countryenergy

TransGrid

FINAL REPORT

PROPOSED NEW LARGE TRANSMISSION NETWORK ASSET

DEVELOPMENT OF ELECTRICITY SUPPLY TO THE LOWER MID NORTH COAST

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Executive Summary

This final report has been has been prepared to provide a basis for TransGrid and Country Energy to consult with NEM registered participants, NEMMCO and interested parties to identify options for the development of electricity supply to the Lower Mid North Coast that will be included in an application of the Australian Energy Regulator's regulatory test.

Section 1 provides a description of the context of this final report within the regulatory process and summarises the outcomes of that process.

Section 2 describes in detail the regulatory requirements relating to proposals for new large transmission network assets, the existing supply arrangements, nature of the growing load in the Lower Mid North Coast and the network limitations that give rise to a need to augment supply to the area. The agreed network performance requirements (planning criterion) against which the need and effectiveness of augmentation options are assessed are also described.

In Section 3 two feasible network augmentation options are described. Each option relieves present and emerging network limitations in the Lower Mid North Coast over a planning horizon to 2035. Each option involves the construction of a double circuit 330 kV transmission line from the proposed new Tomago 330 kV substation to the Tarro area (near EnergyAustralia's Beresfield Substation), the construction of a double circuit 132 kV line between Tarro and Stroud, the formation of 132 kV circuits between Tomago and Stroud, construction of a new line between Stroud and the Taree area and eventual provision of 330 kV supply to the Taree area from Tomago.

In Section 4 the results of an application of the regulatory test to these options are presented.

The main conclusion is that either option could satisfy the regulatory test however Option 1 is preferred on the basis of a shorter length of new line construction.

Given the uncertainty of the timing of the requirement for 330 kV supply to Taree and the available lead time for that stage it is not proposed to proceed with construction of those works at this time.

Consequently the proposed actions are for TransGrid and Country Energy to construct the first two stages (to 2014) of Option 1 as described in Section 3.1 and depicted in the 2014 diagram for that option. These works are estimated to cost around $180 million.

1. Introduction

1.1. Purpose and Scope

TransGrid owns the majority of the transmission network within NSW and is responsible, inter alia, for planning and developing its network to meet the requirements of customers within the State and to facilitate operation of the National Electricity Market (NEM). As part of its planning responsibilities and the requirements of the National Electricity Rules (the Rules) TransGrid consults with NEM registered participants, NEMMCO and interested parties on emerging limitations within its transmission network and options being considered to relieve them.

TransGrid and Country Energy have responsibilities under the Rules to carry out joint planning to facilitate the optimal development of their networks.

This final report has been prepared in accordance with Clause 5.6.6 (h) of the Rules. It relates to a proposal for a new large transmission network asset that will address limitations in the capacity of the transmission networks supplying the Lower Mid North Coast.

It includes:

- A summary of the load forecast for the area;
- A description of the network reliability criterion that has been adopted for planning purposes;
- A description of the network limitations identified by TransGrid and Country Energy that have led to a necessity for augmentation of the transmission networks supplying the Lower Mid North Coast;
- A description of all reasonable network and non-network options that have been identified to meet these limitations;
- An analysis of the ranking of these options in accordance with the Australian Energy Regulator's (AER's) regulatory test;
- An assessment of the outcome of the regulatory test and proposed actions; and
- Information that may be relevant to persons who may wish to dispute any aspect of this final report.

1.2. Outline of Consultation Process

TransGrid published a description of the need for the reinforcement of the transmission network in the Newcastle and Lower Mid North Coast areas in its Annual Planning Reports (APRs) for 2006 - 2009. The 2009 APR includes a summary new large transmission network asset proposal for that area. The APR 2009 also describes emerging network limitations in the Hawks Nest/Tea Gardens area and the Forster/Tuncurry area.

Joint planning by TransGrid and EnergyAustralia has led to a proposal to jointly reinforce the transmission network supplying the Newcastle area. These works are yet to be constructed but are referred to in this final report.

In December 2008 TransGrid and Country Energy published an application notice covering a proposal for a new large transmission network asset that would address the network limitations described in Section 2.5. A summary of the application notice was published on NEMMCO's website on 19th December 2008. Interested parties were invited to make submissions in the period to 6th February 2009. No submissions were received.

TransGrid and Country Energy have applied the regulatory test to all known reasonable options to meet the network limitations described in this final report and have determined the option that satisfies the test.

Accordingly TransGrid and Country Energy have completed their obligations under clause 5.6.6(b) of the Rules and will proceed in accordance with the proposed actions detailed in Section 5 of this final report.

Persons wishing to dispute any aspect of this final report are referred to Section 6.

A summary of this final report has been posted on NEMMCO's website.

2. Identification of a Necessity for Augmentation

2.1. Regulatory Requirements

2.1.1. Requirements of the National Electricity Rules

This final report covers a proposal for a new large transmission network asset.

The requirements of the National Electricity Rules for new large transmission network asset proposals are set out in Clause 5.6.6. This requires applicants (in this case TransGrid) inter-alia to:

- Set out the reasons for proposing the new large transmission network asset, including the actual or potential constraint or inability to meet network performance requirements;
- Describe all reasonable network and non-network options to address the constraint;
- Rank the options in accordance with the principles of the AER's regulatory test including detailed analysis of why the applicant considers the new large transmission network asset satisfies the regulatory test;
- Where relevant, provide analysis of why the applicant considers that the new large transmission network asset is a reliability augmentation; and
- Provide an augmentation technical report or consents to proceed from affected TNSPs if the new large transmission network asset is likely to have a material inter-network impact.

These requirements are underpinned by Clauses 5.6.2 (a), (b) and (c) of the Rules, which require network service providers to:

- Analyse their networks and conduct annual joint planning reviews to identify necessities for augmentation or extension of those networks; and
- Undertake joint planning in order to determine plans that can be considered by registered participants, NEMMCO and interested parties.

2.1.2. Requirements of the Regulatory Test

The regulatory test may be applied in either one of two ways. The regulatory test states that an option satisfies the test if:

(a) in the event the option is necessitated principally by the inability to meet the service standards linked to the technical requirements of schedule 5.1 of the NER or in applicable regulatory instruments - the option minimises the costs of meeting those requirements, compared with alternative option/s in a majority of reasonable scenarios;

(b) in all other cases - the option maximises the expected net economic benefit to all those who produce, consume and transport electricity in the national electricity market compared to the likely alternative option/s in a majority of reasonable scenarios. Net economic benefit equals the market benefit less costs.

The Rules define a reliability augmentation as:

> A transmission network augmentation that is necessitated principally by the inability to meet the minimum network performance requirements set out in schedule 5.1 or in relevant legislation, regulations or any statutory instrument of a participating jurisdiction.

Thus for reliability augmentations clause (a) of the test should be used. That is for reliability augmentations the option that satisfies the regulatory test is the one that minimises the cost of meeting the minimum network performance requirements set out in schedule 5.1 of the Rules or via a jurisdictional or customer requirement.

2.2. Jurisdictional Requirements

2.2.1. Requirements of the Energy Services Corporations Act

TransGrid's enabling legislation is the Energy Services Corporation Act 1995. Section 6B of the Act sets out the five principal objectives which in summary are:

1. To be a successful business. This includes:
    a. To operate at least as efficiently as any comparable business;

   b. To maximise the net worth of the State's investment in it;
   c. To exhibit a sense of social responsibility by having regard to the interest of the community in which it operates;
2. To protect the environment by conducting its operations in compliance with the principles of ecologically sustainable development;
3. To exhibit a sense of responsibility to regional development;
4. To operate efficient, safe and reliable facilities; and
5. To promote effective access.

It is important to note that the Act explicitly identifies that each of these objectives is of equal value, and thus a balanced approach must be taken in decision making to reflect this obligation. In particular it is worth noting that efficiency is not superior to the environment or the community.

When developing options to overcome actual or potential network constraints, TransGrid initially assesses possible options against the above requirements and then applies the regulatory test to those which satisfy them.

Possible options which were considered but not pursued are described in Section 3.5.

2.2.2. Network Service Criteria

As stated in its Annual Planning Report, TransGrid is expected by the NSW jurisdiction to plan and develop its transmission network on an "N-1" basis. That is, unless specifically agreed otherwise by TransGrid and the affected distribution network owner or major directly connected end-use customer, there will be no inadvertent loss of load (other than load which is interruptible or dispatchable) following an outage of a single circuit (a line or a cable) or transformer, during periods of forecast high load.

These requirements are underpinned by the introduction in 2005 of mandatory licence conditions for Distribution Network Service Providers (DNSPs) which inter-alia set out reliability standards for subtransmission and distribution networks. The licence conditions for Country Energy specify N-1, one minute reliability levels for subtransmission lines and zone substations supplying loads greater than or equal to 5 MVA in urban and non-urban areas. Consequently Country Energy has requested TransGrid to incorporate N-1 reliability levels into its planning standards and processes.

