Economic Benchmarking Regulatory Information Notice

Basis of Preparation

2014/15

October 2015

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Glossary of terms

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AFW	Application for Work
BOM	Bureau of Meteorology
EBSS	Efficiency Benefit Sharing Scheme
GWh	Gigawatt hours
IRSR	Intra and Inter Regional Settlements Residues
kV	kilovolt
MAR	Maximum Allowable Revenue
MDP	Meter Data Provider
MIC	Market Impact Component
MLF	Marginal Loss Factor
MMS	Market Management System
MVA	Mega volt ampere
MVAr	Megavar
MW	Megawatt
NEM	National Electricity Market
NEMMCO	National Electricity Market Management Company Limited
NOS	Network Outage Scheduler
PTRM	Post Tax Revenue Model
RIN	Economic Benchmarking RIN issued by the AER, 28 November 2013
Rules	National Electricity Rules
SCADA	Supervisory Control and Data Acquisition
STPIS	Service Target Performance Incentive Scheme
TAPR	Transmission Annual Planning Report
TNI	Transmission Node Identifier

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Sheet: 3.1 Revenue

Table: 3.1.1 Revenue Grouping by chargeable quantity

Variable: *TREV0101 – From Fixed Customer (Exit Point) Charges*
TREV0102 – From Variable Customer (Exit Point) Charges
TREV0103 – From Fixed Generator (Entry Point) Charges
TREV0104 – From Variable Generator (Entry Point) Charges
TREV0105 – From Fixed Energy Usage Charges (Charge per day basis)
TREV0106 – From Variable Energy Usage charges (Charge per kWh basis)
TREV0107 – From Energy based Common Service and General Charges
TREV0108 – From Fixed Demand based Usage Charges
TREV0109 – From Variable Demand based Usage Charges
TREV0110 – Revenue from other Sources

RIN Requirements

This section has been completed in accordance with chapter 2, section 2.1 of the Benchmarking RIN Instructions and Definitions.

Consistent with the RIN requirements[1], unless stated otherwise all amounts reported reconcile to the Prescribed Transmission Services revenues reported in the Income Statement forming part of Powerlink's Regulatory Financial Statements. In instances where a difference exists an explanation and reconciliation has been provided.

Table 3.1.1 has been populated with actual data.

Source

All financial information required to complete this table was sourced from Powerlink's Grid Revenue Billing System.

Methodology and Assumptions

Powerlink has prepared its response using actual information contained in its Grid Revenue Billing System.   The system is used to manage billing for all of Powerlink's customers, which include DNSPs and directly connected customers.

Variables	Assumptions / Data Source
TREV0101	***Fixed connection charges –*** sourced from Powerlink's Grid Revenue Billing System.
TREV0102	***Variable connection charges –*** Powerlink does not have any customers with variable connection charges. As permitted under the RIN[2], Powerlink has therefore included a value of zero in these cells.
TREV0103	***Fixed generators connection charges –*** sourced from Powerlink's Grid Revenue Billing System.
TREV0104	***Variable generators connection charges –*** Powerlink does not have any customers with variable generator charges. As permitted under the RIN[3], Powerlink has therefore included a value of zero in these cells.

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[1] Australian Energy Regulator (2013a). Economic Benchmarking RIN for Transmission Network Service Providers, Instructions and Definitions, Queensland Electricity Transmission Corporation Limited, p.12.
[2] Australian Energy Regulator (2013a). pp.6, 12.

TREV0105	*Fixed nominated demand charges* – sourced from Powerlink's Grid Revenue Billing System.
TREV0106	*Variable metered charges* – sourced from Powerlink's Grid Revenue Billing System.
TREV0107	*General and Common charges* – sourced from Powerlink's Grid Revenue Billing System.
TREV0108	*Fixed charges from Customers under Maximum Contract Demand agreements* – sourced from Powerlink's Grid Revenue Billing System.
TREV0109	*Variable charges from Customers under Maximum Contract Demand agreements* – sourced from Powerlink's Grid Revenue Billing System.
TREV0110	*Revenue from other sources* – sourced from the following: - Intra and Inter Regional Settlements Residues (IRSR); - Over/under collections; and - Other Revenue.

Reconciliation

From FY2015 there has been a change in the accounting treatment of regulated revenues to report them on an 'as billed' basis. Powerlink no longer reports over/under collections for the year in its Income Statement. Under-collection has been included in total revenue for RIN purposes to align to MAR. Reconciliation to the Regulatory Financial Statements has been provided below:

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Total Revenue per Regulatory Financial Statements	868,391.554
Under-collected Revenue	87,863.146
Total Revenue reported in RIN	956,257.700

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[3] Australian Energy Regulator (2013a). pp.6, 12.

