TransGrid

TransGrid's Submission to the Australian Competition & Consumer Commission

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Revised Transmission Capital Investment Program 2004-2009

Attachment 8A

Telecommunications Development Outline Plan

November 2004

ATTACHMENT 8A

TELECOMMUNICATIONS DEVELOPMENT OUTLINE PLAN

Version 1- 10/11/2004

Transmission Development
File: ND/P/98

1. Introduction

To support its transmission network, TransGrid operates an extensive telecommunications network. Development of this network is primarily driven by transmission network augmentations. However it is heavily influenced by rapid changes in communication technology, standards and regulation as well as the relatively short asset life of communication equipment.

The "backbone" of TransGrid's telecommunications system is an Optical Fibre Powerline Ground Wire (OPGW) link on 330 kV lines that extends from Jindera (near Albury) to Dumaresq and on to the Queensland border. There is also an OPGW link from Sydney to the Western power stations. In transit the OPGW link connects to the majority of key main system power stations and substations.

The introduction of the power system data requirements of the National Electricity Code means that improved communication system security will need to be developed over about the next four years. Consistent with other TNSPs, TransGrid will progressively develop alternative communication paths to most key sites by about 2008. In general these alternative communication paths will be predominantly via microwave radio links with some sections of new OPGW links. It is intended that a number of strategically formed "broad loops" (as shown in the diagram in this Section) will be developed to provide the increased communication security as required by the NEC.

This Telecommunications Development Outline Plan covers the expected telecommunications developments within the next decade to satisfy the reliability requirements of the NEMMCO Standard for Power System Data Communications (PSCDS), to meet corporate data needs and to provide for power system developments in the longer term. All works necessary to meet the reliability standards of Section 3 of the Power Systems Data Communications Standard must be completed within 54 months of the date of introduction of the Standard, 1st January, 2004, ie by 2008.

This Outline Plan provides a description of the developments that are expected to be required. Figure 1 shows the existing telecommunications system. Figure 2 shows the potential telecommunications systems developments over the next decade and Figure 3 shows these developments in broad terms.

These developments include the communications requirements for the western NSW system, the Wollar – Wellington 330 kV line development, the backup to the southern optical fibre system, the NSW south west, the mid to far north coast SCADA, the New England area and the provision of disaster recovery for the SCADA.

Wollar 330kV switching station and western NSW system

The establishment of the Wollar switching station in association with the Wollar – Wellington 330 kV line, and the opportunity that this will provide to extend communications through the western portion of TransGrid's HV network, will enable the communication services associated with the major NSW power stations to meet the requirements for "main dispatch data" as defined in the NEMMCO Standard for Power Systems Data Communications.

This work will also enable the reliability of protection signalling and SCADA facilities to be improved for the 330kV transmission lines and substations west and north of Sydney.

Southern Backup
The establishment of an OPGW throughout the SMA area and the provision of communications between the Southern region and the Western region will provide a similar improvement to the reliability and availability of SCADA and protection signalling functions for 330kV assets south of Sydney, including the vital NSW/Victorian interconnectors in the Snowy Mountains and Riverina areas.

SCADA Communications Augmentation
The SCADA augmentation project is progressing, and new facilities will be installed in many 132kV substations that previously did not have adequate information capabilities. The establishment of radio communications to the North Coast 132kV network in particular will be able to provide adequate facilities for six significant 132kV substations in high load-growth areas, and will be commissioned in time to provide protection and SCADA services for the proposed Coffs Harbour 330kV substation. Later projects will also provide improved SCADA facilities in the New England and South Western/Riverina areas.

Disaster Recovery
System security requirements have prompted the development of disaster recovery facilities for the SCADA network, particularly to cover any extensive damage to communications apparatus rooms. A rapid-response facility is to be mounted in a self-contained portable structure that can be used to provide limited protection, SCADA, OPGW and radio facilities under emergency conditions.