Accordingly TransGrid and Country Energy have jointly agreed that the network performance requirements for reliability to be applied to transmission networks in the Lower Mid North Coast are as follows:

1. With all network elements in service, the loading on each element is not to exceed the continuous rating of that element.
2. Following outage of one network element, the loading on each remaining element is not to exceed the short time emergency rating of that element whilst operator actions, such as opening of other network elements and transferring of loads via lower voltage networks, are taking place.
3. With one network element out of service and following operator actions:
   - The loading on each remaining element is not to exceed the contingency rating of that element;
   - The voltage levels at end-user premises are to be within acceptable levels following switching of reactive plant and operation of transformer tap-changers.

In terms of network reliability standards as described in the Rules, this constitutes a nominal "N-1" reliability criterion (as described in S5.1.2.2 (b) (4)).

2.3. Supply Arrangements in the Lower Mid North Coast

The Lower Mid North Coast as described in this document includes the local government areas of, Dungog, Gloucester, Great Lakes and Greater Taree. They have a total population of around 95,000. The electrical load is characterised primarily by residential loads with some commercial and light industrial loads in the major population centres and rural and agricultural loads in surrounding areas.

A number of developments in the Newcastle area and on the Lower Mid North Coast (of relevance to but not covered by this final report) are planned. These are:

1. A 330/132 kV substation at Tomago and connections to EnergyAustralia's 132 kV network are planned to relieve limitations within EnergyAustralia's 132 kV network in the Newcastle area.

2. A 132/33 kV substation at Hawks Nest is proposed to relieve limitations within the Country Energy 33 kV network supplying the Tea Gardens/Hawks Nest area. That substation would be supplied from the existing 963 Tomago – Taree 132 kV transmission line.
3. A 132/66 kV substation near Nabiac is proposed to relieve limitations within Country Energy's 66 kV network supplying the Forster/Tuncurry area from Taree. That substation would also be supplied from the 963 Tomago – Taree 132 kV transmission line.
4. A 132/66 kV substation in the Herons Creek area (just north of Kew) is proposed to relieve limitations in Country Energy's 66 kV network north of Taree and 33 kV network south of Port Macquarie. That substation would be supplied from the existing 964 Taree – Port Macquarie 132 kV transmission line.

The transmission network serving Newcastle and the NSW North Coast is shown in Figure 1 with the Lower Mid North Coast area of interest indicated by the dotted ellipse. TransGrid and EnergyAustralia's transmission network supplying the Lower Mid North Coast is shown in schematic form in Figure 2.

The 132 kV transmission system supplying the Mid North Coast operates in parallel with the 330 kV system. Consequently flows within this 132 kV network depend on power flows on the main system, particularly flows to and from Queensland on the NSW – Queensland Interconnector (QNI).

To manage voltage conditions on the Mid North Coast, TransGrid has installed capacitor banks at a number of its substations in the area.

Figure 1 Transmission Network Serving Newcastle and the NSW North Coast

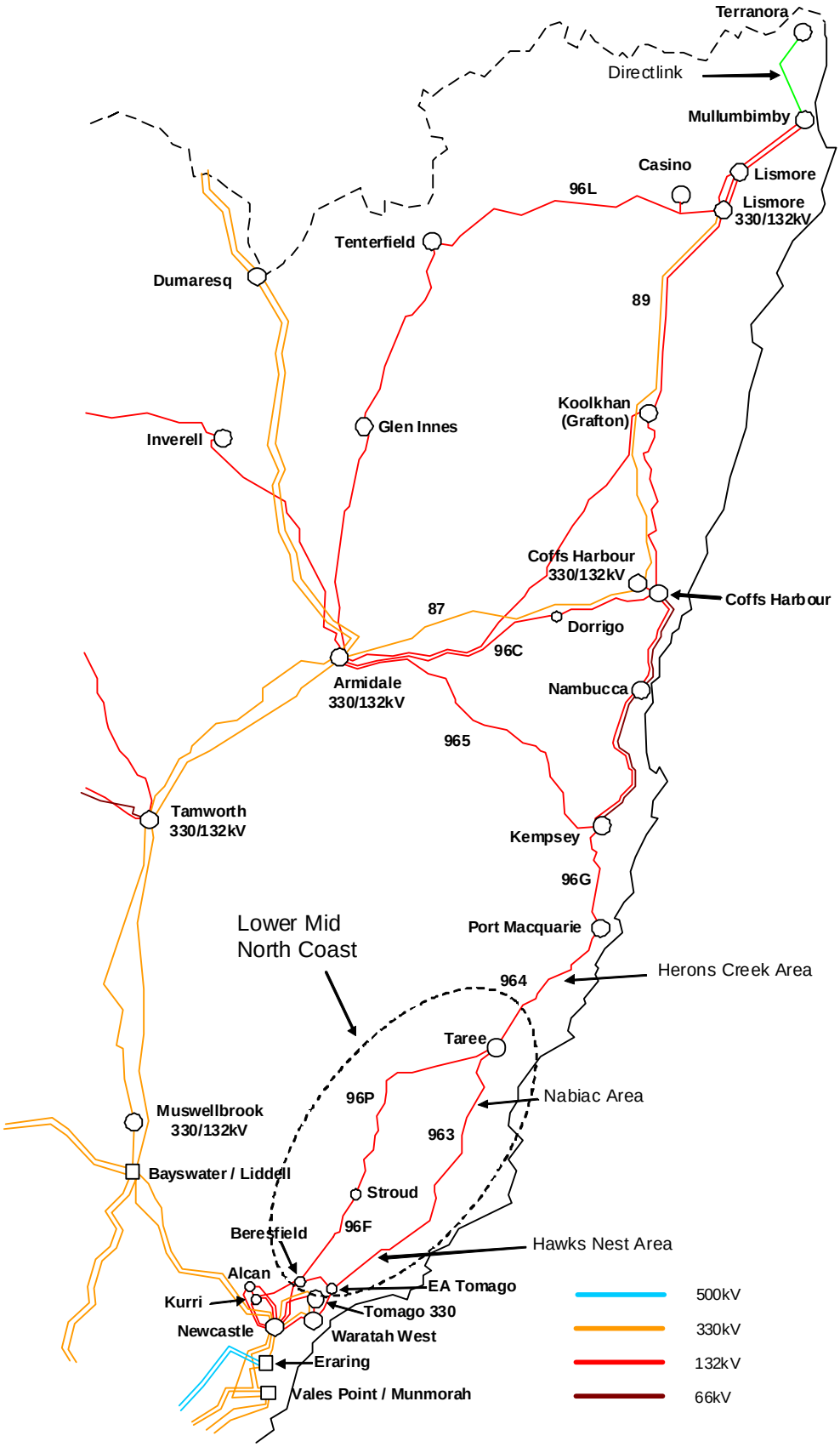
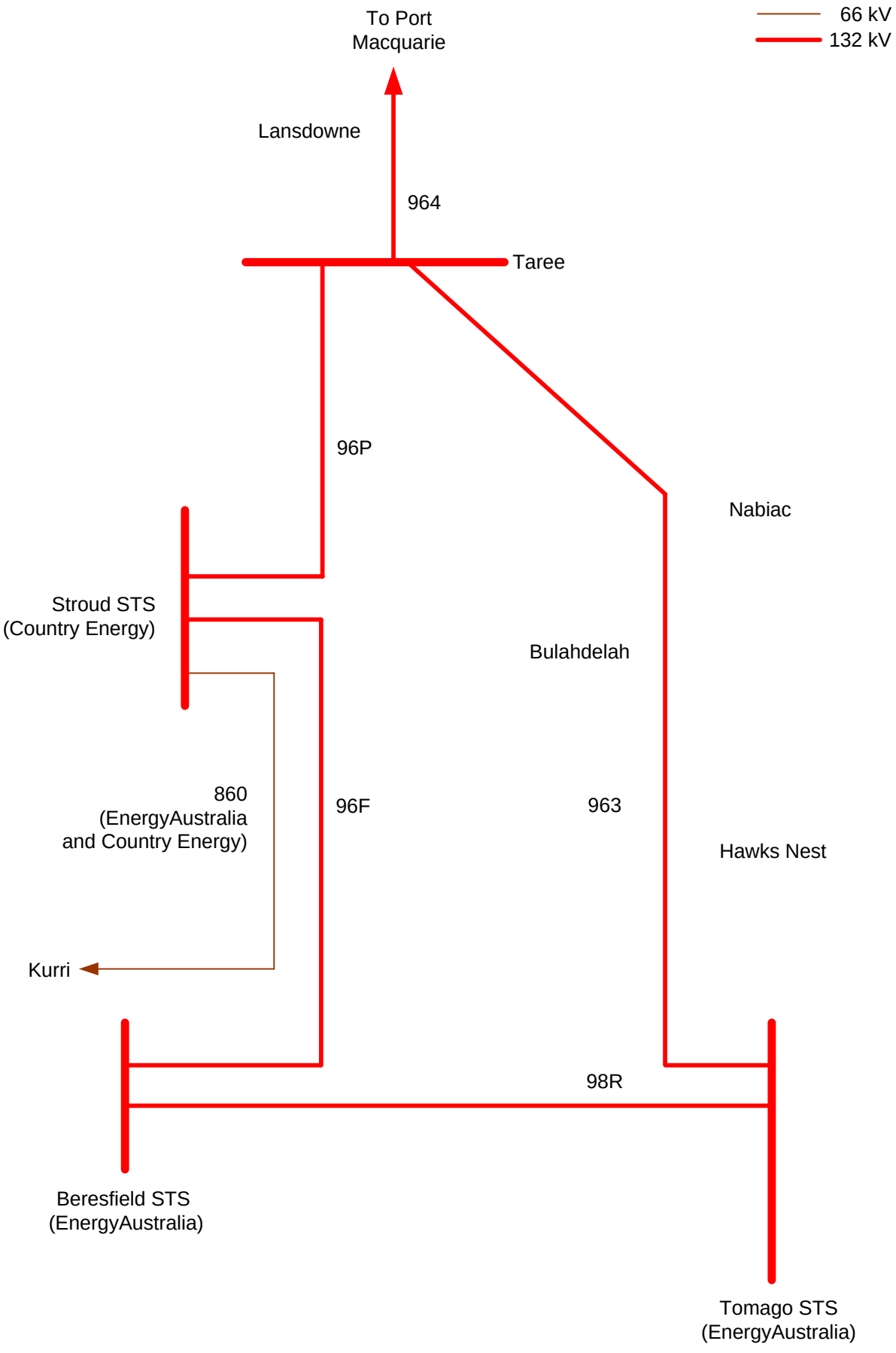