Table: 3.1.2 Revenue Grouping by type of connected equipment

Variable: TREV0201 – From Other connected transmission networks
TREV0202 – From Distribution networks
TREV0203 – From Directly connected end–users
TREV0204 – From Generators
TREV0205 – Other revenue

RIN Requirements

This section has been completed in accordance with chapter 2, section 2.1 of the Benchmarking RIN Instructions and Definitions.

Consistent with the RIN requirements[4], unless stated otherwise all amounts reported reconcile to the Prescribed Transmission Services revenues reported in the Income Statement forming part of Powerlink's Regulatory Financial Statements. In instances where a difference exists an explanation and reconciliation has been provided.

Table 3.1.2 has been populated with actual data.

Source

All financial information required to complete this table was sourced from Powerlink's Grid Revenue Billing System.

Methodology and Assumptions

Powerlink has prepared its response using actual information contained in its Grid Revenue Billing System.

Variables	Assumptions / Data Source
TREV0201	***Other connected transmission networks –*** Under the current TUOS pricing arrangements, Powerlink does not earn revenue from Other Connected Transmission Networks. As permitted under the RIN[5], Powerlink has therefore included a value of zero in these cells.
TREV0202	***Distribution networks –*** sourced from Powerlink's Grid Revenue Billing System.
TREV0203	***Total revenue from directly connected end users –*** sourced from Powerlink's Grid Revenue Billing System.
TREV0204	***Generators –*** sourced from Powerlink's Grid Revenue Billing System.
TREV0205	***Other Revenue –*** sourced from the following: - Intra and Inter Regional Settlements Residues (IRSR); - Over/under collections; and - Other Revenue.

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[4] Australian Energy Regulator (2013a). p.6.
[5] Australian Energy Regulator (2013a). pp.6, 12.

Table: 3.1.3 Revenue (penalties) allowed (deducted) through incentive schemes

Variable: TREV0301 – EBSS
*   TREV0302 – STPIS*
*   TREV0303 – Other*

RIN Requirements

This section has been completed in accordance with chapter 2, section 2.1 of the Benchmarking RIN Instructions and Definitions.

Table 3.1.3 has been populated with actual data.

Source

The EBSS data was obtained from the AER's Final Decision on Powerlink's Transmission Determination 2012/13 to 2016/17 (April 2012).

The STPIS data was obtained from the AER's notification of the approval of Powerlink's performance against the service target performance incentive scheme for each calendar year.

Methodology and assumptions

Variables	Assumptions/Source
TREV0301	***EBSS*** – obtained from the AER Final Decision for Powerlink (April 2012).
TREV0302	***STPIS*** – sourced from the AER's annual notification of Powerlink's approved performance against STPIS. As required under the RIN, figures reflect the year in which the incentive applied to Powerlink's revenues[6].
TREV0303	***Other*** – no other revenue (penalties) allowed (deducted) through incentive schemes to be reported. As permitted under the RIN[7], Powerlink has therefore included a value of zero in these cells consistent with RIN requirements.

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[6] Australian Energy Regulator (2013a). p.13.
[7] Australian Energy Regulator (2013a). pp.6, 12.

Sheet: 3.2 Opex

Table: 3.2.1 Opex Categories

Sub-table: 3.2.1.1 Current opex categories and cost allocations

Variable: *TOPEX0101A - Field Maintenance - Routine*
TOPEX0102A - Field Maintenance - Condition-based
TOPEX0103A - Field Maintenance - Corrective
TOPEX0104A - Maintenance Support
TOPEX0105A - Refurbishment
TOPEX0106A - Insurance Premiums
TOPEX0107A - Self Insurance
TOPEX0108A - Network Operations
TOPEX0109A - Asset Management Support
TOPEX0110A - Corporate Support
TOPEX0111A - Revenue Reset
TOPEX0112A - Debt Management Costs
TOPEX0113A - Grid Support
TOPEX0114A - Depreciation
TOPEX0115A - Net Loss on Disposal of Property, Plant & Equipment

RIN requirements

This section has been completed in accordance with chapter 3, section 3.1 of the Benchmarking RIN Instructions and Definitions.

Consistent with the RIN requirements, unless stated otherwise all amounts reported reconcile to the Prescribed Transmission Services expenditure reported in the Income Statement and/or supporting schedules forming part of Powerlink's Regulatory Financial Statements. In instances where a difference exists an explanation has been provided.

Table 3.2.1.1 has been populated with actual data.

Source

All financial information was sourced from the Historic Opex by Expenditure Category schedule that forms part of the Regulatory Financial Statements submitted to the AER annually.

Methodology and Assumptions

The Historic Opex by Expenditure Category schedule in the Regulatory Financial Statements contains a greater level of detail on the Opex activities than that reported in the Income Statement and as such has been used to populate this table.

Sub-table: 3.2.1.2 Historical opex categories and cost allocations

RIN requirements

There has been no change in Powerlink's costing methodology, basis of preparation for its Regulatory Financial Statements or response to the Information Guidelines since the last

Economic Benchmarking RIN. Therefore, the historic opex categories information is a replication from the current opex categories table.

