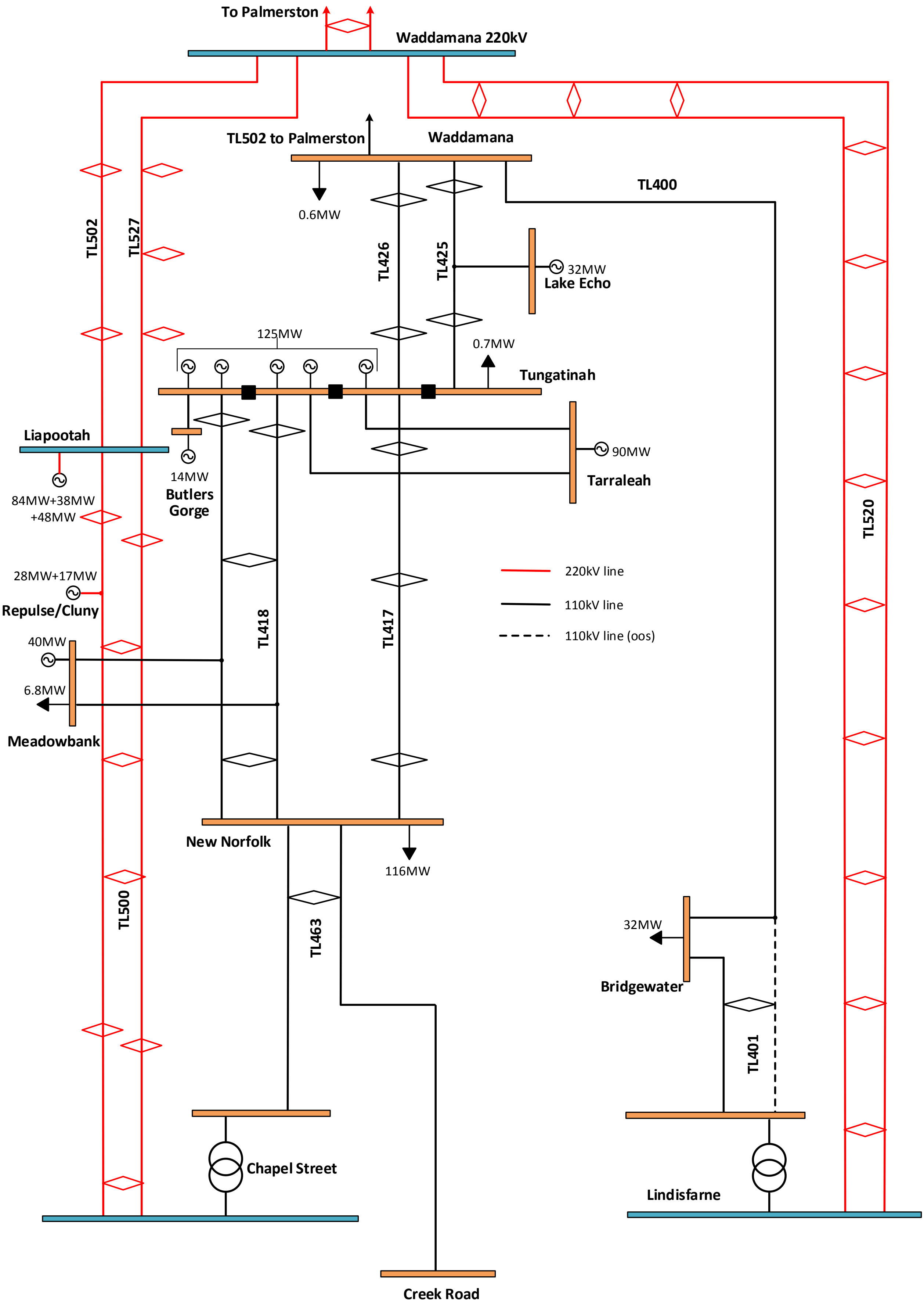
- TL417 (1938 built), Tungatinah–New Norfolk transmission line (74 km);
- TL400 (1943 built), Waddamana–Bridgewater Junction transmission line (86 km);
- TL418 (1945 built), Tungatinah–Meadowbank–New Norfolk transmission line (74 km);
- TL425 (1953 built), Tungatinah–Lake Echo–Waddamana transmission line (34 km); and
- TL426 (1956 built), Tungatinah–Waddamana transmission line (34 km).

These transmission lines, together with TL463, New Norfolk–Chapel Street (Creek Road) 110 kV T/L and TL502, Waddamana–Palmerston 110 kV T/L[3], form a 110 kV path from Palmerston in the north to Chapel Street (Creek Road) in the south. Figure 2 presents the existing Upper Derwent 110 kV core grid together with its neighbouring 220 kV core grid. Due to the forecast maintenance activities (tower replacement in particular) that may be required on the transmission assets in this area, TasNetworks has conducted a comprehensive options analysis to derive a southern 110 kV transmission rationalisation strategy (The Strategy[4]) for this area, of which the Stage 1 is to decommission Waddamana–Bridgewater Junction 110 kV transmission line TL400 after establishing an alternative supply to Bridgewater Substation from Lindisfarne by utilising the existing unused second circuit of TL401 (ref Figure 2).

[3] TL502 was built as 220 kV T/L, of which the section from Waddamana to Palmerston is currently operating at 110 kV.

[4] Southern 110 kV transmission strategy

Figure 2: Existing Upper Derwent 110 kV core grid and its neighbouring 220 kV core grid



4 Customers

This section details the material existing and proposed generation and load customers in the Tasmanian electricity transmission network which possess significant impact on Core Grid development.