Figure 2 Transmission Network in the Lower Mid North Coast Area



Country Energy plans to use part of the 860 Kurri – Stroud 66 kV line between Dungog and the Clarencetown area as part of a 33 kV line providing a backup supply to their Martins Creek and Gresford zone substations.

2.4. Local Load Forecast

The load in the Lower Mid North Coast is growing strongly. Table 1 and Table 2 show the forecast summer and winter maximum demands (in MW)[1].

Table 1 Forecast Summer Maximum Demands for the Lower Mid North Coast (MW)

Substation	2008/ 09	2009/ 10	2010/ 11	2011/ 12	2012/ 13	2013/ 14	2014/ 15	2015/ 16	2016/ 17	2017/ 18
Hawks Nest		10.0	10.0	11.0	11.0	12.0	12.0	13.0	13.0	13.0
Nabiac			40.0	41.0	43.0	44.0	46.0	48.0	49.0	50.0
Stroud	34.0	36.0	37.0	39.0	40.0	42.0	43.0	45.0	47.0	49.0
Taree 33 kV	30.0	32.0	32.0	33.0	34.0	35.0	36.0	37.0	38.0	39.0
Taree 66 kV	73.0	76.0	43.0	29.0	31.0	32.0	33.0	34.0	36.0	38.0
Total	**137**	**154**	**162**	**153**	**159**	**165**	**170**	**177**	**183**	**189**
Diversified Total	**131**	**147**	**155**	**146**	**152**	**158**	**162**	**169**	**175**	**180**

Table 2 Forecast Winter Maximum Demands for the Lower Mid North Coast (MW)

Substation	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Hawks Nest		0.0	10.0	10.0	11.0	11.0	12.0	12.0	13.0	13.0
Nabiac			0.0	42.0	43.0	44.0	46.0	47.0	48.0	50.0
Stroud	32.0	33.0	34.0	35.0	36.0	37.0	39.0	40.0	41.0	42.0
Taree 33 kV	27.0	28.0	28.0	29.0	29.0	30.0	31.0	31.0	32.0	33.0
Taree 66 kV	80.0	83.0	85.0	48.0	36.0	37.0	38.0	40.0	41.0	42.0
Total	**139**	**144**	**157**	**164**	**155**	**159**	**166**	**170**	**175**	**180**
Diversified Total	**135**	**140**	**152**	**159**	**150**	**154**	**161**	**165**	**170**	**175**

The above forecasts include new substations at Hawks Nest and Nabiac as described in Section 2.3. A new substation in the Herons Creek area is also proposed. These new substations will reduce the loading of existing substations, as shown in Table 3.

Table 3 Substations Off-loaded by New Substations

New Substation	Existing Substations Off-loaded
Hawks Nest	EnergyAustralia Tomago STS
Herons Creek	Taree 66 kV and Port Macquarie
Nabiac	Taree 66 kV

2.5. Network Limitations

The transmission network supplying the Lower Mid North Coast is affected by four network limitations which are described in the following sections. In each case the extent and severity of the limitations depend on flows on QNI.

2.5.1. Outage of the Tomago – Taree 132 kV Line 963

On outage of the Tomago – Taree 132 kV line 963 the loading on the 96F Beresfield – Stroud 132 kV line can exceed its rating and/or low voltages can occur on the Mid North Coast. These limitations presently exist.

Table 4 and Table 5 show the risk exposure for an outage of line 963 in summer and winter.

[1] Since the Application Notice was published, TransGrid has published its 2009 APR which includes updated load forecasts. However, for consistency with the Application Notice the forecast published in the 2008 APR has been included in this Final Report. The dates for completion of the proposed works would not change under the 2009 forecast.

Table 4 Approximate Summer Exposure for an Outage of Line 963

Summer	Approx. Max. MW at Risk[2]
2008/09	35
2009/10	45
2010/11	85
2011/12	100
2012/13	110
2013/14	125
2014/15	145

Table 5 Approximate Winter Exposure for an Outage of Line 963

Winter	Approx. Max. MW at Risk[2]
2009	35
2010	65
2011	75
2012	80
2013	90
2014	110

2.5.2. Outage of the Beresfield – Stroud 132 kV Line 96F

On outage of the Beresfield - Stroud 132 kV line 96F the loading on the Tomago - Taree 132 kV line 963 can exceed its rating and/or low voltages can occur on the Mid North Coast particularly at Stroud. These limitations presently exist.

Table 6 and Table 7 show the risk exposure for an outage of line 96F in summer and winter.

Table 6 Summer Exposure for an Outage of Line 96F

Summer	Approx. Max. MW at Risk[3]
2008/09	20
2009/10	45
2010/11	60
2011/12	70
2012/13	85
2013/14	100
2014/15	115

[2] The Load at Risk is modelled as a load reduction (MW only) at Taree. Should the load reductions also include reactive power (MVAr) and/or be at another location the quantities would differ.

[3] The Load at Risk is modelled as load reductions initially at Stroud and then at Taree once the required reduction exceeds the magnitude of the Stroud load. Should the load reductions be at another location the quantities would differ.

Table 7 Winter Exposure for an Outage of Line 96F

Winter	Approx. Max. MW at Risk[3]
2009	10
2010	30
2011	40
2012	45
2013	55
2014	70

2.5.3. Outage of the Stroud – Taree 132 kV Line 96P

On outage of the Stroud – Taree 132 kV line 96P the loading on the Tomago - Taree 132 kV line 963 can exceed its rating and/or low voltages can occur on the Mid North Coast. These limitations are expected to emerge from about summer 2009/10.

Table 8 and Table 9 show the risk exposure for an outage of line 96P in summer and winter.

Table 8 Summer Exposure for an Outage of Line 96P

Summer	Approx. Max. MW at Risk[4]
2008/09	-
2009/10	8
2010/11	20
2011/12	25
2012/13	40
2013/14	55
2014/15	65

Table 9 Winter Exposure for an Outage of Line 96P

Winter	Approx. Max. MW at Risk[4]
2009	-
2010	-
2011	5
2012	5
2013	15
2014	30

2.5.4. Outage of the Armidale – Coffs Harbour 330 kV Line 87

At present the 132 kV network between Armidale/Coffs Harbour and Newcastle is operated normally closed. Consequently flows on this network are affected by flows on the main 330 kV system, particularly flows to and from Queensland via QNI.

The establishment of additional transmission capacity between Tomago and the Taree area, which would relieve the limitations described in Sections 2.5.1 to 2.5.3, and completion of the proposed Dumaresq – Lismore 330 kV line and associated works, would allow this network to be operated normally open when required. This would eliminate “through-flows” related to flows on the main 330 kV network.

The location of the open point would depend on system conditions. If a transmission line in the network south of Taree was out of service the open point would be between Taree and Herons Creek to reduce the

[4] The Load at Risk is modelled as a load reduction (MW only) at Taree. Should the load reductions also include reactive power (MVAr) and/or be at another location the quantities would differ.

load supplied from the south. If a line in the network north of Port Macquarie was out of service the open point would be between Herons Creek and Port Macquarie to reduce the load supplied from the north.