For further details refer to section 3.2.

Table: 3.2.3 Provisions

Variable: TOPEX0301 – The carrying amount at the beginning of the period
TOPEX0302-0304 – Increases to the provision
TOPEX0305-0307 – Amounts used (that is, incurred and charged against the provision) during the period
TOPEX0308-0310 – Unused amounts reversed during the period
TOPEX0311-0313 – The increase during the period in the discounted amount arising from the passage of time and the effect of any change in the discount rate
TOPEX0314 – The carrying amount at the end of the period

<u>RIN requirements</u>

This section has been completed in accordance with chapter 3, section 3.1 of the Benchmarking RIN Instructions and Definitions.

Consistent with the RIN requirements[8], unless stated otherwise all opening and closing amounts reported reconcile to the Balance Sheet forming part of the Regulatory Financial Statements. In instances where a difference exists an explanation and reconciliation has been provided.

Table 3.2 has been populated with actual and estimated data. Estimated data has been disaggregated as described in the *Methodology and Assumptions* section below.

<u>Source</u>

All financial information required to complete this table was sourced from Powerlink's Statutory and Regulatory Financial Statements, Payroll reports and general ledger. In instances where a difference exists an explanation and reconciliation has been provided.

<u>Methodology and assumptions</u>

The methodologies utilised to disaggregate the provision balances between Regulated and Non-Regulated and Opex and Capex are detailed below. In instances where the disaggregation ratio differs from the previous year the opening balance has been amended to reflect the ratio for the current reporting year. This has resulted in instances of the closing balance for the previously reported year differing from the opening balance for the current reporting year. This approach ensures that the movement in the provision balances is preserved for the purposes of the RIN reporting.

Employee Entitlements
Powerlink has utilised the labour time charged to Regulated and Non-Regulated activities to disaggregate the Employee Entitlements provisions between Regulated and Non-Regulated activities. The Regulated provision balances were then apportioned between Opex and Capex based on the labour time charged to Opex and Capex activities.

The opening balance for 2014/15 differs from the closing balance reported in Powerlink's Economic Benchmarking RIN response for previous years due to the change in the disaggregation ratio discussed previously.

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[8] Australian Energy Regulator (2013a). p.18.

For line items *TOPEX0311A & TOPEX0313A "the increase during the period in the discounted amount arising from the passage of time and the effect of any change in the discount rate",* Powerlink has used the financial impact of the statutory adjustment as required by Australian Accounting Standards as the basis of reporting.

Others
Other Provisions include the Organisation Restructure provision which relate only to Regulated Opex.

Dividends
The provision for Dividends has been allocated between Regulated and Non-Regulated in accordance with the apportionment of Powerlink's fixed asset base as reported in the Regulatory Financial Statements disaggregated Balance Sheet for each financial year submitted to the AER.

Sheet: 3.3 Assets (RAB)

Table: 3.3.1 Regulatory Asset Base Values

Variable:
TRAB0101 – Opening value
TRAB0102 – Inflation addition
TRAB0103 – Straight line depreciation
TRAB0104 – Regulatory depreciation
TRAB0105 – Actual additions (recognised in RAB)
TRAB0106 – Disposals
TRAB0107 – Closing value for asset value

RIN requirements

This section has been completed in accordance with chapter 4 of the Benchmarking RIN Definitions and Instructions.

Consistent with the RIN requirements[9], unless stated otherwise all amounts reported reconcile to the final Roll Forward Model (RFM) used to establish Powerlink's Regulatory Asset base for each of the relevant regulatory periods and the Regulatory Financial Statements submitted to the AER annually. In instances where a difference exists an explanation and reconciliation has been provided.

Source

Table 3.3.1 has been populated with actual data for additions and disposals. Other variables have been populated with information calculated using information from the regulatory financial statements submitted to the AER annually.

Methodology and assumptions

Powerlink used the RFM for the period 2008 – 2012 as a base to create a model for the regulatory period commencing 2012/13 and refreshed all necessary fields to allow the model to function for the next regulatory period. The RFM has been originally designed to cater for "RAB as incurred" but the Economic Benchmarking Regulatory Information Notice ("EB RIN") requires "RAB as commissioned" information. Powerlink has therefore added functionality to the model to enable it to be rolled forward on a "RAB as commissioned" basis.

In re-categorising the substation land assets Powerlink reviewed its land assets and aligned them to the RIN requirements based on actual usage.

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[9] Australian Energy Regulator (2013a). p.20.