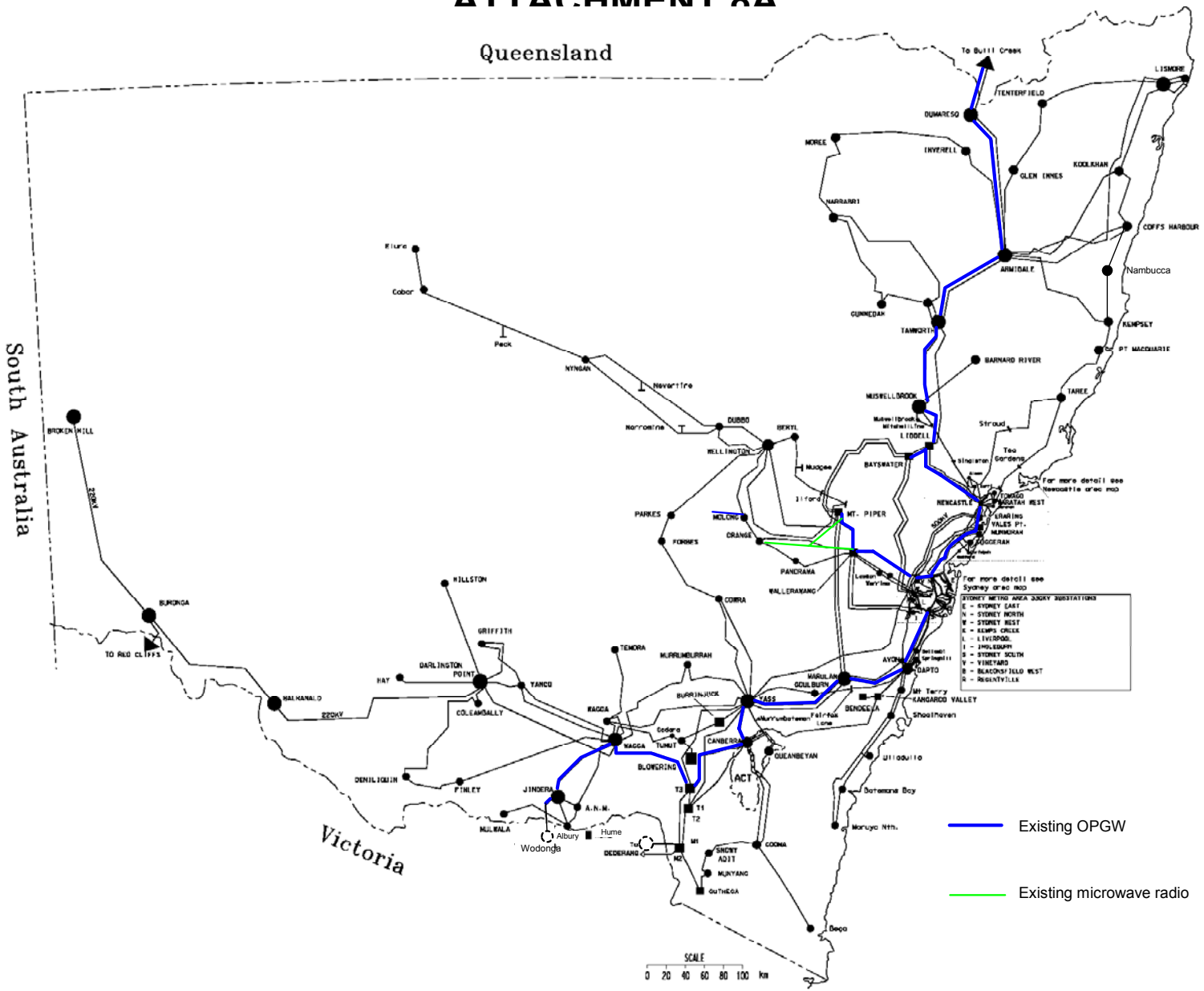

Figure 1 - Existing Telecommunications Network

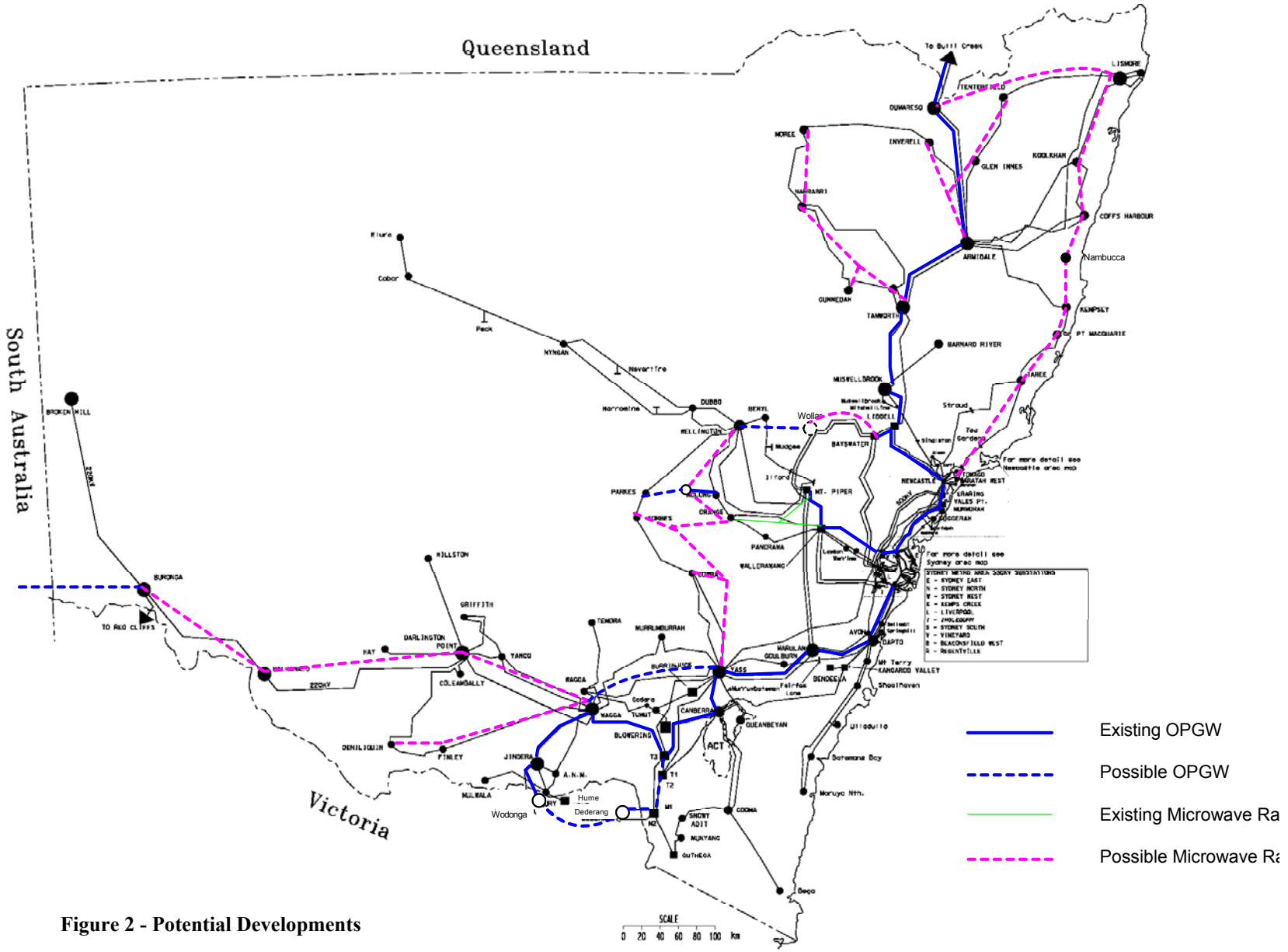

Figure 2 - Potential Developments

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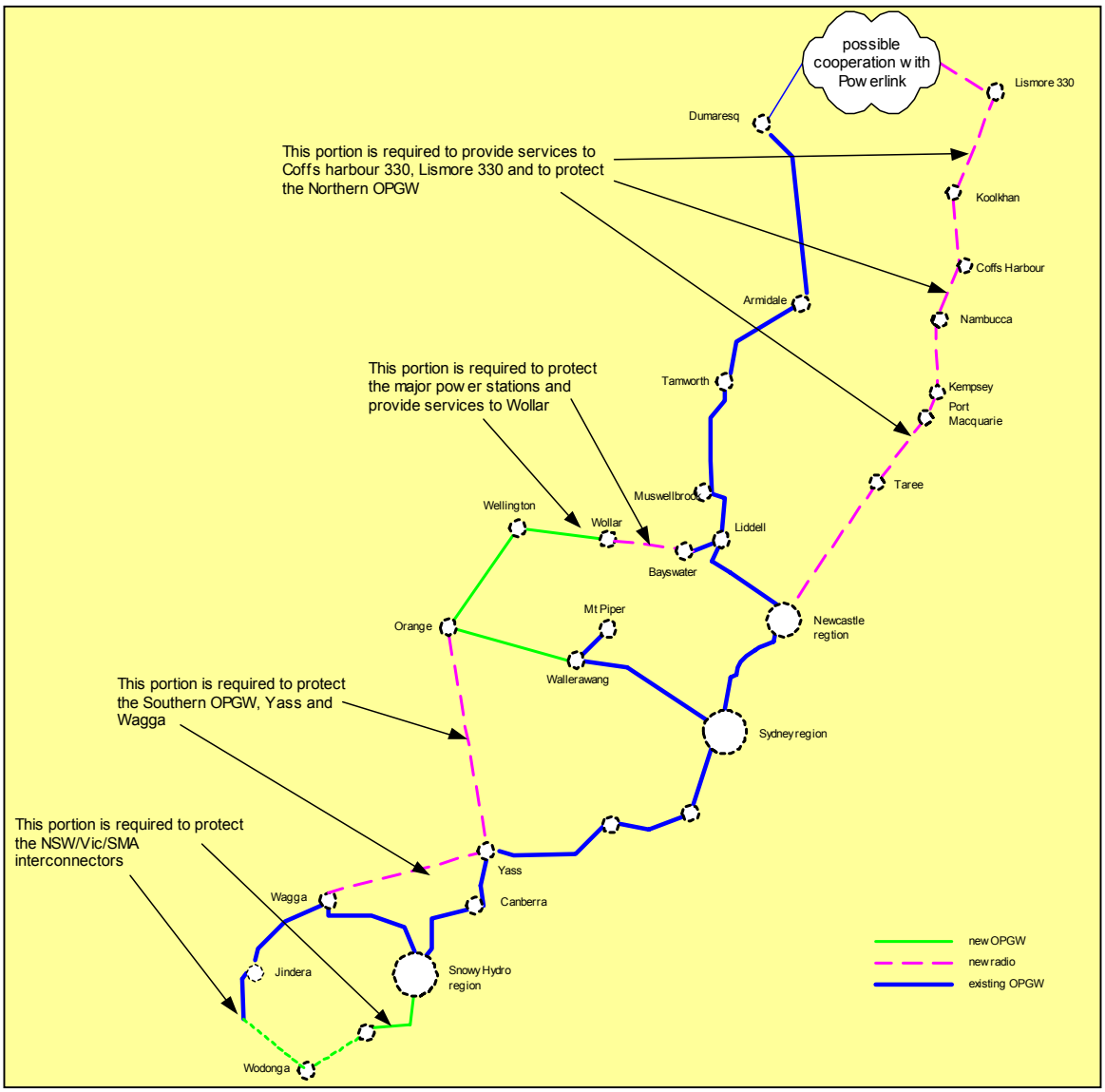


Figure 3 - Developments in Broad Terms

2. NEED FOR TELECOMMUNICATIONS DEVELOPMENTS

The main drivers for the development of the additional links in the telecommunication system are

- Provision of SCADA facilities to 132 kV substations
- Communication of corporate data to staff at all sites
- Operational communications
- Monitoring of plant
- Physical security
- NEMMCO Power Systems Data Communications Standard (PSCDS).

To enable the secure operation of the NSW power system, remote control and monitoring facilities are required. Modern SCADA systems are able to provide this level of control and monitoring, but are reliant on reliable high speed data communications systems to deliver the necessary capabilities.

The ongoing development of the system will require increased application of Special Protection Schemes. The schemes require high standards of reliability and availability, similar to that required by a classical protection intertripping system.

Management of maintenance now relies heavily on IT based systems such as email, TAMIS and WMS for the efficient use of resources.

Whilst the major 330kV network is well supplied by the OPGW and microwave radio systems provided for protection signalling functions, many 132kV substations and a few remote 330kV substations have poor communications facilities. In order to continue to provide an adequate standard of service a substantial augmentation of TransGrid's telecommunications networks will be required over the next 5 years.

3. BACKUP FUNCTIONALITY

Calculations carried out during the discussion phase of the PSCDS indicated that the availability of a protection service using OPGW without diverse path protection can fall below acceptable levels. The provision of an alternate path for OPGW based communications is required.