4.1 Load

4.1.1 Load growth

Forecasted load growth within the next 20 years in Tasmania is minimal[5], which is not expected to impact on any investment decisions with regard to Core Grid.

4.1.2 Load decline

Significant load decline is not forecasted in Tasmania either. However, given the high percentage of major industrial loads in Tasmania, load decline caused by falling of major industrial loads is a possibility.

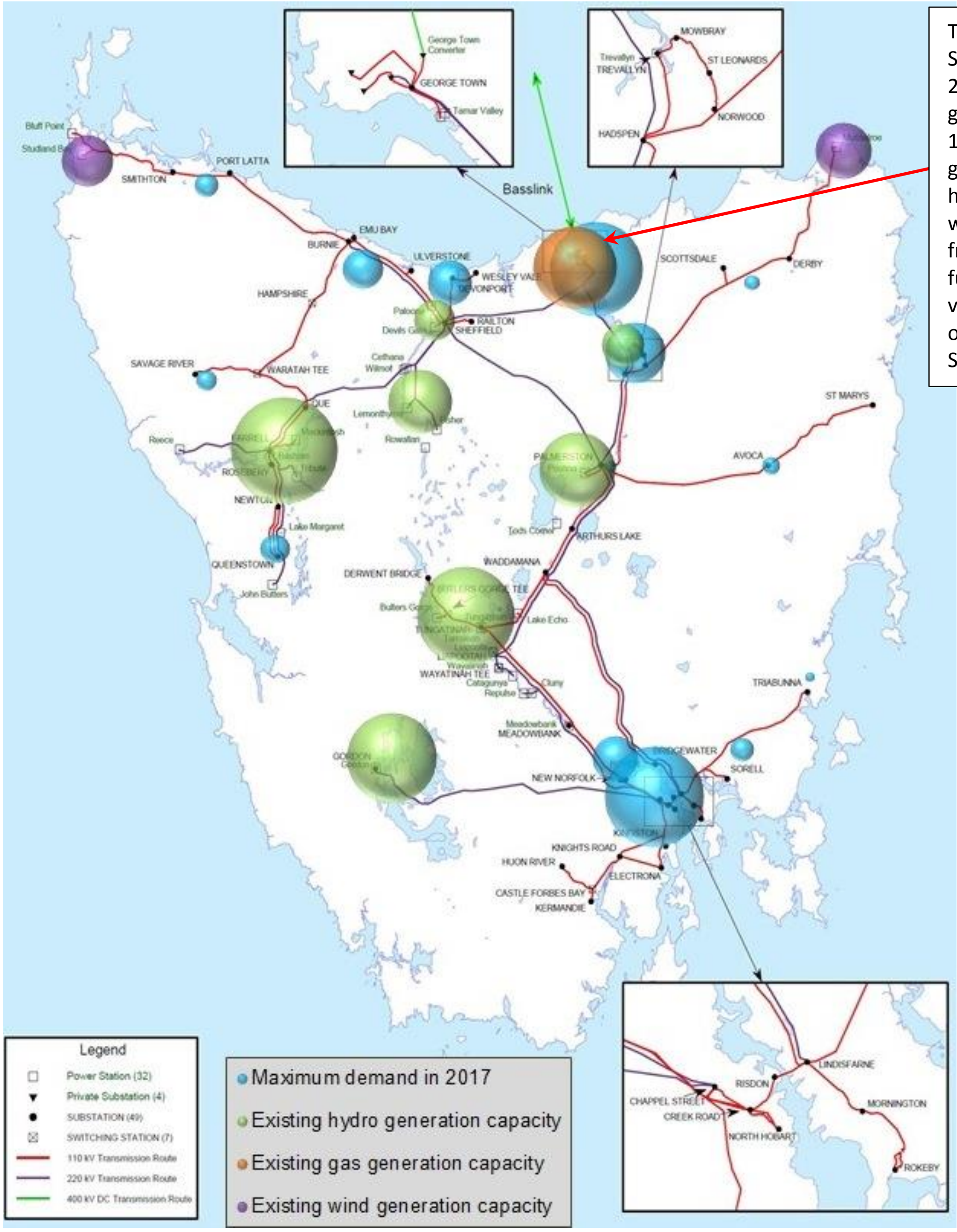
4.2 Generation

4.2.1 Existing generation

In Tasmania, there are 25 hydro power stations with a total installed capacity of 2310 MW, three wind farms with a total capacity of 308 MW and one gas-fired power station Tamar Valley with a total capacity of 383 MW. Figure 3 below presents the indicative location and size of lumped power stations and maximum demand within Tasmania.