Table: **3.3.2 Asset value roll forward**

Variable: *TRAB0201, 0301, 0401, 0501, 0601 & 0701 – Opening value*
TRAB0202, 0302, 0402, 0502, 0602 & 0702 – Inflation addition
TRAB0203, 0303, 0403, 0503, 0603 & 0703 – Straight line depreciation
TRAB0204, 0304, 0404, 0504, 0604 & 0704 – Regulatory depreciation
TRAB0205, 0305, 0405, 0505, 0605 & 0705 – Actual additions (recognised in RAB)
TRAB0206, 0306, 0406, 0506, 0606 & 0706 – Disposals
TRAB0207, 0307, 0407, 0507, 0607 & 0707– Closing value for asset value

RIN requirements

This section has been completed in accordance with chapter 4 of the Benchmarking RIN Definitions and Instructions.

Table 3.3.2 has been populated with actual data for additions and disposals. Other variables have been populated with information calculated using the functionality contained within the AER's RFM.

Source

All information required to complete this table was sourced from a Roll Forward Model (RFM)[10]. Powerlink used the RFM for the period 2008 – 2012 as a base to create a fresh model for the regulatory period commencing 2012/13.

Methodology and assumptions

The underlying methodology and resulting financial information used to populate Table 3.3.1 has formed the base to complete Table 3.3.2

Asset categories used by Powerlink differ from those required to complete Table 3.3.2. As such Powerlink has used the following matrix to align to the RIN requirements:

EB RIN template categories	Powerlink's categories	Assumptions
Overhead Transmission Assets	Transmission Lines - Overhead Transmission Lines – Refit	• No assumptions made
Underground Transmission Assets	Transmission Lines – Underground	• No assumptions made
Transmission switchyards, substations	Substations Primary Plant Insurance Spares Substations Secondary Systems Land - Substations	• Insurance Spares are classified in the same way as Substations Primary Plant • Powerlink owned land has been disaggregated into three categories being Substations, Other Purposes and Easements.
Easements	Easements Land - Easements	• Powerlink owned land has been disaggregated into

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[10] See section in relation to Table 3.3.1.

		three categories being Substations, Other Purposes and Easements.
Other Assets with long lives	Commercial Buildings Communications Other Assets Comms - Civil Works Network Switching Centres Land – Other Equity raising costs	• These asset classes have a useful life of more than 10 years • Equity raising costs are recognised as part of the RAB and are amortised over 43 years. • Powerlink owned land has been disaggregated into three categories being Substations, Other Purposes and Easements.
Other Assets with short lives	Computer Equipment Office Furniture & Miscellaneous Office Machines Vehicles Moveable Plant	• These asset classes have a useful life of less than 10 years

Table: **3.3.3 Total disaggregated RAB asset values**

Variable: *TRAB0801 – Overhead transmission assets (wires and towers/poles etc)*
TRAB0802 – Underground transmission assets (cables, ducts etc)
TRAB0803 – Substations, switchyards, transformers etc with transmission functions
TRAB0804 – Easements
TRAB0805 – Other assets with long lives (please specify)
TRAB0806 – Other assets with short lives (please specify)

RIN requirements

This section has been completed in accordance with chapter 4 of the Benchmarking RIN Definitions and Instructions.

Table 3.3.3 has been populated with the information from the preceding Tables 3.3.1 and 3.3.2.

Source

This table was completed using an average formula of the Opening and Closing values of each category in Table 3.3.2[11].

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[11] Australian Energy Regulator (2013a). p.22.

Table: **3.3.4 Asset Lives**

Sub-table: **3.3.4.1Asset lives – estimated service life of new assets**

Variable: *TRAB0901 – Overhead transmission assets (wires and towers/poles etc)*
      TRAB0902 – Underground transmission assets (cables, ducts etc)
      TRAB0903 – Switchyards, substations and transformer assets
      TRAB0904 – Other assets with long lives (please specify)
      TRAB0905 – Other assets with short lives (please specify)

RIN requirements

This section has been completed in accordance with Chapter 4 of the Benchmarking RIN Definitions and Instructions.

Table 3.3.4.1 has been populated with estimated data.

Source

This table was completed using outputs from the Regulated RFM.

Methodology and assumptions

Consistent with the RIN requirements[12] the weighted average calculation was used and the following assumptions were made:

1) Land and Easements do not have a definite useful life and therefore were excluded from the weighted average calculations.

2) In the weighted average asset life calculation provided in the template Powerlink used the following figures:

EB RIN Requirements	Assumptions
n is the number of assets in category j	Individual asset information is not available within the Regulated RFM, as such Powerlink has substituted the number of asset classes within a category for n
$X_{i,j}$ is the value of asset i in category j	The Nominal Opening Regulatory Asset Base values calculated from the Regulated RFM were used for $X_{i,j}$
$EL_{i,j}$ is the expected life of asset i in category j	The expected useful lives as contained in the Regulatory RFM per asset class were used for $EL_{i,j}$
RC_j is the sum of the value of all assets in category j	No assumptions

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[12] Australian Energy Regulator (2013a). p.22.