An improvement in reliability may be achieved by dedicated backup microwave radio. Where practicable the communications network development would be incorporated into the normal HV network growth.

4. TELECOMMUNICATIONS FOR COMMITTED NETWORK DEVELOPMENTS

There are a number of HV network augmentations presently taking place that require telecommunication developments:

Yass Switchyard Reconstruction

On completion of this Project, a number of power line carrier based systems in the Yass area will be decommissioned, and replaced by low capacity digital UHF radio links. This will substantially improve the SCADA, Corporate Data Network and substation data facilities available at Burrinjuck, Murrumburrah, Queanbeyan and Cooma 132kV substations.

Tuggerah – Sterland 330kV Line Reconstruction

On completion of this Project, a new portion of double circuit 330kV transmission line will be in place between Tuggerah 330/132kV Substation and the existing Sterland 'tee' point on Transmission Line 21 Munmorah – Sydney North tee Tuggerah. This OPGW capacity will provide capacity for Tuggerah services and will replace the existing microwave radio facilities.

Establishment of 330/132kV Transformation at Waratah West

Technical services augmentations are required for the development of the 330 kV substation at Waratah West.

Augmentation Works near Vales Point and Eraring.

A number of transmission lines will be re-terminated to relieve constraints between the Central Coast power stations. This will require some amendments to power line carrier system allocations and protection systems.

5. TELECOMMUNICATIONS FOR IMMINENT NETWORK DEVELOPMENTS

The Wollar – Wellington line and Coffs Harbour 330/132 kV Substation projects are being progressed to the construction phase. The major telecommunications developments are set out below.

5.1 Provision of Communication Services for the Wollar – Wellington Line

Wellington currently relies on power line carrier technology for protection signalling, operational voice and SCADA channels.

The new 330kV transmission line planned to augment supply to Wellington will be connected to the existing Bayswater to Mt Piper / Wallerawang line at Wollar and will include an OPGW link.

TransGrid is required under the NEC to upgrade communications to Wellington for protection signalling and SCADA purposes. These works will give an opportunity to form a "communication loop" from the western power stations to the Hunter Valley power stations, significantly improving communications reliability to all sites from Sydney to the Hunter Valley and Western areas

There are a number of options available to meet these telecommunications requirements:

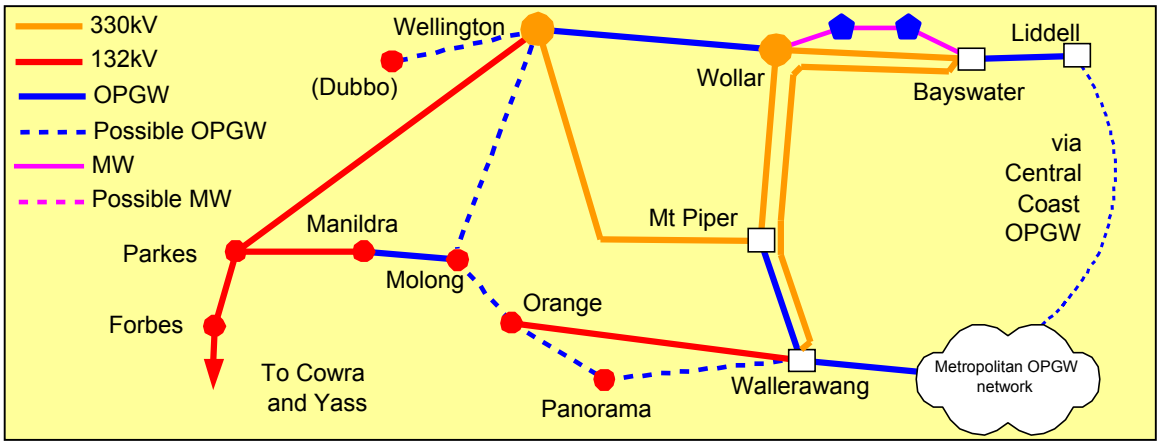
Options to provide services to Wellington via Wollar are:

- OPGW or microwave from Bayswater to Wollar; and
- Power line carrier protection signalling and leased services for SCADA.

A failure of the OPGW system west of Sydney will isolate the Western power stations at Mt Piper and Wallerawang. Provision of a backup communication system to protect against this occurring will also protect SCADA and protection signalling services for the Upper Hunter and Central Coast power stations.

Options to provide services to Wellington via Orange are:

- Increasing capacity of the existing low capacity Orange – Mt Piper – Wallerawang microwave radio network;
- Fibre-based services using OPGW retrofitted to existing 132kV lines between Wallerawang and the Orange region;
- Microwave or OPGW retrofitted to existing 132 kV lines between Orange and Wellington; and



- Leased services from a third party.

Provision of these links may be developed in conjunction with the Federal Government's "Co-ordinated Communication Infrastructure Fund" (CCIF) scheme to minimise costs and maximise utilisation.

The establishment of a communications network between Wellington, Orange and the main OPGW network at Wallerawang will improve the reliability of the Western OPGW to Wallerawang and Mt Piper and will also provide facilities at Panorama, Orange and Molong.

5.2 Provision of services for the Coffs Harbour 330/132kV Substation

The establishment of Coffs Harbour 330/132kV Substation and the associated augmentations to the 330kV network in the immediate region will require suitable duplicated protection-grade telecommunications to be made available in the Coffs Harbour area for the expected completion date of 2005/6.

The technical services facilities being prepared for the North Coast area described below will provide suitable communications to the site of the existing Coffs Harbour 132kV substation. The augmentation of these facilities to include access to the newly constructed Coffs Harbour 330/132kV substation may be achieved by extending the microwave radio to the new site.