This arrangement is expected to be adequate until around 2025. At this time, an outage of the 87 Armidale – Coffs Harbour 330 kV line at times of high summer demand is expected to result in the rating of the 96C Armidale – Coffs Harbour 132 kV line being exceeded. Due to the growing loads, to manage this limitation at that stage, it would be necessary to open the 132 kV network north of Port Macquarie however this would result in the capacity of the network from Tomago to Port Macquarie being exceeded.

Consequently by around 2025 it is expected that a 330 kV supply will be required on the Mid North Coast.

2.6. Joint Planning

Country Energy and TransGrid have jointly planned the network supplying the Lower Mid North Coast for many years.

TransGrid and Country Energy have jointly carried out annual planning reviews as required by Clause 5.6.2 (b) of the Rules. As required by Clause 5.6.2(c) they have identified that the network limitations outlined in Section 2.5 give rise to a need for network augmentations and have carried out joint planning to determine options for these augmentations.

2.7. Reliability Augmentation

It follows from Sections 2.1 – 2.5 that the proposals covered by this final report constitute a reliability augmentation and that the regulatory test should be applied in accordance with Clause 1(a) of the test.

2.8. Material Inter-network Impact

The Rules require TransGrid to assess whether a proposed new large transmission network asset is reasonably likely to have a material inter-network impact.

TransGrid has determined that none of the options described in Section 3 will impose power transfer constraints or adversely impact on the quality of supply to adjoining transmission networks.

2.9. Consideration of Demand Management and Local Generation

As discussed in Section 1.2 the network limitations described in Section 2.5 have previously been described in TransGrid's Annual Planning Reports for 2006 - 2009.

In April 2006 TransGrid and Country Energy published a document titled "Emerging Transmission Network Limitations on the New South Wales Mid North Coast". That document sought proposals from proponents of developments which may relieve the limitations in the transmission network supplying the area. Four responses relating to potential developments were received however none have yet come to fruition.

In addition, no submissions were received in response to the Application Notice.

3. Options

TransGrid and Country Energy have developed two network options to meet the network limitations described in Section 2.5. These options are described in the following sections together with other developments that have been considered but not put forward as partial or complete options.

A basic requirement of all options is that the network limitations described in section 2.5 can only be fully addressed over a short to medium term planning horizon by the construction of an additional 132 kV link from the Newcastle area to Taree and over a medium to long term planning horizon by the establishment of a 330 kV supply to the Mid North Coast (refer to Section 2.5.4).

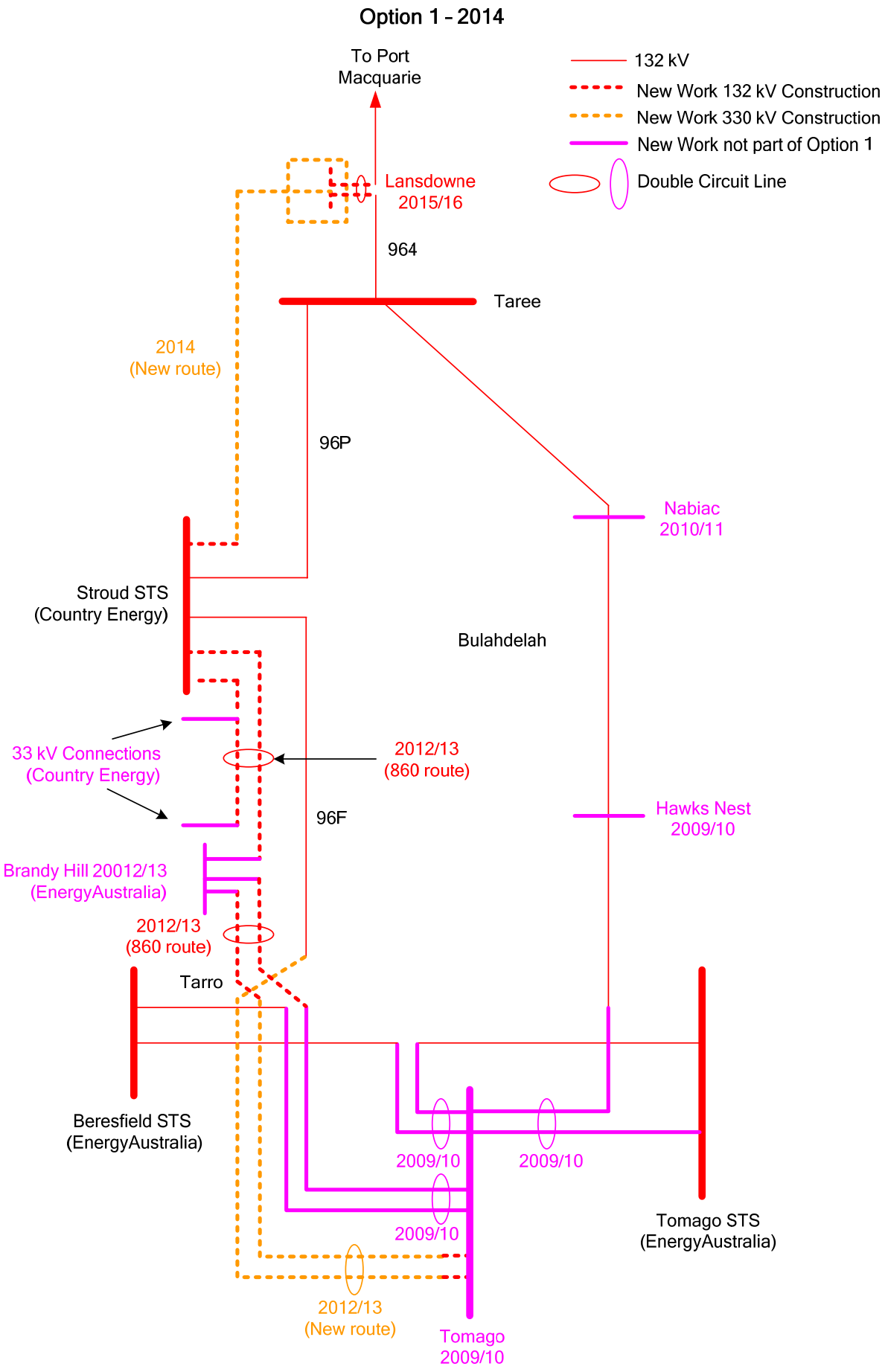
Over the shorter term there is a need to provide a reliable 132 kV supply from the Newcastle area to EnergyAustralia's proposed Brandy Hill 132 kV substation and a need for a Country Energy 33 kV supply out of Stroud which would utilise a part of one circuit of a Tomago – Stroud 132 kV double circuit line for some years.

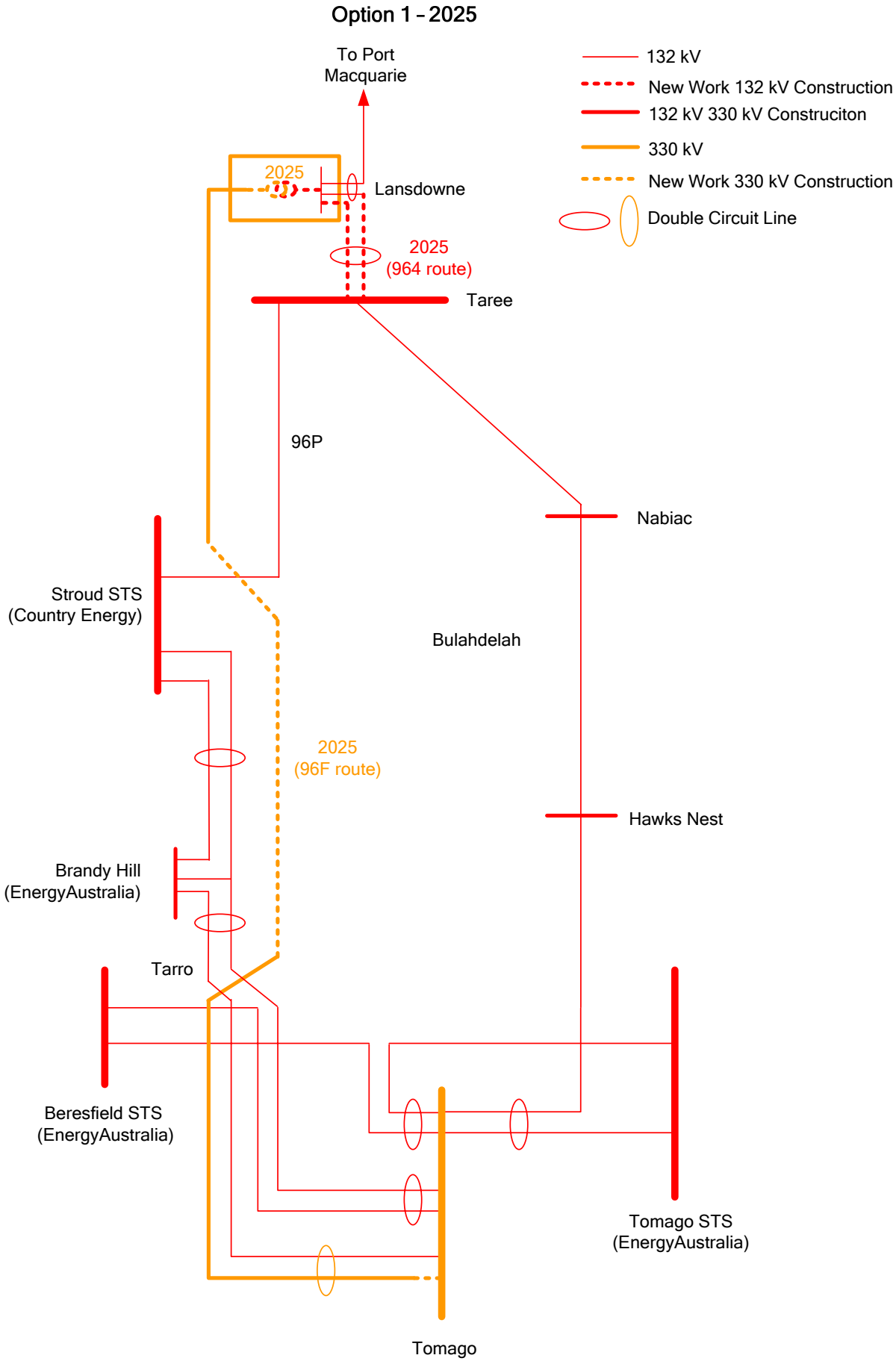
The need to maximise the use of line routes at reasonable cost dictates the use of double circuit construction for new 132 kV lines. Both options therefore include the construction of a short section of double circuit 330 kV transmission line from the planned new Tomago 330 kV substation to the Tarro area (near EnergyAustralia's Beresfield STS), the construction of a double circuit 132 kV line between Tarro and Stroud and the construction of a line between Stroud and the Taree area. They also include the later completion of a 330 kV connection between Tomago and Lansdowne (near Taree). However as the timing of this later stage is somewhat uncertain and outside the lead time for its construction it is not proposed to commit to its construction at this stage.