Sub-table: 3.3.4.2 Asset lives – estimated residual service life

Variable: TRAB1001 – Overhead transmission assets (wires and towers/poles etc)
TRAB1002 – Underground transmission assets (cables, ducts etc)
TRAB1003 – Switchyards, substations and transformer assets
TRAB1004 – Other assets with long lives (please specify)
TRAB1005 – Other assets with short lives (please specify)

RIN requirements

This section has been completed in accordance with Chapter 4 of the Benchmarking RIN Definitions and Instructions.

Table 3.3.4.2 has been populated with estimated data.

Source

This table was completed using data from Powerlink's Enterprise Resource Planning (ERP) system, SAP, and outputs from the Regulated RFM.

Methodology and assumptions

Estimated residual service life is based on an estimate of the average expended life of each type of asset. This is then subtracted from the corresponding estimated service life of new assets (variables TRAB0901 – TRAB0905) to derive the estimated residual service life.

Why an estimate is required

It is not possible to provide actual data on the residual service life of assets. The actual service life will not be determined until an asset is finally removed from service at the end of its life. While a new asset might be expected to achieve a certain operating life when it is first placed into service, it will be subject to the vagaries of the operating environment in which it is placed and the operating stresses to which it is subjected. The AER has recognised this in the RIN Instructions and Definitions when it has directed Powerlink to report "a current estimation" of the residual service life[13].

How the data was estimated

The method for estimating the average expended life of each type of asset is set out below:

Variables TRAB1001 – TRAB1003
The historical record of the year in which each type of asset was installed was sourced from SAP. A volume weighted average age, based on the count of the number of assets, was then determined for each regulatory year. For example, if there is one substation asset that is one year old, and three assets that are five year old the average age of substation assets is $((1 \times 1) + (3 \times 5)) / (3 + 1) = 4$ years. If the estimated service life of new substation assets is 40 years then the estimated residual life of these substation assets is $40 - 4 = 36$ years.

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[13] Australian Energy Regulator (2013a). p.23.

The specific physical equipment that comprises the count of assets for each variable is:

- TRAB1001 Overhead transmission assets – transmission towers;
- TRAB1002 Underground transmission assets – underground cable sections; and
- TRAB1003 Switchyard, substation and transformer assets – substation switchbays

Variable TRAB1004 – TRAB1005

The individual assets included in these variables are significantly more diverse than the individual assets in the other variables. For this reason a simple count of asset or equipment numbers is not appropriate and an asset value ($'s) weighted average approach has been adopted.

Asset values and an estimated remaining life for the start of the analysis were sourced from the Regulated RFM. For each subsequent year the existing assets were rolled forward and 'aged' by one year and any increase in asset value was assumed to have the estimated service life of the corresponding asset type (ie. variables TRAB0904 – TRAB0905). From this a dollar-weighted average age was determined.

Sheet: 3.4. Operational data

Table: 3.4.1 Energy delivery

Variables: TOPED0101, TOPED0102, TOPED0103, TOPED0104, TOPED0105, TOPED0106, TOPED0107, TOPED0108, TOPED0109, TOPED0110, TOPED0111, TOPED0112, TOPED0113 - Energy Grouping by Downstream Connection type

<u>RIN Requirements</u>

This section has been completed in accordance with chapter 5, section 5.1 of the Economic Benchmarking RIN Instructions and Definitions. At each settlement location for transmission networks (TOPED0101), distribution networks (TOPED0102),directly connected end-users (TOPED0103 to TOPED0112) and pumping and power station auxiliaries (TOPEDO113), customers' energy values are recorded.

Table 3.4.1 has been populated with actual data.

<u>Source</u>

These recordings are stored in Powerlink's metering database, known as LoadDB, as half hour average demands for each connection point, expressed in MW. As required under the Rules:

- Data for TOPED0101 - TOPED0113 has been provided by registered Meter Data Providers (MDPs) [14].

<u>Methodology and assumptions</u>

Numbers provided have been processed from raw meter data and are the sum of half hour average MW demands recorded for all connection points over the year. This is then divided by two thousand in order to give a net GWh energy total for each of the variables.

Energy delivered to other connected transmission networks (variable TOPED0101) is calculated as the sum of the absolute value of all energy transfers. That is, gross exported energy plus gross imported energy.

Energy delivered to pumping and Power Station Auxiliaries (variable TOPED0113) is calculated using only connection points whose auxiliary supply is metered separately from its primary generation connection, ie. excludes connection points where generation and auxiliary supply is measured on the same meter or the auxiliary supply is measured downstream from an already metered connection point.

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[14] Australian Energy Market Commission, National Electricity Rules, Version 60, January 2014, clause 7.2.5 (c1).

Table: 3.4.2 Connection points

Variables: TOPCP0101 to TOPCP0111 - Number of entry points at each transmission voltage level

<u>RIN Requirements</u>

This section has been completed in accordance with chapter 5, section 5.1 of the Economic Benchmarking RIN Instructions and Definitions. Further context is provided by reference to chapter 6 of the *Better Regulation Explanatory Statement: Regulatory Information Notices to Collect Information for Economic Benchmarking* ('the Economic Benchmarking Explanatory Statement').