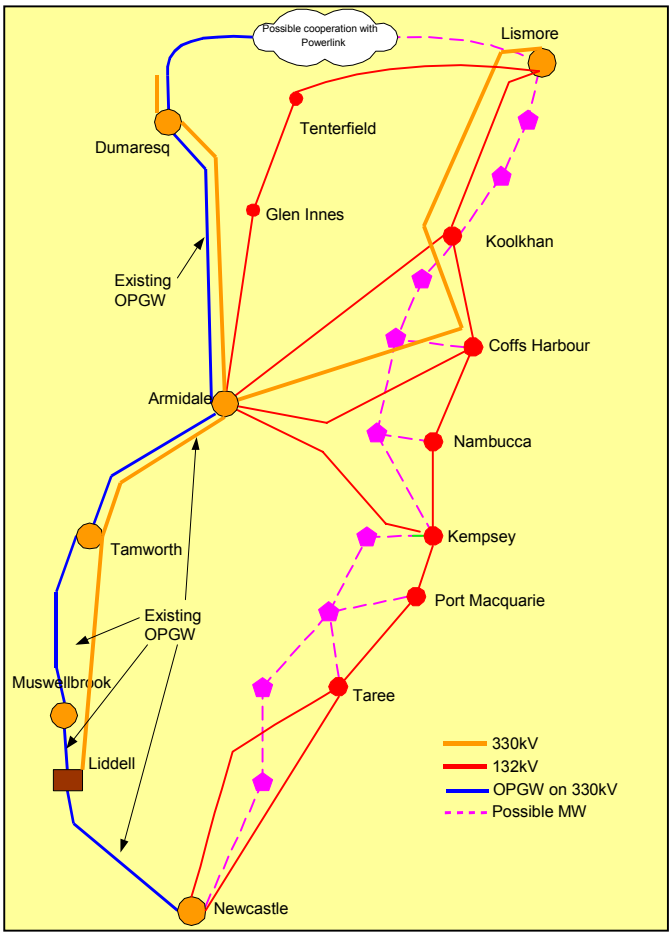
6. TECHNICAL SERVICES AUGMENTATIONS

The SCADA facilities in use within TransGrid substations are currently being upgraded to improve existing facilities in a number of substations and to establish SCADA facilities at a number of 132kV substations that currently do not have these facilities. The following projects augment the TransGrid telecommunications network to provide high quality communications in areas not served by the OPGW network.

6.1 Communication Services to the North Coast

The capability of the existing communication services in the north coast system is very limited.

Lismore 330kV Substation is relatively isolated and the provision of broadband communications suitable for SCADA, and protection signalling is needed to meet NEC requirements.



Coffs Harbour 330/132 kV Substation is planned to be in service in 2006. It will also require access to broadband communication services from its commissioning date.

A number of 132kV substations in the North Coast areas have a high system significance due to the magnitude of load in the area. The provision of high speed communications facilities suitable for SCADA is essential to the secure operation of the network.

Options to provide services are:

- Provide a medium to high capacity microwave radio system from the Newcastle area to Coffs Harbour, Lismore and then Dumaresq 330 kV substations, with spurs to 132kV substations with a high network significance;
- Retrofit OPGW to the Armidale – Lismore 330 kV line via Coffs Harbour 330kV substation;
- Retrofit OPGW to suitable 132kV transmission lines
- Leased communication links to substations with a high network significance to provide SCADA services

The piecemeal development of OPGW on the 132kV network as augmentations occur will not provide satisfactory communications before Coffs Harbour 330/132 kV substation is commissioned.

The cost of establishing a microwave radio network from the Newcastle area to Lismore is estimated to be moderate, and it would provide duplicated, high quality communications suitable for protection signalling and SCADA to Taree, Port Macquarie, Kempsey, Nambucca, Coffs Harbour, Koolkhan and Lismore Substations.

The radio system option may be commissioned before the Coffs Harbour 330/132 kV Substation project is completed, and does not require any 330kV line outages. The establishment of a communication link to Dumaresq via Lismore will improve the reliability of the OPGW to Dumaresq and will also permit a number of sites to access the SCADA system with a capacity and availability difficult to achieve by other means. In the interim period before establishment of a microwave or other system it may be necessary to implement temporary satellite-based services.

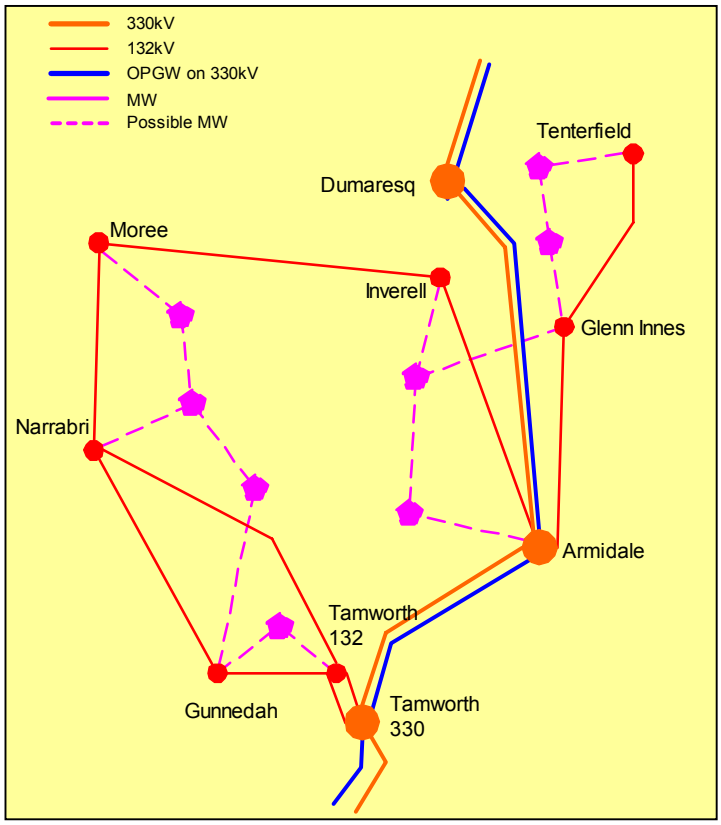
Advantage will be taken of the facilities provided by the “Macrocom” system which has recently been purchased.