[5] AEMO 2017 Electricity Statement of Opportunities

Figure 3: Generation capacities and maximum demand by locations

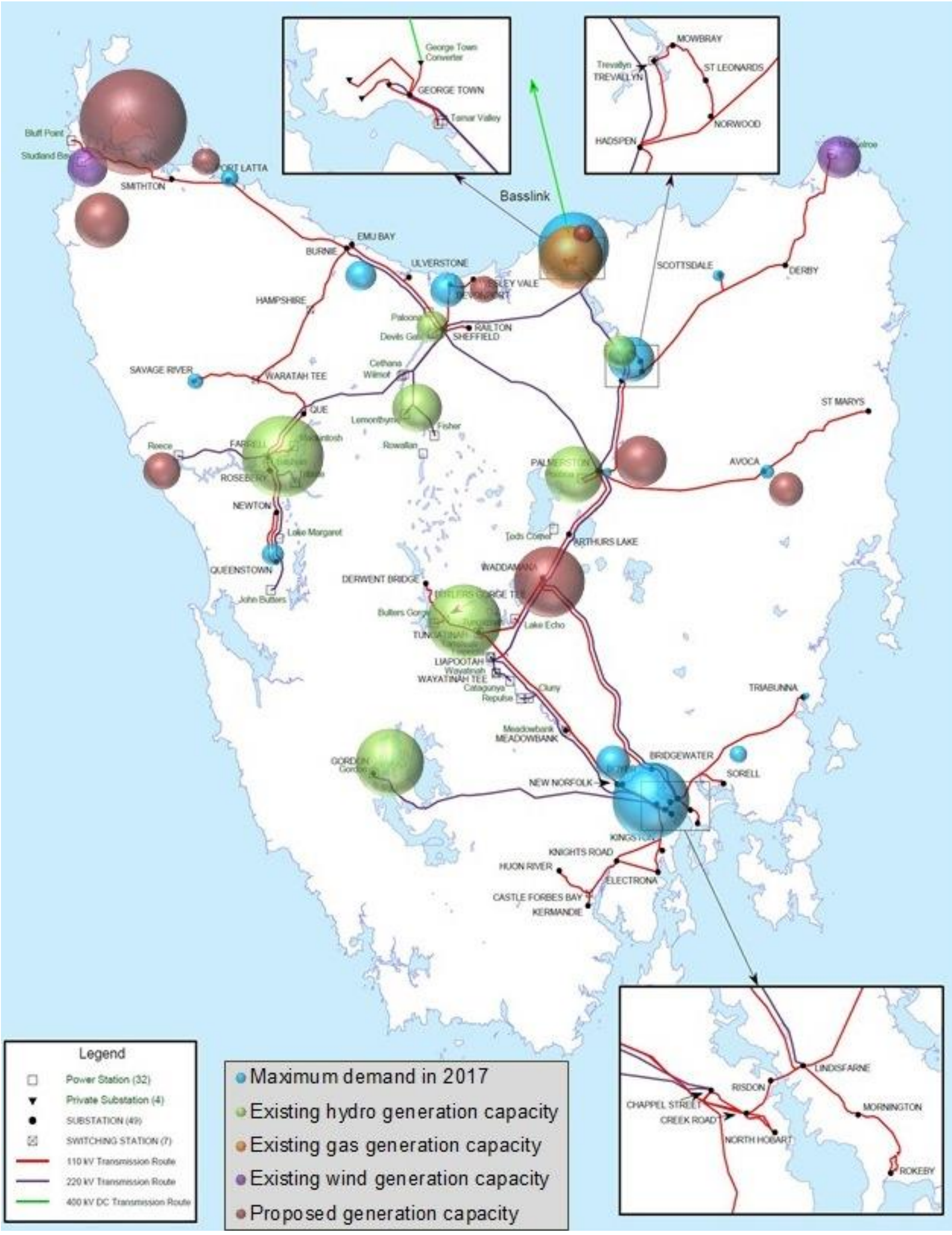


Tamar Valley Power Station consists of a 208 MW combined cycle gas turbine (CCGT) and 178 MW of open cycle gas turbines. The CCGT has been identified as withdrawn from service from 2018 due to high fuel cost, which would virtually reduce the size of Tamar Valley Power Station to 178 MW.

4.2.2 Proposed generation

In 2016 and 2017, a significant number of new generation connection enquiries were received by TasNetworks. These enquiries include wind farms, solar farms as well as other embedded generators. Three areas within Tasmania are identified as being the possible locations where more than 100 MW of new wind generation capacity could eventuate within the next 2 to 10 years. They are North West, West Coast areas, and the Central area, close to Waddamana Substation. Figure 4 below presents the proposed generation developments on top of the existing generation sites as presented previously in Figure 3.

Figure 4: Proposed and existing generation capacities by locations



5 Identified core grid issues

5.1 Thermal

The thermal overloading issue within Core Grid are managed by Australian Energy Market Operator (AEMO) through its National Electricity Market Dispatch Engine (NEMDE) with a series of constraint equations. In addition to this, the following two measures have been adopted by TasNetworks to maximise the thermal transmission capacity within its transmission network. They are:

- Use real time ratings for transmission lines, which are usually greater than static ratings; and
- Use NCSPS under Basslink export scenarios to enable the core grid transmission network to operate to its non-firm conditions.

5.1.1 Existing generation

For the existing generation, the release of any binding thermal constraints on Core Grid was found to be not sufficient to justify any significant augmentation on Core Grid.

5.1.2 Prospective generation

As mentioned in Section 4.2.2 significant amount of new generation is likely to emerge in North-west, West Coast and Central areas. These new generation developments could result in following issues:

- TL504 (ref Figure 1) is a single circuit 220 kV T/L with a rating of 229/138 MVA (Winter/Summer) radially supplying North-west area from Sheffield Substation. This circuit may need to operate non-firm[6] once the new generation capacity in North-west area exceeds around 200 MW; and
- TL503 (ref Figure 1) is a single circuit 220 kV T/L with a rating of 298/239 MVA (Winter/Summer) linking Sheffield and Palmerston substations. This circuit has only bound thermally for four hours for power flows from Sheffield to Palmerston in the past three years with an average marginal value of -$21. However, an increase of new generation capacity in both the North-west and West Coast areas is likely to see more thermal binding on this circuit.