The difference between the options relates to the line between Stroud and the Taree area. In Option 1 this would be constructed as a single circuit 330 kV line initially operating at 132 kV. In Option 2 it would be constructed as a double circuit 132 kV line.

Both options include works providing sufficient capacity to address all existing and emerging network limitations in the transmission network supplying the Lower Mid North Coast area over a planning horizon to at least 2025.

3.1. Option 1


Option 1 - 2014
To Port Macquarie
132 kV
New Work 132 kV Construction
New Work 330 kV Construction
New Work not part of Option 1
Double Circuit Line
Lansdowne 2015/16
964
Taree
2014 (New route)
96P
Nabiac 2010/11
Stroud STS (Country Energy)
Bulahdelah
33 kV Connections (Country Energy)
2012/13 (860 route)
96F
Hawks Nest 2009/10
Brandy Hill 20012/13 (EnergyAustralia)
2012/13 (860 route)
Tarro
Beresfield STS (EnergyAustralia)
2009/10
2009/10
2009/10
Tomago STS (EnergyAustralia)
2012/13 (New route)
Tomago 2009/10


Option 1 – 2025
To Port Macquarie
132 kV
New Work 132 kV Construction
132 kV 330 kV Construciton
330 kV
New Work 330 kV Construction
Double Circuit Line
2025
Lansdowne
2025
(964 route)
Taree
96P
Nabiac
Stroud STS
(Country Energy)
Bulahdelah
2025
(96F route)
Hawks Nest
Brandy Hill
(EnergyAustralia)
Tarro
Beresfield STS
(EnergyAustralia)
Tomago STS
(EnergyAustralia)
Tomago

Option 1 would involve works as indicated by dashed lines in the diagrams on the preceding two pages and detailed below. For completeness other future developments that are not part of Option 1 but which have been independently planned are shown the 2014 diagram in pink.

Works to be completed prior to summer 2012/13:

- Construction of a new double circuit 330 kV line (approx 6 km long on a new route) between the proposed Tomago 330/132 kV substation and a suitable point on the Kurri – Stroud 66 kV line 860 in the Tarro area;
- Construction of a double circuit 132 kV line (approx 65 km long primarily using the route of the existing Kurri – Beresfield – Stroud 66 kV line 860) between Tarro and Country Energy's Stroud STS;
- Provision of 132 kV switchbays at Tomago and Stroud for connection of new 132 kV circuits; and
- Formation of 132 kV circuits between Tomago, Tarro and Stroud as indicated in the 2014 diagram for Option 1;

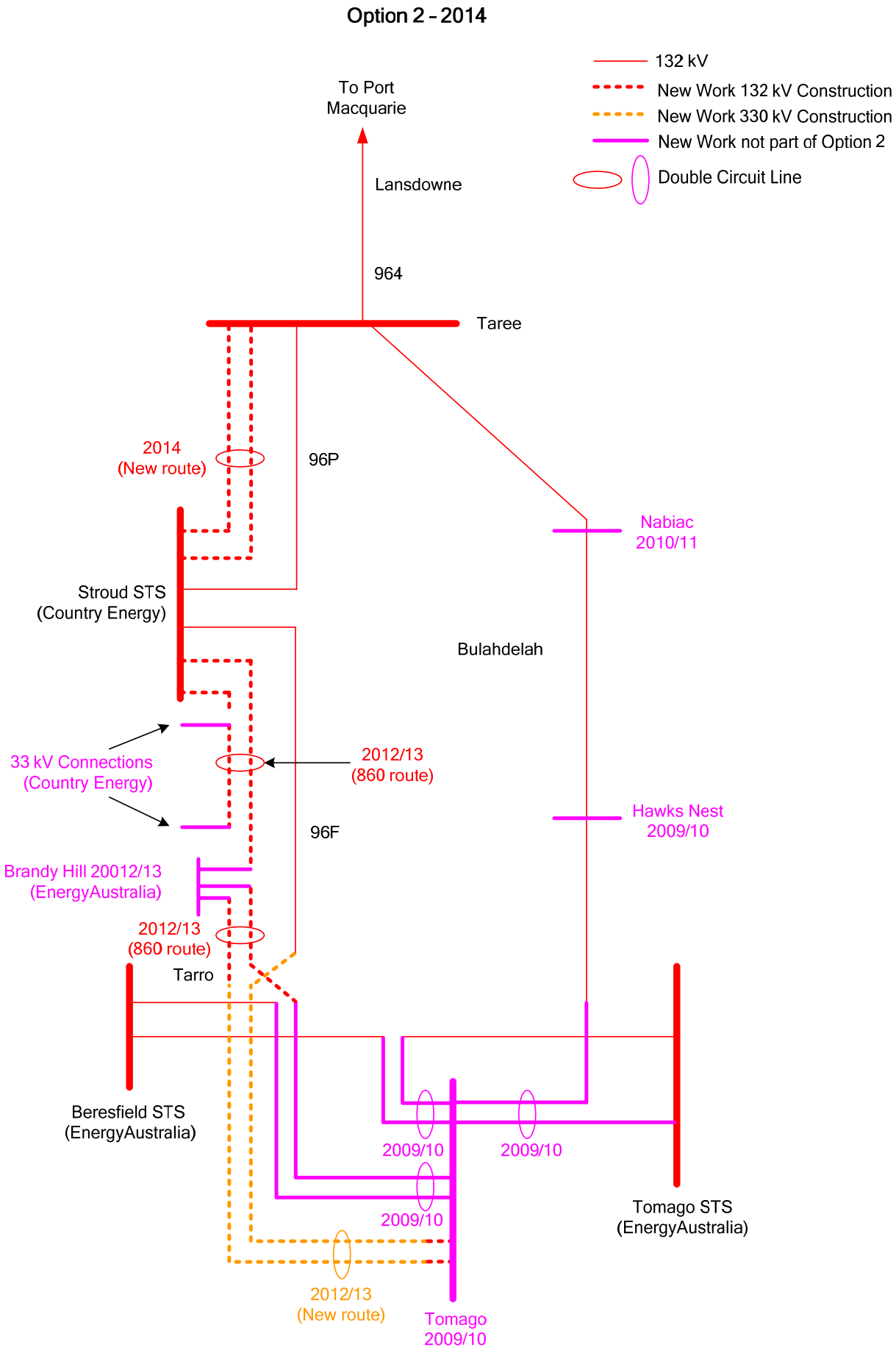
Works to be completed in 2014:

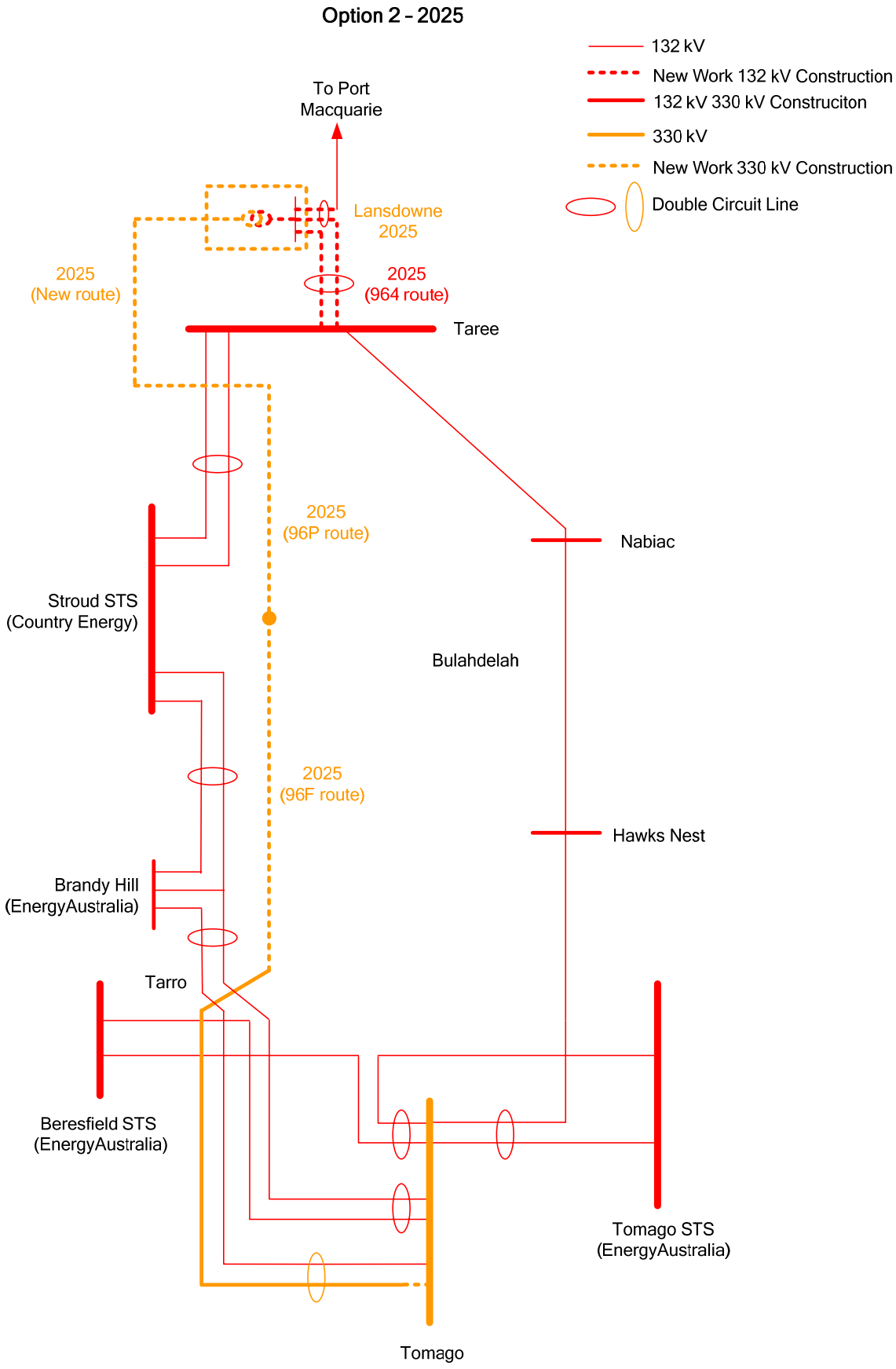
- Construction of a single circuit 330 kV line (approx 110 km long on a new route) between Stroud STS and Lansdowne;
- Construction of a double circuit 132 kV line (approx 2 km long on a new route) between Lansdowne and the Taree – Port Macquarie 132 kV line 964;
- Establishment of a new 132 kV switching station at Lansdowne; and
- Formation of 132 kV circuits between Stroud, Lansdowne, Taree and Port Macquarie as indicated in the 2014 diagram for Option 1;

Works to be completed around 2025:

- Construction of a single circuit 330 kV line (approx 65 km long using the route of the existing Beresfield – Stroud 132 kV line 96F) between Tarro and Stroud;
- Conversion of Lansdowne 132 kV switching station to a 330/132 kV substation;
- Reconstruction of the Taree - Lansdowne 132 kV line 964 as a double circuit 132 kV line; and
- Formation of a Tomago – Lansdowne 330 kV circuit and other 132 kV circuits as indicated in the 2025 diagram for Option 1.

3.2. Option 2


Option 2 – 2014
132 kV
New Work 132 kV Construction
New Work 330 kV Construction
New Work not part of Option 2
Double Circuit Line
To Port Macquarie
Lansdowne
964
Taree
2014 (New route)
96P
Nabiac 2010/11
Stroud STS (Country Energy)
Bulahdelah
33 kV Connections (Country Energy)
2012/13 (860 route)
96F
Hawks Nest 2009/10
Brandy Hill 20012/13 (EnergyAustralia)
2012/13 (860 route)
Tarro
Beresfield STS (EnergyAustralia)
2009/10
2009/10
2009/10
Tomago STS (EnergyAustralia)
2012/13 (New route)
Tomago 2009/10


Option 2 – 2025
132 kV
New Work 132 kV Construction
132 kV 330 kV Construciton
330 kV
New Work 330 kV Construction
Double Circuit Line
To Port Macquarie
Lansdowne 2025
2025 (New route)
2025 (964 route)
Taree
2025 (96P route)
Nabiac
Stroud STS (Country Energy)
Bulahdelah
2025 (96F route)
Hawks Nest
Brandy Hill (EnergyAustralia)
Tarro
Beresfield STS (EnergyAustralia)
Tomago STS (EnergyAustralia)
Tomago

Option 2 would involve works as indicated by dashed lines in the diagrams on the preceding two pages and detailed below. For completeness other future developments that are not part of Option 2 but which have been separately proposed are shown the 2014 diagram in pink.

Works to be completed prior to summer 2012/13:

- Construction of a new double circuit 330 kV line (approx 6 km long on a new route) between the proposed Tomago 330/132 kV substation and a suitable point on the Kurri – Stroud 66 kV line 860 in the Tarro area;
- Construction of a double circuit 132 kV line (approx 65 km long using the route of the existing Kurri – Beresfield – Stroud 66 kV line 860) between Tarro and Country Energy's Stroud STS;
- Provision of 132 kV switchbays at Tomago and Stroud for connection of new 132 kV circuits; and
- Formation of 132 kV circuits between Tomago, Tarro and Stroud as indicated in the 2014 diagram for Option 2;

Works to be completed in 2014:

- Construction of a double circuit 132 kV line (approx 85 km long on a new route) between Stroud STS and Taree 132 kV Substation;
- Provision of 132 kV switchbays at Taree and Stroud for connection of two new 132 kV circuits; and
- Formation of 132 kV circuits between Stroud and Taree as indicated in the 2014 diagram for Option 2;

Works to be completed around 2025:

- Construction of a single circuit 330 kV line (approx 65 km long using the route of the existing Beresfield – Stroud 132 kV line 96F) between Tarro and Stroud;
- Construction of a single circuit 330 kV line (approx 110 km long using the route of the existing Stroud - Taree 132 kV line 96P between Stroud and Taree and on a new route between Taree and Lansdowne) between Stroud and Lansdowne;
- Establishment of a new 330/132 kV substation at Lansdowne;
- Construction of a double circuit 132 kV line (approx 2 km long on a new route) between Lansdowne and the Taree – Port Macquarie 132 kV line 964;
- Reconstruction of the Taree - Lansdowne 132 kV line 964 as a double circuit 132 kV line; and
- Formation of a Tomago – Lansdowne 330 kV circuit and other 132 kV circuits as indicated in the 2025 diagram for Option 2.

3.3. Notes on Options 1 and 2

1. TransGrid's Tomago 330/132 kV substation and 132 kV connections between Tomago substation, Tomago STS and Beresfield STS are proposed for construction by summer 2009/10. They form part of a joint TransGrid/EnergyAustralia new large transmission network asset proposal for which a final report was issued in December 2007.
2. The 66 kV line 860 and the 132 kV line 96F between Tarro and Stroud and the 132 kV line 96P between Stroud and Taree may be released at times suitable for the construction of Options 1 or 2.
3. Part of one circuit of the Tarro – Stroud line (north of Brandy Hill) is proposed to initially be used for a 33 kV connection between Country Energy's Dungog and Martins Creek substations.
4. 132 kV connections near Tarro and at Brandy Hill may vary from those that are indicated in the diagrams without materially affecting the costs and effectiveness of Options 1 or 2.
5. The required date for the 2025 works in Options 1 and 2 is subject to uncertainty (with respect to future load forecast outcomes) and therefore the timing of these works will be varied in the application of the regulatory test. The timing of the 2012/13 and 2014 works is determined by the practicability of completing the works in these times.
6. TransGrid now aims to complete the works which were proposed for 2015/16 in the Application Notice in 2014.