6.2 New England Area SCADA

A number of 132kV substations in the New England area require enhanced communication facilities to provide SCADA services.

Options to provide services are:

- Establish low-capacity radio to the various sites;
- Use leased line facilities;
- Establish power line carrier to suitable substations and use satellite facilities for Narrabri and Moree;
- Establish microwave to the various sites; and
- Establish OPGW to the various sites.



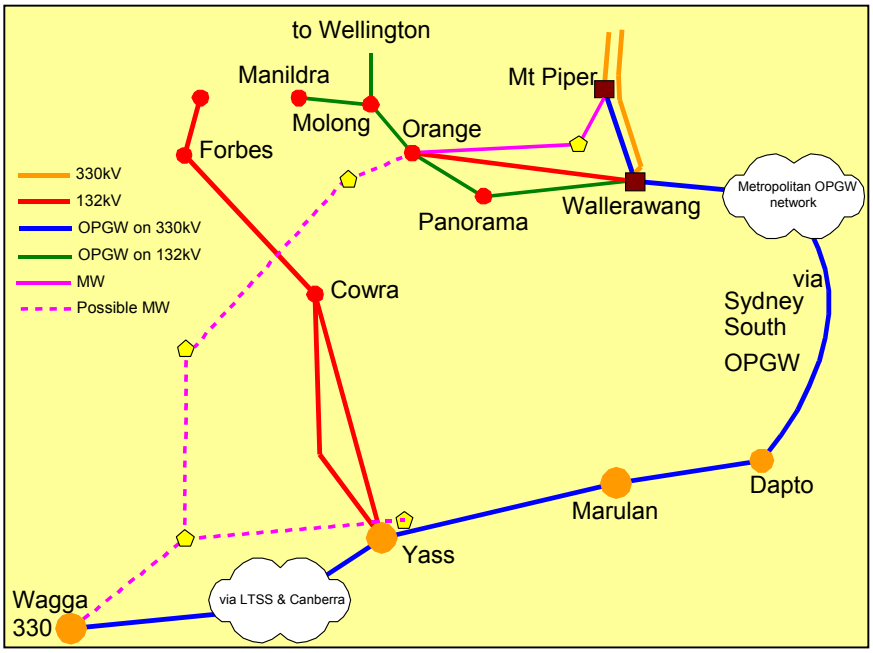
Low capacity unduplicated radio, using existing repeater sites wherever possible, would be able to provide suitable services for SCADA with limited corporate data network or security facilities.

Power line carrier capacity suitable for SCADA channels could be established to some sites. Gunnedah, Inverell, Glen Innes and Tenterfield could be provided with SCADA access using this technology at moderate cost.

Investigation of these alternatives is proceeding.

6.3 Communication Services Supporting the OPGW System South of Sydney

A failure of the OPGW system south of Sydney will isolate the Yass control facilities and affect the ability to control the interconnections with Snowy and Victoria. A backup communication system is required to meet NEC standards. Forming a link from Wagga (or Yass) to Orange provides an alternative communication path for southern services.

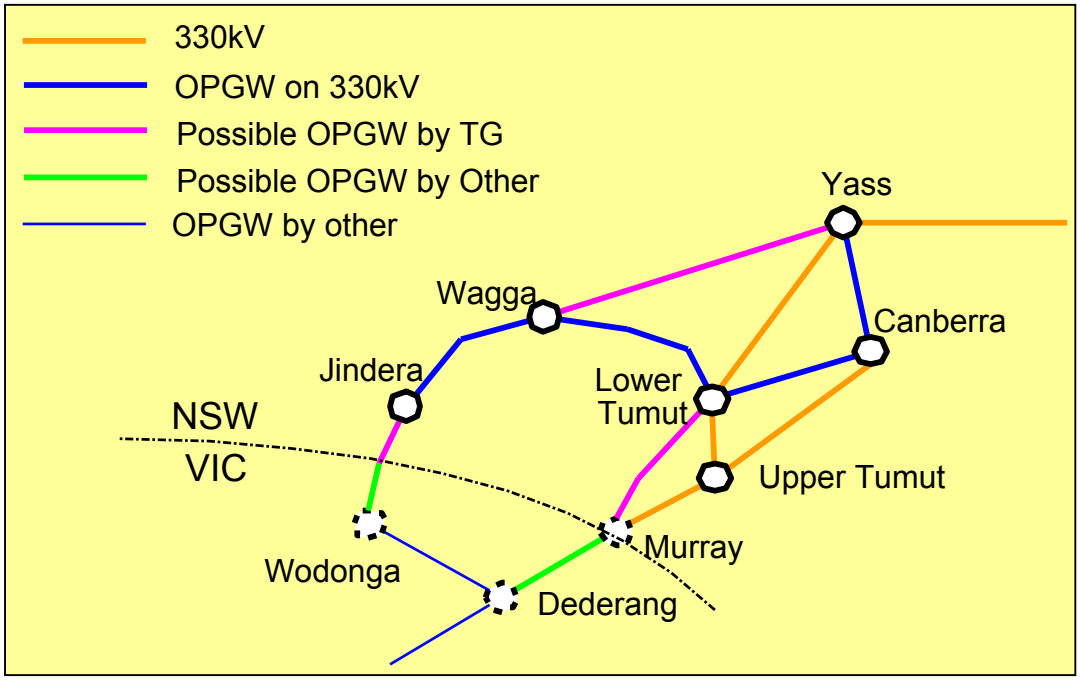


There are a number of options available to meet these telecommunications requirements:

- Microwave radio between Wagga and Orange;
- Fibre-based services using OPGW retrofitted to existing 132kV lines between Yass and the Orange region; and
- Leased services from a third party.