5.2 Voltage

Voltage control at George Town has been a constant issue since the commissioning of the Basslink interconnector. This issue is currently managed by constraint equations, which would generally limit Basslink export to avoid the breach of system security operating limits. These constraints have bound for 158 hours in the past three years with an average marginal value of -$29. The voltage control at George Town usually emerges as the following issues listed below when the 208 MW combined cycle gas turbine (CCGT) at Tamar Valley Power Station is out of service:

- Temporary overvoltage when Basslink trips on high export;
- Lack of reactive reserve when one of the Sheffield–George Town circuits trips on high export;
- Lack of reactive reserve when one of the Hadspen–George Town circuits trips on high export;
- Voltage control difficulties following the trip of Basslink 98 MVAr capacitor bank (HF7); and
- Overvoltage caused by FCSPS when Basslink trips on high import[7].

5.2.1 Existing generation

Due to the identified withdrawn of CCGT in 2018[5], voltage control at George Town will become more difficult.

5.2.2 Prospective generation

As mentioned in Section 4.2.2 significant amount of new generation is likely to emerge in North-west, West Coast and Waddamana areas. These new generation developments will result in high Basslink export and hence more binding constraints on Basslink due to voltage control requirement at George Town.

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[6] Non-firm operation could be achieved by implementing either an inter-trip or run-back scheme.
[7] System strength study on Tasmanian Power System

5.3 Transient stability

There is only one transient stability constraint in Tasmanian transmission network. It is a limit on total West Coast export via the double circuit Sheffield–Farrell 220 kV transmission line TL518 (ref Figure 1). This equation prevents the system from transient instability following the loss of one of the Sheffield–Farrell 220 kV circuits. It has bound for 36 hours in the past three years with an average marginal value of -$17.

5.3.1 Existing generation

For existing generation, the release of the above mentioned transient stability constraint on Sheffield–Farrell 220 kV corridor was found to be not sufficient to justify any significant augmentation.

5.3.2 Prospective generation

As mentioned in Section 4.2.2 significant amount of new generation is likely to emerge in North-west, West Coast and Central areas. New generation eventuating in the West Coast area will make the above mentioned transient stability constraint bind more often.

5.4 Oscillatory stability

There are currently two oscillatory stability constraints for the intact Tasmanian transmission network. They both prevent poorly damped north – south oscillations following a fault and trip of the Palmerston to Sheffield 220 kV transmission line. These constraint equations have bound for 58 hours in the past three years with an average marginal value of -$802.

5.4.1 Existing generation

For the existing generation, the release of the above mentioned oscillatory stability constraint on Palmerston–Sheffield 220 kV corridor was found to be not sufficient to justify any significant augmentation on this core grid.

5.4.2 Prospective generation

As mentioned in Section 4.2.2 significant amount of new generation is likely to emerge in North-west, West Coast and Central areas. New generation eventuating in both North-west and West Coast areas will make the above mentioned oscillatory stability constraints bind more often.

5.5 Network performance requirements

The *Electricity Supply Industry (Network Planning Requirements) Regulations 2007*[8] (The Regulations) require certain single asset failures to be planned for, including non-credible contingencies such as the failure of a double circuit transmission line. The clause 5(1)(a)(ii) and 5(1)(a)(iii) of The Regulations are relevant for planning the Core Grid. They are listed in the following box:

5. Minimum network performance requirements

(1) Power system planning in respect of a relevant transmission system must be such that the system is likely to meet the following network performance requirements:

(a) in respect of an intact transmission system –

(ii) no more than 850 MW of load is to be capable of being interrupted by a single asset failure; and

(iii) load that is interrupted by a single asset failure is not to be capable of resulting in a black system;

[8] Electricity Supply Industry (Network Planning Requirements) Regulations 2007

5.5.1 Existing generation

For the existing generation, no issue was found which would violate the above mentioned clause 5(1)(a)(ii) or 5(1)(a)(iii) of The Regulations.

5.5.2 Prospective generation

As mentioned in Section 4.2.2 significant amount of new generation is likely to emerge in North-west, West Coast and Waddamana areas. New generation in both North-west and West Coast areas will need to transport via the Sheffield–George Town corridor or the Palmerston–Sheffield corridor (ref Figure 1) to the rest of network other than North-west and West Coast Tasmania. This increased level of power transfer via two Sheffield–George Town circuits and one Palmerston–Sheffield circuit could cause the violation of the above mentioned clause 5(1)(a)(ii) and 5(1)(a)(iii) of The Regulations in that a failure of the double circuit Sheffield–George Town 220 kV transmission line would result in significant interruption to supply or in the worst case a black system when the total power flow on those two Sheffield–George Town circuits and one Palmerston–Sheffield circuit exceeds certain threshold. System study suggests that this limit can be expressed as a constraint equation as presented below:

$$SH_{Exp} \leq 695.2 + 0.237 \times BL_{Exp} + 0.0463 \times TotalTasLoad \qquad (1)$$

Where:

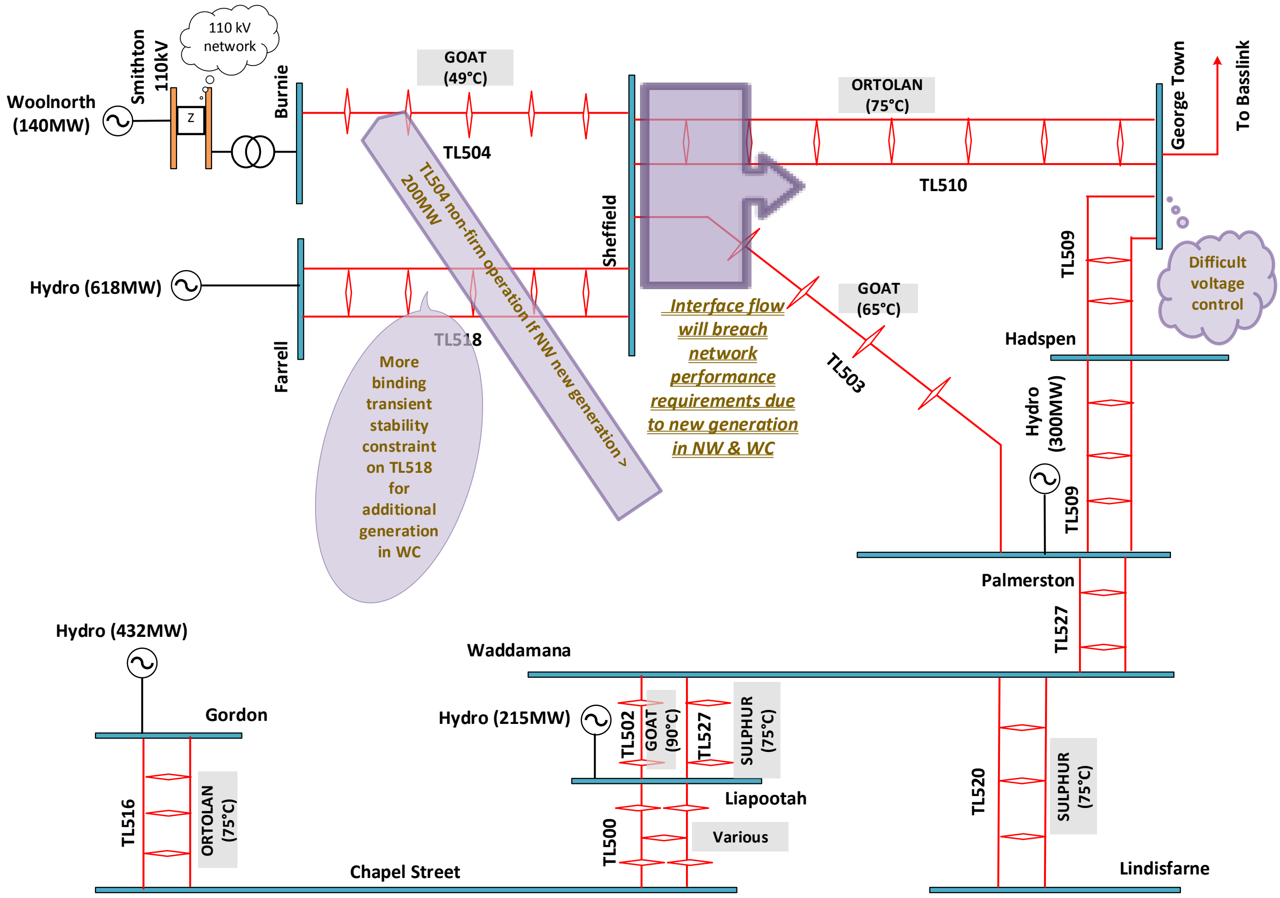
SH_{Exp} is the summation of MW flow from Sheffield Substation on the three circuits of Sheffield–George Town and Palmerston–Sheffield transmission lines;

BL_{Exp} is Basslink export (+) or import (-) MW flow; and

TotalTasLoad is the summation of MW load (excluding Basslink) in Tasmania.

To meet the clause 5(1)(a)(ii) and 5(1)(a)(iii) of The Regulations, generation in West Coast and North West Tasmania will need to be constrained when the above equation binds, causing spill. The issues identified in Section 5 are summarised in Figure 5:

Figure 5: Identified issues on Core Grid



6 Development plan

The following development plan projects are currently underway or proposed.

6.1 George Town Substation capacitor bank installation

To improve voltage control at George Town and hence reduce the amount of time that constraints will need to be applied to Basslink export, a 40 MVAr 110 kV capacitor bank will be installed at George Town Substation. This is now a committed project and is expected to be operational by December 2018.

6.2 Waddamana–Bridgewater Junction 110 kV T/L decommissioning

As mentioned in Section 3.2, Waddamana–Bridgewater Junction 110 kV transmission line TL400 will be decommissioned in 2018–19 following the establishment of an alternative supply to Bridgewater Substation. Parts of TL400 may be repurposed. This is now an advanced project.

6.3 Dynamic reactive power device for George Town Substation

A project to install ±50 MVAr STATCOM at George Town Substation has been proposed in TasNetworks' Revenue Reset 2019 (R19) works program, which is to:

- address non-compliance issues at George Town caused by unbalanced voltages; and
- provide net market benefit by releasing Basslink export or import constraints.