3.4. Comparison of Options 1 and 2

In this section Options 1 and 2 are compared with respect to factors other than their costs (which is done in the regulatory test application in Section 4).

Table 10 below details the lengths of line segments that would constructed under each option, whether they are of 330 kV or 132 kV construction and whether they are constructed on new or existing line routes.

Table 10 Line Segments Constructed under Options 1 and 2

	Option 1				Option 2			
Year	**Line**	**km**	**kV**	**Route**	**Line**	**km**	**kV**	**Route**
2012/13	Tomago - Tarro	6	330	New	Tomago - Tarro	6	330	New
2012/13	Tarro - Stroud (860)	65	132	Exist	Tarro - Stroud (860)	65	132	Exist
2014	Stroud - Lansdowne	110	330	New	Stroud - Taree	85	132	New
2025	Tarro - Stroud (96F)	65	330	Exist	Tarro - Stroud (96F)	65	330	Exist
2025					Stroud - Taree - Lansdowne (96P)	45	330	Exist
2025					Stroud - Taree - Lansdowne (New)	65	330	New
2025	Lansdowne - 964	2	132	New	Lansdowne - 964	2	132	New
2025	Lansdowne - Taree (964)	12	132	Exist	Lansdowne - Taree (964)	12	132	Exist
	Total	260			Total	345	**85 km**	
	Total New	118			Total New	158	**40 km**	
	Total Exist	142			Total Exist	187	**45 km**	
	Total 330 kV	181			Total 330 kV	181	**0 km**	
	Total 132 kV	79			Total 132 kV	164	**85 km**	

Note: Figures in blue are the differences in line lengths.

From Table 10 it can be seen that a total of 85 extra km of 132 kV line would be constructed under Option 2 compared with Option 1. The additional environmental and community impacts (during construction) of this extra length of line are not captured by the regulatory test.

Comparing the 2025 figures for Options 1 and 2 it can be seen that the total route length of in service 330 kV and 132 kV line would be similar. The main difference between the options occurs between Stroud and Taree. In Option 2 the Stroud – Taree 132 kV line 96P would effectively be "relocated" onto a new route and converted to double circuit and there would be an out of service section of 132 kV line between the Gloucester area and Taree. In Option 1 this would not occur.

3.5. Other Developments that were Considered

This section describes other developments that have been considered but not put forward as partial or complete options for various reasons.

3.5.1. Newcastle Area to Stroud

Two other methods of providing additional transmission capacity between Newcastle and the Stroud area were considered in preliminary planning.

Construction of a New 132 kV Line on a New Route

This development would involve obtaining a new line route between the Newcastle area and Stroud. Given that reconstruction of an existing lower voltage line (860 line) is feasible it is extremely unlikely that environmental/community consent could be obtained for a new line route. Consequently this development was not pursued.

Reconstruction of the Existing 96F Line Prior to Reconstruction of 860 Line

The existing 96F Beresfield – Stroud 132 kV line is the most critical line supplying the lower Mid North Coast. It would not be possible to obtain extended outages of this line to enable it to be dismantled and a new line constructed in its place prior to the provision of additional 132 kV capacity to Stroud. Consequently Options 1 and 2 assume that the 66 kV line 860 is constructed as a double circuit 132 kV line prior to the reconstruction of 96F line.

3.5.2. Stroud – Bulahdelah 132 kV Line

Construction of a 132 kV line between Stroud and Bulahdelah together with works at Bulahdelah to connect it could potentially delay the onset of the limitation described in Section 2.5.1 associated with an outage of the Tomago – Hawks Nest 132 kV line (the southern part of the present 963 Tomago – Taree 132 kV line). This development was not pursued as:

- It could not be completed until Summer 2013/14;
- It exacerbates the limitation described in Section 2.5.3 (associated with an outage of the 96P Stroud – Taree 132 kV line); and
- It is expected to cost around $50 million.

3.5.3. Armidale – Mid North Coast 330 kV Line

The option of establishing a 330/132 kV substation on the Mid North Coast together with a 330 kV transmission line supplying it from Armidale was considered. The 330 kV line would utilise (parts of) the route of the existing 965 Armidale – Kempsey 132 kV line.

It would not be effective in overcoming the limitation described in Section 2.5.3. Consequently it was not pursued.

4. Application of the Regulatory Test

An application of the regulatory test considering network Options 1and 2 has been carried out. A summary of the results is provided in the following sections.

4.1. Form of the Regulatory Test

As discussed in Section 2 the options covered by this final report are a reliability augmentation and the regulatory test is to be applied in accordance with clause 1(a) of the test:

(a) in the event the option is necessitated principally by inability to meet the service standards linked to the technical requirements of schedule 5.1 of the NER or in applicable regulatory instruments - the option minimises the costs of meeting those requirements, compared with alternative option/s in a majority of reasonable scenarios;

TransGrid's interpretation of the regulatory test for reliability augmentations is as follows.

The following costs should be included:

- Capital costs of options;
- Operation and maintenance (O&M) costs of options; and
- Costs of complying with laws, regulations and applicable administrative requirements in relation to the option;

The following avoided costs should not be included:

- Reductions in electrical losses;
- Reductions in unserved energy;
- Deferrals or avoidance of generation or transmission investment elsewhere in the NEM (ie not associated with the option); and
- Avoided fuel costs elsewhere in the NEM.

Market development scenarios are only relevant to the extent that they affect the timing of the onset of network limitations and/or the ability of options to meet those limitations.

4.2. Regulatory Test Application – Summary

4.2.1. Costs

For the regulatory test application only the capital and O&M costs of Options 1 and 2 have been explicitly included.

There are no known existing or anticipated government tax or subsidy schemes that would apply materially differently to either of these options.

There are no known emerging network limitations in the area (other than those described in Section 2.5) for which the solution would be materially differently affected by either of these options.

The costs have been escalated to 2009 dollars. Those in the Application Notice were 2008 dollars.

4.2.2. Scenarios

Timing of Newcastle – Taree 330 kV Development

The precise timing of the emergence of the network limitations requiring a 330 kV development from Newcastle to Taree (refer to Section 2.5.4) is uncertain. As the details and therefore costs of this development are materially different between Options 1 and 2 its timing has the potential to affect the ranking of options. Thus in the regulatory test application a range of timings for this development are considered as different market development scenarios.

As discussed in Section 3 it is not proposed to commit to the construction of this development at the conclusion of this application of the regulatory test. It has been included in options to facilitate the selection of the most economic option over the short, medium and long term.

Load Forecast Outcomes, Generation Developments and Demand Management Developments

Only a single medium economic growth load forecast outcome has been considered and future generation or demand management developments are not modelled. This is due to:

- The need for network augmentation being within the lead time of all known reasonable options.
- There being no known committed or advanced generation or demand management developments that are likely to affect the timing of the onset of the network limitations or the ability of either option to meet them.

Summary of Scenarios

In consequence of the above considerations three market development scenarios have been considered:

- "Nominal" Newcastle to Taree 330 kV development required by a "best estimate" of 2025;
- "Early" Newcastle to Taree 330 kV development required by 2020; and
- "Late" Newcastle to Taree 330 kV development required by 2030;

4.2.3. End Calculations

In this application of the regulatory test, options include significant expenditures close to the end of the planning horizon. To check whether end calculations materially affect the ranking of options, three methods are employed:

1. Residual

   Residual calculations assume that projects are partially depreciated at the end of the planning horizon and that O&M costs associated with projects occur up to that date but no further. Straight line deprecation is assumed. This method has the advantage of avoiding the necessity to make assumptions about distant future outcomes.

2. Terminal 1

   Terminal 1 calculations assume that projects are fully depreciated at the end of their asset lives and that O&M costs continue beyond the end of the planning horizon to the end of the projects asset life but no further. This method is most closely aligned with the wording of the regulatory test.

3. Terminal 2

   Terminal 2 calculations assume that projects are replaced by an identical project at the end of their asset lives and that this process continues indefinitely. Similarly O&M costs continue indefinitely. There is a view that this is the most theoretically ideal end calculation.

In all cases end calculations are summarised as a single cash flow for a project occurring at the end of the planning horizon.

It should be noted that the present value of the costs of options may vary significantly between these end calculation methods even though the ranking of options may not vary significantly.

4.2.4. Results

The present values of costs of each option have been calculated for a base case of financial and technical assumptions and the options ranked accordingly. Sensitivity tests of these calculations due to reasonable variations to the major assumptions have been carried out. These calculations are repeated for each of the scenarios described in Section 4.2.2 and end calculation methods described in Section 4.2.3.

The base case assumptions and the range over which sensitivity tests were conducted are shown in Table 11. The results of the analysis are shown in Tables 12, 13 and 14. Details of the base case economic model for the Nominal scenario are shown in Appendix A.