The Economic Benchmarking RIN Instructions and Definitions require that:

> Connection point numbers must be reported as the average of connection point numbers in the relevant Regulatory Year under system normal conditions. The average is calculated as the average of the number of connection points on the first day of the Regulatory Year and on the last day of the Regulatory Year.[15]

The AER has clarified that:

> The purpose of our connection point variables is to provide an indicator of the requirements for transmission services a TNSP has to provide at connection points. These services are a necessary part of maintaining the quality, reliability and security of supply.[16]

For these variables, Table 3.4.2 has been populated with actual data. Powerlink has populated four variables in this table for the following voltage levels:

- TOPCP0102: 330 kV
- TOPCP0103: 275 kV
- TOPCP0105: 132 kV
- TOPCP0106: 110 kV

<u>Source</u>

For calculating the number of entry points, Powerlink has used AEMO's List of Regional Boundaries and Marginal Loss Factors report that is published for each financial year[17]. This report documents a marginal loss factor (MLF) for each transmission connected generator in the NEM.

<u>Methodology and assumptions</u>

The number of entry points at the end of a regulatory year has been calculated using the number of unique Transmission Node Identifier (TNI) Codes for Queensland transmission connected generators listed in Appendix A of AEMO's annual List of Regional Boundaries and Marginal Loss Factors report (MLF Report), with the following exceptions:

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[15] Australian Energy Regulator (2013a). p.24.

[16] Australian Energy Regulator (2013b). Better Regulation Explanatory Statement, Regulatory Information Notices to Collect Information for Economic Benchmarking, November, p.40.

[17] Available at: http://www.aemo.com.au/Electricity/Market-Operations/Loss-Factors-and-Regional-Boundaries/List-of-Regional-Boundaries-and-Marginal-Loss-Factors-for-the-2014-2015-Financial-Year. Prior to 1 July 2009 this was reported by NEMMCO.

- Where separate commercial entities share a single TNI Code, the separate commercial entities are counted as separate entry points. For example, Braemar Power Station, Braemar Stage 2 Power Station and Darling Downs Power Station all share the TNI Code of QBRA but are counted as three entry points.
- Where power station auxiliary load connections have a TNI Code different from the generating units they support, they are counted as a single entry point. For example, Collinsville PS and Collinsville PS Load have distinct TNI Codes (QCVP and QCVX) but are counted as only one entry point.
- Generating units not connected to Powerlink assets are not counted – for example, Mackay GT connects to the Ergon 33kV bus and is not counted as an entry point.
- Wivenhoe Pumps are not counted separately from Wivenhoe Generation.

The number of entry points at a voltage level in a given regulatory year is taken as the average of:

- The number of entry points at that voltage level determined from the AEMO MLF Report for that regulatory year; and
- The number of entry points at that voltage level determined from the AEMO MLF Report for the previous regulatory year.

Variables: TOPCP0201 to TOPCP0212 - Number of exit points at each transmission voltage level

RIN Requirements

This section has been completed in accordance with chapter 5, section 5.1 of the Economic Benchmarking RIN Instructions and Definitions. Further context is provided by reference to chapter 6 of the Economic Benchmarking Explanatory Statement. Consistent with subsequent instructions issued by the AER, Powerlink has also reported interconnectors as exit points in Table 3.4.2 and not as entry points[18]. Consistent with the AER's approach, prescribed and non-prescribed connection points are included.

Consistent with the requirements in relation to entry points, the Economic Benchmarking RIN Instructions and Definitions requires that:

> Connection point numbers must be reported as the average of connection point numbers in the relevant Regulatory Year under system normal conditions. The average is calculated as the average of the number of connection points on the first day of the Regulatory Year and on the last day of the Regulatory Year.[19]

For these variables, Table 3.4.2 has been populated with actual data. Powerlink has populated eight variables in this table for the following voltage levels:
- TOPCP0202: 330 kV
- TOPCP0203: 275 kV
- TOPCP0205: 132 kV
- TOPCP0206: 110 kV
- TOPCP0207: 66 kV
- TOPCP0209: 33 kV
- TOPCP0210: 22 kV
- TOPCP0211: 11 kV.

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[18] E-mail from AER, EBT RIN – interconnectors and connection point numbers, 12 February 2014.
[19] Australian Energy Regulator (2013a). p.24.

<u>Source</u>

For calculating the number of exit points at the end of a regulatory year Powerlink has used AEMO's annual List of Regional Boundaries and Marginal Loss Factors report, which documents a MLF for each transmission connected load point in the NEM in that regulatory year. As noted above, the AER has stipulated that interconnectors must also be treated as exit points.