7 Core Grid enhancement approach

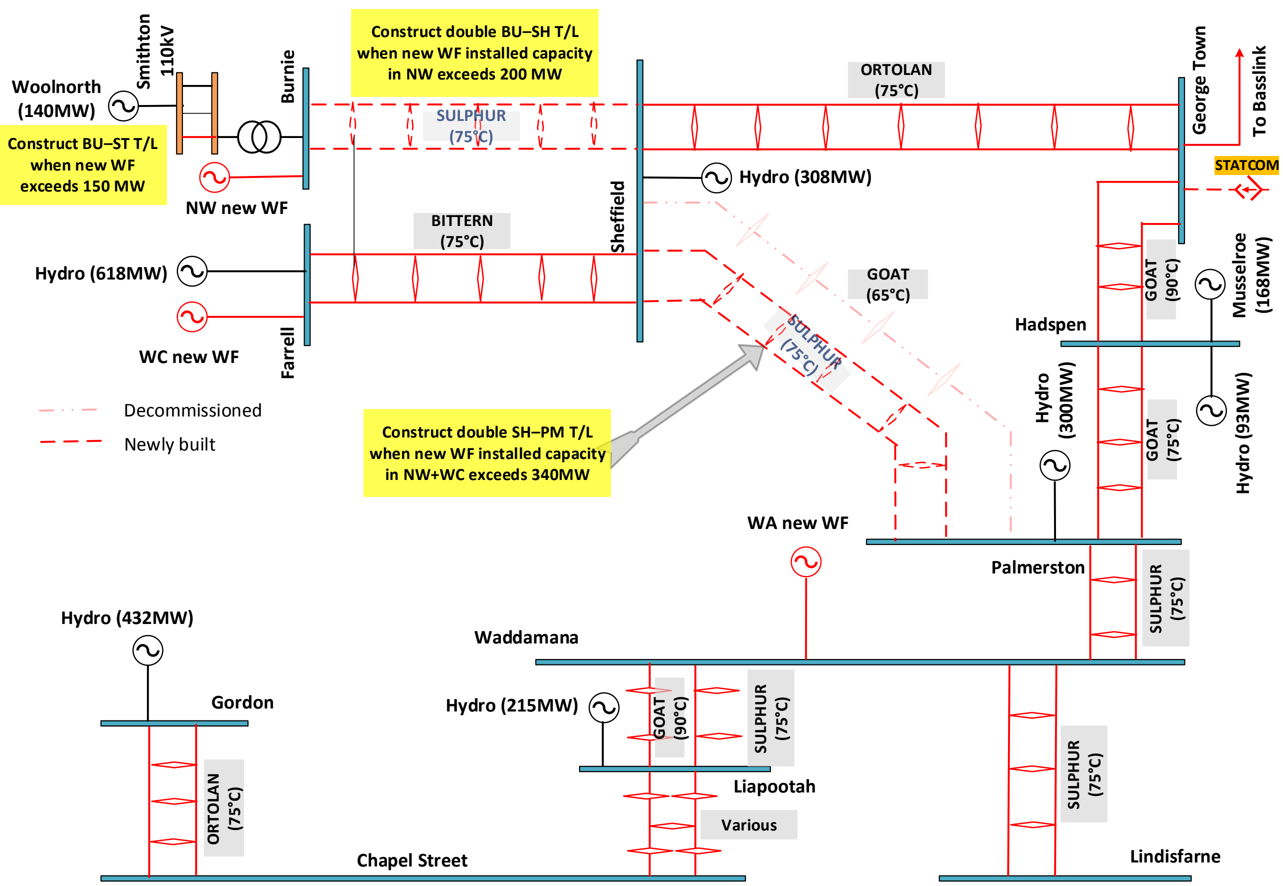
Core Grid enhancement approach presents two most likely core grid snapshots in Tasmanian transmission network for the future based on the most likely generation and load scenarios as well as assets replacement requirement. They are:

- possible Core Grid to 2032; and
- possible Core Grid beyond 2032.

7.1 Indicative 220 kV core grid for Tasmania to 2032

The indication of possible 220 kV core grid development for Tasmanian electricity transmission network in the next 15 years was based on the likely generation development scenarios across Tasmania. These developments can be advanced or delayed depending on the actual outcome of new generation or load variations. The forecast enhancement to 220 kV core grid for Tasmania to 2032 is presented in Figure 6:

Figure 6: Indicative 220 kV core grid for Tasmania to 2032



7.1.1 Second Bass Strait Interconnector

Figure 6 excludes a second (or third) HVDC interconnector that may eventuate within this period. There are a number of landing locations TasNetworks considers probable for additional interconnection, including Port Latta, Sheffield, and George Town. The feasibility study and assessment into a second Bass Strait interconnector led by TasNetworks, and cofounded with ARENA, will develop a position on a preferred landing location as part of the analysis. For the purposes of this strategy and TasNetworks' proposed R19 works program, a second interconnector is assumed to connect into Sheffield Substation via an on land transmission extension.

The estimated cost of a second interconnector is $550 million, representing a 50% contribution to the project from the Tasmanian Region.

A second Bass Strait Interconnector is proposed as a Contingent Project in the 2019-24 reset period. The triggers for this project are further described in TasNetworks revenue proposal.

7.1.2 New double circuit Palmerston–Sheffield 220 kV transmission line

Identified need

The existing Palmerston–Sheffield 220 kV transmission line TL503 is a single circuit line built in 1957 with GOAT conductor at a design temperature of 65°C (ref Figure 1). This line is likely to bind thermally for increased amount of time following the eventuation of hundreds MW of new generations in both North West and West Coast areas (ref 5.1.2).

Increased generation in North-west and West Coast areas will also see the total export of power via the double circuit Sheffield–George Town and single circuit Palmerston–Sheffield transmission lines increase to the level that would breach the clause 5(1)(a)(ii) and 5(1)(a)(iii) of The Regulations (ref 5.5.2).

Proposed solution

We propose to construct a new double circuit Palmerston–Sheffield 220 kV transmission line. The new transmission line will use SULPHUR conductor at a design temperature of 75°C and to be construct along the existing easement in parallel with the existing circuit. Market benefit analysis[9] suggests that this project is able to provide net market benefit once the installed capacity of new generation in both North West and West Coast areas exceeds 340 MW.

The estimated cost of the project is $120 million.

Once the new transmission line is built, the existing Palmerston–Sheffield 220 kV transmission line can be converted to 110 kV operation to enable the establishment of a new 110/22 kV connection point in the Deloraine/Westbury area (refer North west Area Strategy).