Table 11 Base Case Values and Range of Values Used in Sensitivity Tests

Parameter	Base Case Value	Sensitivity Tests at
Real Discount Rate	9%	6% and 12%
Annual O&M Cost	2% of Capital Cost	1% and 3% of Capital Cost
Asset Lifetimes Substations Transmission Lines	 30 years 45 years	 20 and 40 years 30 and 60 years

Capital Costs	Nominal Value	±25% variation

Table 12 Present Value of Costs and Ranking - Early Scenario

	Residual				Terminal 1				Terminal 2			
Sensitivity Case	**Opt 1**	**Rank**	**Opt 2**	**Rank**	**Opt 1**	**Rank**	**Opt 2**	**Rank**	**Opt 1**	**Rank**	**Opt 2**	**Rank**
Base Case	158.9	1	166.2	2	177.2	1	190.8	2	182.2	1	195.9	2
12% Discount Rate	132.0	1	133.4	2	140.1	1	144.3	2	141.4	1	145.6	2
6% Discount Rate	190.2	1	205.4	2	233.1	1	263.1	2	255.1	1	287.1	2
25% Decrease in Capital Costs	119.2	1	124.6	2	132.9	1	143.1	2	132.9	1	143.1	2
25% Increase in Capital Costs	198.7	1	207.8	2	221.6	1	238.5	2	227.8	1	244.9	2
Decrease in Asset Lives	178.4	1	186.6	2	192.4	1	205.2	2	208.6	1	223.9	2
Increase in Asset Lives	156.0	1	162.9	2	177.8	1	191.4	2	179.4	1	193.0	2
Decreased O&M Cost	145.8	1	152.6	2	161.5	1	173.8	2	166.1	1	178.5	2
Increased O&M Cost	172.1	1	179.8	2	193.0	1	207.7	2	198.4	1	213.3	2

Table 13 Present Value of Costs and Ranking - Nominal Scenario

	Residual				Terminal 1				Terminal 2			
Sensitivity Case	**Opt 1**	**Rank**	**Opt 2**	**Rank**	**Opt 1**	**Rank**	**Opt 2**	**Rank**	**Opt 1**	**Rank**	**Opt 2**	**Rank**
Base Case	143.1	2	129.6	1	162.5	2	156.7	1	167.1	2	160.8	1
12% Discount Rate	118.9	2	103.2	1	127.5	2	115.2	1	128.7	2	116.2	1
6% Discount Rate	171.6	2	162.5	1	217.2	1	226.3	2	237.5	1	246.7	2
25% Decrease in Capital Costs	107.3	2	97.2	1	121.9	2	117.5	1	125.3	2	120.6	1
25% Increase in Capital Costs	178.9	2	162.0	1	203.2	2	195.9	1	208.8	2	201.1	1
Decrease in Asset Lives	148.8	2	135.2	1	163.0	2	155.6	1	176.3	2	169.4	1
Increase in Asset Lives	140.4	2	126.8	1	163.1	2	157.2	1	164.5	2	158.5	1
Decreased O&M Cost	131.3	2	119.1	1	148.1	2	142.8	1	152.2	2	146.5	1
Increased O&M Cost	154.9	2	140.1	1	177.0	2	170.7	1	181.9	2	175.1	1

Table 14 Present Value of Costs and Ranking - Late Scenario

	Residual				Terminal 1				Terminal 2			
Sensitivity Case	**Opt 1**	**Rank**	**Opt 2**	**Rank**	**Opt 1**	**Rank**	**Opt 2**	**Rank**	**Opt 1**	**Rank**	**Opt 2**	**Rank**
Base Case	132.4	2	104.9	1	153.0	2	134.6	1	157.2	2	138.0	1
12% Discount Rate	111.2	2	85.5	1	120.4	2	98.7	1	121.5	2	99.5	1
6% Discount Rate	157.1	2	129.1	1	205.3	2	198.7	1	224.4	2	216.4	1
25% Decrease in Capital Costs	99.3	2	78.7	1	114.7	2	100.9	1	117.9	2	103.5	1
25% Increase in Capital Costs	165.6	2	131.2	1	191.3	2	168.3	1	196.5	2	172.6	1
Decrease in Asset Lives	137.6	2	109.3	1	153.5	2	133.7	1	165.8	2	145.3	1
Increase in Asset Lives	129.9	2	102.7	1	153.5	2	135.1	1	154.7	2	136.0	1
Decreased O&M Cost	121.5	2	96.4	1	139.4	2	122.6	1	143.2	2	125.7	1
Increased O&M Cost	143.4	2	113.4	1	166.6	2	146.6	1	166.6	2	146.6	1

Tables 12, 13 and 14 are coloured green to highlight cases where Option 1 has the higher ranking and yellow to highlight where Option 2 has the higher ranking. This helps to show the variability of the ranking of options to variations of scenarios, end calculation methods and financial and technical parameters.

The results indicate that Option 1 is the highest ranked option for all cases in the early scenario and Option 2 is the highest ranked option for all cases in the late scenario. In the nominal scenario the results are mixed. Option 1 is the highest ranked option for both of the terminal end calculation methods where the discount rate is low and Option 2 is the highest ranked option for the other cases.

In many cases the PV of cost figures are within a few percent of each other.

These results support the view that neither Option 1 nor Option 2 is clearly more economically efficient than the other (as measured by the regulatory test for reliability augmentations). Thus either Option 1 or Option 2 could satisfy the regulatory test. A choice between Option 1 and Option 2 would then depend on factors that are not captured by the regulatory test.

5. Conclusions and Proposed Actions

TransGrid and Country Energy conclude that:

- Either Option 1 or Option 2 could satisfy the regulatory test;
- Given that Option 1 would result in a significant reduction in the lengths of new line construction to achieve a similar network to that of Option 2 in the medium to long term, Option 1 is preferred.

Given the uncertainty of the timing of the requirement for 330 kV supply to Taree and the available lead time for that stage it is not proposed to proceed with construction of those works at this time.

Consequently the proposed actions are for TransGrid and Country Energy to construct the first two stages (to 2014) of Option 1 as described in Section 3.1 and depicted in the 2014 diagram for that option. These works are estimated to cost around $180 million ($2009).

6. Notice of Disputes

Persons wishing to dispute the contents, findings, assumptions or recommendations of this final report are referred to clause 5.6.6(j) of the Rules.

Disputing parties must lodge a notice of the dispute in writing to the AER and provide a copy of the dispute notice to TransGrid within 30 business days of the publication of the summary of this final report on AEMO's website.

TransGrid copies of dispute notices regarding this final report should be forwarded to:

Garrie Chubb
Tel: 02 9284 3553
fax: 02 9284 3456
email: garrie.chubb@transgrid.com.au

Appendix A - Least Capital and Operating Cost Analysis of Base Case Nominal Scenario

Supply to Lower Mid North Coast - Application of the Regulatory Test: Option 1

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Resid
Tomago 2 x 132 kV Switchbays					1.1																							-0.3
Tomago - Tarro area D/C 330 kV Line					11.9																							-5.8
Tarro - Stroud STS D/C 132 kV Line					39.8																							-19.4
Stroud 2 x 132 kV Switchbays					1.2																							-0.3
Stroud - Lansdowne 330 kV S/C Line						113.0																						-57.8
Lansdowne SwS						14.7																						-3.9
Tarro - Stroud S/C 330 kV Line																	67.6											-51.1
Lansdowne SwS -> SS + Tomago 330 kV Switchbay																	20.3											-12.8
Lansdowne - Taree 132 kV D/C Line																	9.3											-7.0
O+M Costs						1.1	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	
Total Expenditure					53.9	128.8	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	100.8	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	-158.4
PV of Costs ($Million)	**143.1**																											
Total Capex Costs ($Million)	**278.8**																											

Supply to Lower Mid North Coast - Application of the Regulatory Test: Option 2

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Resid
Tomago 2 x 132 kV Switchbays					1.1																							-0.3
Tomago - Tarro area D/C 330 kV Line					11.9																							-5.8
Tarro - Stroud STS D/C 132 kV Line					39.8																							-19.4
Stroud 3 x 132 kV Switchbays					1.7																							-0.4
Stroud - Taree 132 kV D/C Line						68.4																						-34.9
Taree 2 x 132 kV Switchbays						1.2																						-0.3
Tarro - Stroud S/C 330 kV Line																	67.6											-51.1
Stroud - Lansdowne 330 kV S/C Line																	113.0											-85.4
Lansdowne SS + Tomago 330 kV Switchbay																	35.0											-22.2
Lansdowne - Taree 132 kV D/C Line																	9.3											-7.0
O+M Costs		0.0	0.0	0.0	0.0	1.1	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	0.0
Total Expenditure	0.0	0.0	0.0	0.0	54.5	70.6	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	227.4	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	-226.8
PV of Costs ($Million)	**129.6**																											
Total Capex Costs ($Million)	**348.9**																											