The establishment of a microwave radio system between Wagga and Orange will improve the reliability performance of the Southern OPGW to Jindera and will also permit the future extension of radio services to 132kV substations in the area such as Cowra, Parkes and Forbes.

6.4 OPGW Augmentation in the Snowy Region

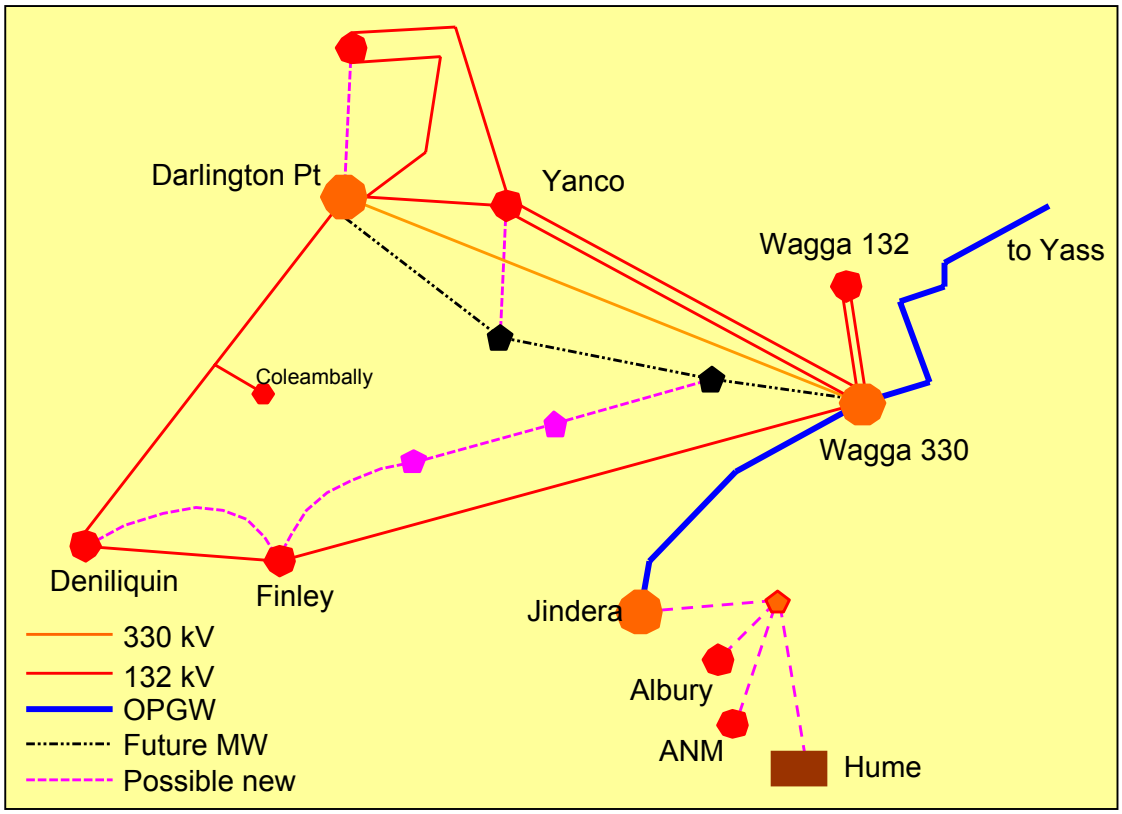


The loss of an OPGW-bearing line around the south-western portion of NSW would severely restrict the operational control of substations in the area.

Options to provide services in the Snowy region are:

- Complete the OPGW link between Jindera and Wodonga (jointly with SPI-PowerNet);
- Extend OPGW from Lower Tumut to Upper Tumut and Murray;
- Develop effective microwave radio capacity in conjunction with Snowy Hydro;
- Leased carrier services for SCADA to Jindera and Murray; and
- Satellite services for SCADA to Jindera and Murray;

6.5 South Western NSW Development



Duplicated protection-grade communications is required to Darlington Pt Substation. In addition there is a need for augmented communications to 132 kV substations in the area.

The communications systems will be developed in two stages. The first stage is a direct microwave communications link from Wagga to Darlington Pt. This project is presently being constructed.