This project is proposed as a Contingent Project in the 2019-24 reset period. The triggers for this project are further described in TasNetworks revenue proposal.

7.1.3 New double circuit Sheffield–Burnie 220 kV transmission line

Identified need

The existing Sheffield–Burnie 220 kV transmission line TL504 is a single circuit line built in 1957 with GOAT conductor at a design temperature of 49°C (ref Figure 1). This line is likely to bind thermally once the new generation capacity in North-west area exceeds around 200 MW (ref 5.1.2).

Operate this circuit non-firm as an interim solution is possible[6]. This however can’t be considered as a long term solution, as the fault level at the proposed wind farms[10] in the North West could fall to less than 150 MVA following a contingency of the single circuit Sheffield–Burnie 220 kV transmission line.

Proposed solution

We propose to construct a new double circuit Sheffield–Burnie 220 kV transmission line. The new transmission line will use SULPHUR conductor at a design temperature of 75°C and to be construct within the existing 220 kV easement[11] to replace the existing single circuit transmission line.

The estimated cost of the project is $80 million.

[9] Trigger for construction of double circuit 220 kV transmission line from Sheffield to Palmerston
[10] Assume wind farms are connected at 220 kV from Burnie.
[11] May need to encroach partial of 110 kV easement as well

This project is proposed as a Contingent Project in the 2019-24 reset period. The triggers for this project are further described in TasNetworks revenue proposal.

7.1.4 New Burnie–Smithton 110 kV transmission line

Identified need

The existing Burnie–Port Latta–Smithton 110 kV transmission corridor consists of two 110 kV circuits, where one connects via loop in/out of Port Latta Substation. As part of a related project (refer North West Area Strategy) the Port Latta connection will be augmented to a double tee from the two Burnie-Smithton circuits. This corridor is currently operated non-firm via a runback scheme, binding at times of high wind generation output. This corridor is likely to bind thermally more often once new generation capacity in North West area exceeds around 150 MW (ref 5.1.2).

Proposed solution

We propose to construct a new Burnie–Smithton 110 kV transmission line to increase the non-firm operating capacity of this corridor. We propose to construct the new transmission line as a 220 kV double circuit tower line, strung one side with SULPHUR conductor at a design temperature of 75°C, operating at 110 kV initially, and to be constructed within the existing 110 kV easement. The construction proposal considers the to extend the 220 kV network into the far North West as required to support both the significant wind resource and development interest in new wind developments, as well as the potential for a second and/or third HVDC interconnector landing in the North West area.

The estimated cost of the project is $70 million.

This project is proposed as a Contingent Project in the 2019-24 reset period. The triggers for this project are further described in TasNetworks revenue proposal.

7.1.5 Uprate existing Sheffield–Burnie 220 kV transmission line TL504

Identified need

As detailed in section 7.1.3, the existing Sheffield–Burnie 220 kV transmission line TL504 is a single circuit line built in 1957 with GOAT conductor at a design temperature of 49°C (ref Figure 1). This line is likely to bind thermally once the new generation capacity in North-west area exceeds around 200 MW (ref 5.1.2). Should additional generation develop in the North West either slower or to a lesser extent, the line is likely to bind thermally during summer when the line rating is as low as 139 MW.

Proposed solution

We propose to uprate the existing TL504 circuit from 49°C to 65°C, providing an increased rating to 298/238 MW (winter/summer). This may be achieved by increasing the under clearances (ground level and/or conductor tension) of certain sections.

The estimated cost of the project is $0.75 million, and would be triggered by generation development.

7.1.6 Commission Burnie 220/110 kV Network Transformer into service

Identified need

As additional generation develops in the North West area the need to maintain system strength and encourage power flows in to the 220 kV network will increase. The 110 kV network are Burnie is coupled to the 220 kV core grid by a single 220/110 kV network transformer and a 110 kV circuit to Sheffield via Emu Bay and Ulverstone substations. A cold spare 220/110 kV network transformer is currently located at Burnie Substation.

Proposed solution

We propose to connect the cold spare network transformer at Burnie, providing a low impedance path for power flows to Sheffield, encouraging generation flow into the 220 kV network.

The estimated cost of the project is $2.4 million, and would be triggered by generation development.

7.2 Proposed future transmission network for Upper Derwent area

Due to the age and assets' condition of the Upper Derwent 110 kV core grid (ref 3.2), The Strategy[4] suggests ***Option 5 – retain two circuits north and south from Tungatinah Substation*** as the preferred development path forward. This included:

Stage 1: Decommissioning Waddamana to Lindisfarne TL400, reconfiguring supply to Bridgewater from Lindisfarne (advanced project);

Stage 2: Renewing Tungatinah to Waddamana TL425 and TL426 lines with higher capacity circuits; and Establishing a 110/220 kV network transformer at Waddamana;

Stage 3: Renewing double circuit Tungatinah to New Norfolk TL418 line; and Decommissioning the Tungatinah to New Norfolk TL417 line.

Recently in conjunction with the Battery of the Nation initiative Hydro Tasmania are investigating the rebuild of the Tarraleah Power. The then new Tarraleah Power Station (Tarraleah 2.0) may connect directly to 220 kV transmission network, reducing generation on the upper Derwent 110 kV circuits. This change, although not certain, is sufficient to change the development path forward for the Upper Derwent 110 kV core grid.

Figure 7 presents the proposed transmission network for Upper Derwent area taking into account the likely impact of Tarraleah 2.0. Due to the proposed decommission of TL426 and partial decommission of TL425, this part of transmission network will halt as part of the Core Grid following the proposed alterations.