<u>Methodology and assumptions</u>

The number of exit points has been calculated as the number of unique TNI Codes for Queensland transmission connected load points listed in Appendix A of AEMO's annual List of Regional Boundaries and Marginal Loss Factors report, with the following exceptions:

- Where separate TNI Codes have been created under the one location to facilitate Full Retail Contestability (where that location may have formerly had a single TNI code), this is still counted as a single exit point. For example, in the 2006/07 report the TNI Code for Woolooga 132kV (QWLG) was replaced with Woolooga Energex (QWLG) and Woolooga Ergon Energy (QWLN).
- Wivenhoe Pumps are not counted as an exit point. The Wivenhoe Power Station connection is already counted as an entry point.
- The QNI and Terranora interconnectors are included as additional exit points.

The number of exit points at a voltage level in a given regulatory year is taken as the average of:

- The number of exit points at that voltage level determined from the AEMO MLF Report for that regulatory year; and
- The number of exit points at that voltage level determined from the AEMO MLF Report for the previous regulatory year.

Table: 3.4.3 System Demand

Sub-table: 3.4.3.1 Annual system maximum demand characteristics – MW measure

Variable: *TOPSD0101 - Transmission system coincident maximum demand (MW)*

RIN Requirements

This section has been completed in accordance with chapter 5, section 5.1 of the Economic Benchmarking RIN Instructions and Definitions. The definition of Transmission System Coincident Maximum Demand set out in chapter 9 of the Economic Benchmarking RIN Instructions and Definitions has been applied.

For this variable, Table 3.4.3.1 has been populated with actual data.

Source

The variable has been populated with actual information from the same source used for variables in Table 3.4.1 (Energy Delivery).

Methodology and assumptions

The reported value is the build-up of two major components:

- the summation of the actual unadjusted (i.e. not weather normalised) MW demands at Powerlink's downstream connection and supply locations at the time when this summation is greatest; and
- any export at the time of the coincident maximum for each interconnector (consistent with the definition set out in chapter 9 of the Economic Benchmarking RIN Instructions and Definitions).

Variable: *TOPSD0102 - Transmission System coincident weather adjusted maximum demand 10% POE (MW)*

RIN Requirements

This section has been completed in accordance with the definition of Transmission System Coincident Weather Adjusted Maximum Demand 10% POE set out in chapter 9 of the Economic Benchmarking RIN Instructions and Definitions.

For this variable, Table 3.4.3.1 has been populated with estimated data. While this variable is based on actual data, being the non-weather adjusted maximum demand, it is also materially dependent on judgments and assumptions in developing the methodology for weather adjustment. As a result, Powerlink considers this data to be estimated.

Source

Powerlink has collected the 50% POE and 10% POE weather correction data, which was developed for the 2015 TAPR. The variable has therefore been populated based on

temperature corrected data developed for Powerlink's 2015 TAPR[20], along with actual information from the variable Transmission System coincident maximum demand (TOPSD0101).

Methodology and assumptions

The 10% POE coincident weather adjusted maximum demand was calculated using similar statistical calculations to the 50% POE coincident weather adjusted maximum demand, which was reported in Powerlink's 2015 TAPR[2022].

The difference between 10% POE weather corrected and uncorrected native state peak demand has been added to the variable 'Transmission system coincident maximum demand' (TOPSD0101).

Variable: TOPSD0103 - Transmission System coincident weather adjusted maximum demand 50% POE (MW)

RIN Requirements

This section has been completed in accordance with the definition of Transmission System Coincident Weather Adjusted Maximum Demand 50% POE set out in chapter 9 of the Economic Benchmarking RIN Instructions and Definitions.

For this variable, Table 3.4.3.1 has been populated with estimated data. While this variable is based on actual data, being the non-weather adjusted maximum demand, it is also materially dependent on judgments and assumptions in developing the methodology for weather adjustment. As there is no independent means of verifying the correctness or otherwise of historical weather adjustment Powerlink considers this variable will remain as estimated data in the future.

Source

Powerlink had collected the data for a 50% POE weather correction within their Transmission Annual Planning Report (TAPR). The variable has therefore been populated based on temperature corrected data reported in Powerlink's 2015 TAPR[21], along with actual information from the variable Transmission System coincident maximum demand (TOPSD0101).

Methodology and assumptions

To report a delivered value for Transmission System coincident weather adjusted maximum demand 50% POE, the difference between the 50% POE weather corrected and uncorrected native state peak demand reported in the 2015 TAPR has been added to the Transmission System coincident maximum demand reported in TOPSD0101.

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[20] Refer:
http://www.powerlink.com.au/About_Powerlink/Publications/Transmission_Annual_Planning_Reports/Transmission_Annual_Planning_Report_2015.aspx, Table 2.7, p.31.
[21] Refer:
http://www.powerlink.com.au/About_Powerlink/Publications/Transmission_Annual_Planning_Reports/Transmission_Annual_Planning_Report_2015.aspx, Table 2.7, p.31.