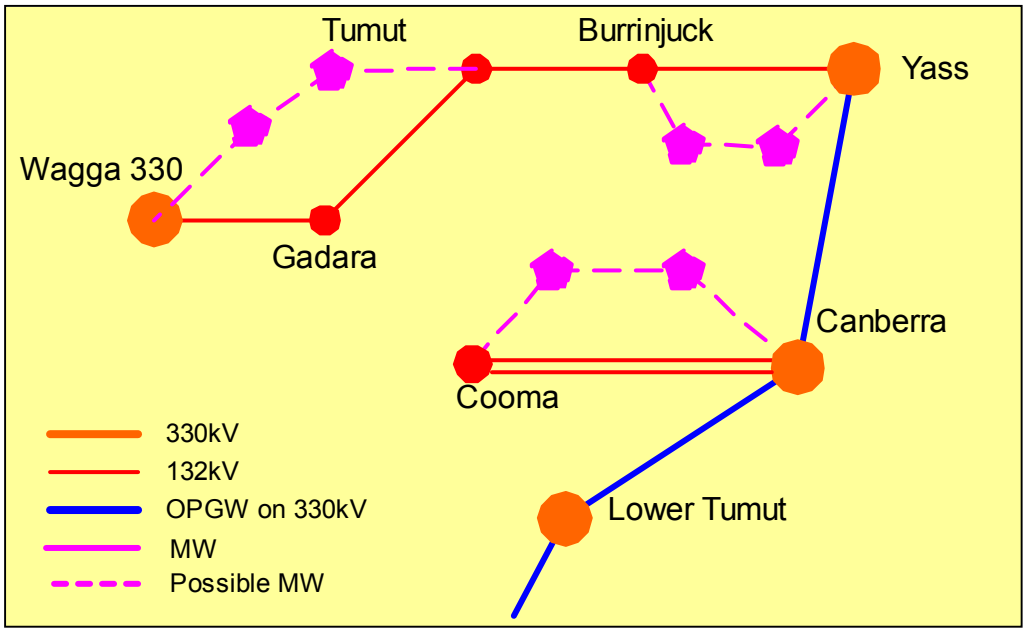
The second stage would augment communication capability to the 132 kV substations in the area.

Options to provide services are:

- Low capacity radio systems to all substations;
- Power line carrier systems to all substations;
- OPGW to all substations;
- Leased services for SCADA services; and
- Satellite based communications channels for SCADA services.

Low capacity unduplicated radio, using existing repeater sites wherever possible, would provide suitable services for SCADA as well as limited capacity for other corporate data network facilities. The cost is expected to be moderate if suitable long-range low capacity radios can be shown to be feasible.

Power line carrier systems to some sites may also be satisfactory although these facilities would not be able to support corporate data network or extensive security requirements.



6.6 Other Communications Developments

The provision of new SCADA facilities to minor 132kV substations will require augmentation to communications facilities to those substations. Unduplicated communications capable of providing 9600bps data communications is required for Burrinjuck, Tumut and Cooma substations to enable these facilities to be incorporated into the SCADA system.

Options to provide services are:

- Low capacity radio systems to minor 132kV substations;
- Power line carrier systems to all substations;
- Leased services for SCADA services; and
- Satellite based communications channels for SCADA services.

7. SCADA DISASTER RECOVERY

The new SCADA system has two independent control systems, one at Sydney West Regional Centre, one at Newcastle Regional Centre. Each is capable of operating the entire TransGrid High Voltage network.

The nature of the telecommunications network requires that communications channels between the SCADA control systems and the individual SCADA outstations must be terminated at a Remote Terminal Gateway (RTG) before being transmitted to each of the two control systems.

A single catastrophic event such as a fire in the Communications Apparatus Room housing the RTG and the local control system will also destroy the ability of that part of the network to communicate with the surviving control system.

The establishment of a Disaster Recovery Site at Sydney South, where a spare RTG can be set up with programmed but inactive communications channels to all SCADA outstations within the TransGrid network, and with access to the main and backup SCADA control systems, will maximise the control available to System Operations after a catastrophic event such as a Communications Apparatus Room fire.

8. LONG-TERM DEVELOPMENTS

Some of the possible longer-term developments are set out below. These are associated with major developments to the NSW network.

Yass – Wagga 330kV Transmission Line

A new 330kV transmission line between Yass and Wagga is proposed. The inclusion of OPGW into this transmission line will provide an OPGW loop around Yass – Wagga – Lower Tumut – Canberra that is independent of any new OPGW works in the SMA area, and will contribute significantly to the reliability performance of SCADA and protection signalling services in the south-west area of NSW.

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Port Macquarie Area 330kV Augmentations

The inclusion of OPGW in any new line developments between Armidale and Kempsey, and the potential for retrofitting of OPGW between Kempsey, Nambucca and Coffs Harbour will increase the interconnection of the main northern OPGW network with the North Coast radio network.

Kemps Creek –Sydney South 330kV Network Augmentation

There is an existing OPGW service on transmission line 13 between Sydney South and Kemps Creek, which will be capable of providing protection signalling and SCADA services for any proposed double circuit 330kV developments between Sydney West/Kemps Creek and Sydney South. Extensive line reconstruction will require an alternative route be developed around the Sydney Metropolitan Area. This would be provided by high-capacity communications between Haymarket and Sydney North.

Catherine Field 330kV Substation

Catherine Field has been identified as a potential site for a future 330kV substation. This site is located near the intersection of the Kemps Creek – Avon and Wallerawang – Sydney South lines. The Western OPGW network between Kemps Creek and Wallerawang passes over this intersection. Any 330kV substation situated at this site will be able to directly access the Western OPGW network.

The commissioning of the loop formed by the Wollar-Wellington OPGW and the associated augmentations will greatly simplify any interruptions to OPGW in this area.

Holroyd (Western Sydney) Area

Options to provide technical services for Holroyd include

- OPGW on the reconstructed 132kV transmission line to Sydney West
- Duplicated radio from Kemps Creek or Sydney South to Holroyd.

- Cooperation between TransGrid and Integral Energy to establish underground optical fibre associated with new 132kV cable works between Holroyd and Integral substations in the Parramatta area.
- Establish a connection between the Integral and TransGrid networks.

Darlington Point Area

Transmission line options include a 220/330kV transmission line from Darlington Point to Deniliquin, or a new NSW – Victorian interconnector. Integration of OPGW is feasible.