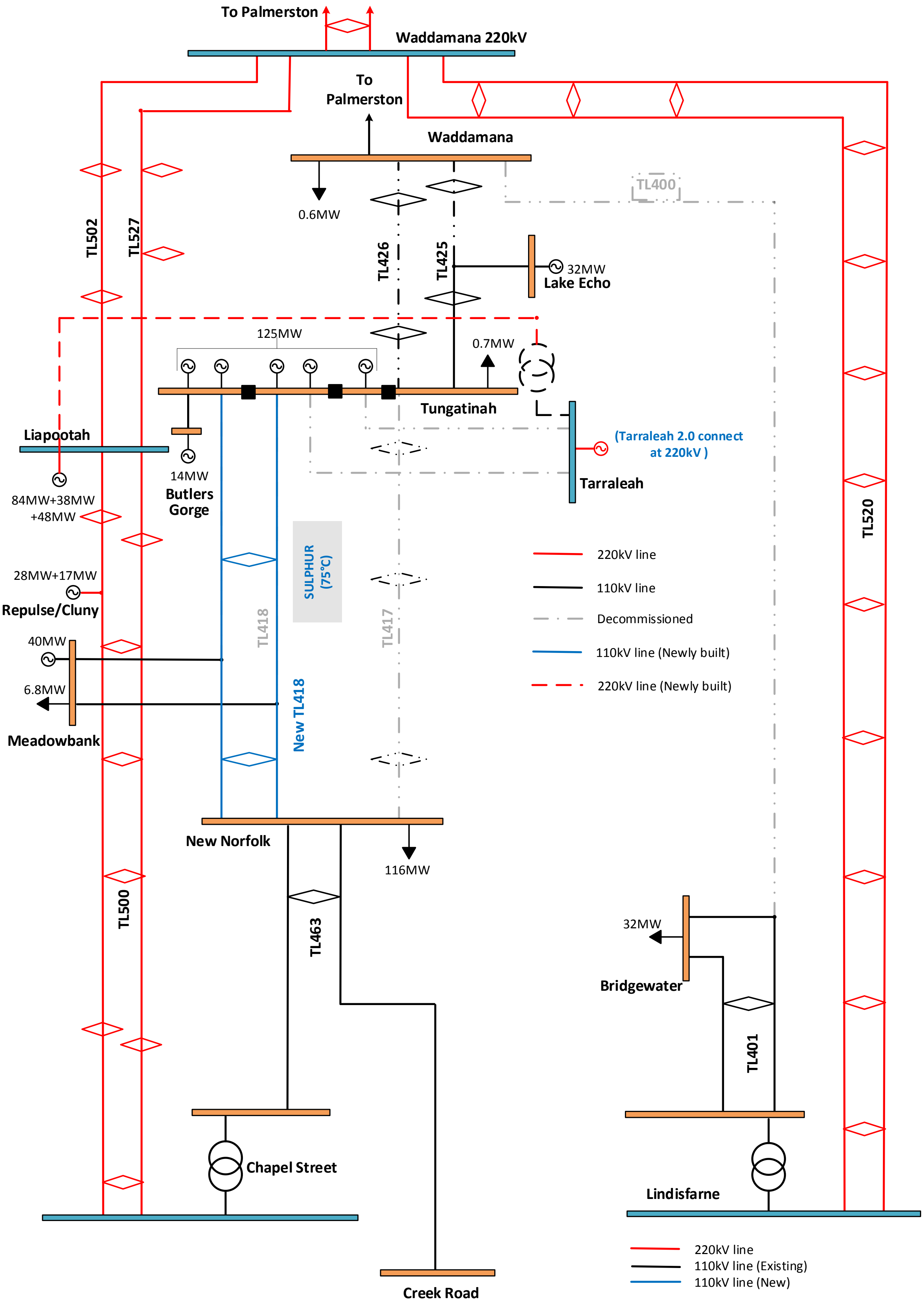
The new double circuit 110 kV transmission line TL418 will be constructed within the easement of the existing double circuit transmission line TL418. The new transmission line will use SULPHUR conductor at a design temperature of 75°C and provides a static ratings of 250 MVA/210 MVA (Winter/Summer) for each circuit. This is firm and sufficient for all the generations at Tungatinah, Lake Echo and Butlers Gorge power stations.

TasNetworks apply real time dynamic ratings for its transmission network, the new double circuit transmission line TL418 (SULPHUR at 75°C) is expected to provide > 266 MVA of firm rating for 99% of time according to the weather in this area for the past three years.

The estimated cost of Stage 2 is $118 million, and would be triggered by a need to address the asset condition of a large proportion of the existing Upper Derwent 110 kV assets. Stage 3 is not expected to occur within the revenue period.

This project (Stage 2) is proposed as a Contingent Project in the 2019-24 reset period. The triggers for this project are further described in TasNetworks revenue proposal.

Figure 7: Proposed transmission network for Upper Derwent area



7.3 Indicative 220 kV core grid for Tasmania beyond 2032

The possible 220 kV core grid development for Tasmanian electricity transmission network post 2032 is very much dependent on how much new wind generations will eventuate and whether a second or third Bass Strait interconnector will go ahead (a second Bass Strait interconnector is proposed as a Contingent Project in TasNetworks' R19 works program). Figure 8 provides an indication of possible Core Grid development post 2032, which includes a second Bass Strait interconnector and its associated 220 kV transmission network to Burnie Substation. Another possible development would be a new double circuit 220 kV transmission line between Palmerston and Waddamana substations. Other transmission development at 220 kV level will most likely be dedicated connection asset to new generation sites.

Figure 8: Indicative 220 kV core grid for Tasmania post 2032