Variable: *TOPSD0104 - Transmission system non-coincident summated maximum*
                 demand (MW)

<u>RIN Requirements</u>

This section has been completed in accordance with chapter 5, section 5.1 of the Economic Benchmarking RIN Instructions and Definitions. The definition of Transmission System Non-Coincident Summated Maximum Demand set out in chapter 9 of the Economic Benchmarking RIN Instructions and Definitions has been applied.

For this variable, Table 3.4.3.1 has been populated with actual data.

<u>Source</u>

The variable has been populated with actual information from the same source used for variables in Table 3.4.1 (Energy Delivery).

<u>Methodology and assumptions</u>

The reported value is the build-up of two major components:

- the actual unadjusted (i.e. not weather normalised) summation of actual MW demands at Powerlink's downstream connection and supply locations irrespective of when they occurred in the year; and
- the highest export value for each interconnector for each year, irrespective of when they occurred (consistent with the definition set out in chapter 9 of the Economic Benchmarking RIN Instructions and Definitions).

Variable: *TOPSD0105 - Transmission System non-coincident weather adjusted*
                 summated maximum demand 10% POE (MW)

<u>RIN Requirements</u>

This section has been completed in accordance with the definition of Transmission System Non-Coincident Weather Adjusted Maximum Demand 10% POE set out in chapter 9 of the Economic Benchmarking RIN Instructions and Definitions.

For this variable, Table 3.4.3.1 has been populated with estimated data. While this variable is based on actual data, being the non-weather adjusted maximum demand, it is also materially dependent on judgments and assumptions in developing the methodology for weather adjustment. As a result, Powerlink considers this data to be estimated.

<u>Source</u>

Non-coincident weather corrected 10% POE demands for Energex and Ergon connection points have been sourced from Energex and Ergon respectively. The connection points that are non-weather dependant have been populated from the same source used for variables in Table 3.4.1 (Energy Delivery).

<u>Methodology and assumptions</u>

Weather correction is only applicable to DNSP connection points, as the large industrial and rail traction loads which connect directly to Powerlink's network are not materially weather-sensitive.

For the non-coincident weather adjusted summated maximum demand, Powerlink has obtained from each DNSP their calculated temperature corrected values at each connection point, as only the DNSPs have the detailed record of downstream outages and load transfers to robustly perform this calculation.

For 10% PoE results, the statistical calculations were set to calculate the temperature correction corresponding to a 10% probability of exceedance

Variable: *TOPSD0106 - Transmission System non-coincident weather adjusted summated maximum demand 50% POE (MW)*

RIN Requirements

This section has been completed in accordance with the definition of Transmission System Non-Coincident Weather Adjusted Maximum Demand 50% POE set out in chapter 9 of the Economic Benchmarking RIN Instructions and Definitions.

For this variable, Table 3.4.3.1 has been populated with estimated data. While this variable is based on actual data, being the non-weather adjusted maximum demand, it is also materially dependent on judgments and assumptions in developing the methodology for weather adjustment. As a result, Powerlink considers this data to be estimated.

Source

Non-coincident weather corrected 50% POE demands for Energex and Ergon connection points have been sourced from Energex and Ergon respectively. The connection points that are non-weather dependant have been populated from the same source used for variables in Table 3.4.1 (Energy Delivery).

Methodology and assumptions

This field was populated as per the variable 'Transmission System non-coincident weather adjusted summated maximum demand 10% POE (MW)', except using adjusted calculations to calculate the temperature correction corresponding to a 50% probability of exceedance.

Sub-table: 3.4.3.2 Annual system maximum demand characteristics – MVA measure

Variable: TOPSD0201 - Transmission system coincident maximum demand (MVA)

RIN Requirements

This section has been completed in accordance with chapter 5, section 5.1 of the Economic Benchmarking RIN Instructions and Definitions. The definition of Transmission System Coincident Maximum Demand set out in chapter 9 of the Economic Benchmarking RIN Instructions and Definitions has been applied.

For this variable, Table 3.4.3.2 has been populated with actual data.

Source

MW and MVAr values were sourced from the same data used for Table 3.4.1 (Energy Delivery) and Sub-table 3.4.3.1 (Annual System Maximum Demand Characteristics – MW measure).

Methodology and assumptions

MVA figures are calculated using MW and MVAr values for each half hour period for each year.

The reported value is a built up of two major components:

- the summation of actual unadjusted (i.e. not weather normalised) MVA demands at Powerlink's downstream connection and supply locations at the time when this summation is greatest; and
- any export at the time of the coincident maximum demand for each interconnector (consistent with the definition set out in chapter 9 of the Economic Benchmarking RIN Instructions and Definitions).

Variable: TOPSD0202 - Transmission System coincident weather adjusted maximum demand 10% POE (MVA)

For this variable, Table 3.4.3.2 has been populated with estimated data. This variable is the summation of the 10% POE weather adjusted coincident MVA maximum demand at each of Powerlink's downstream connection points. Where the 10% POE weather adjusted coincident MVA maximum demand at each connection point is the 10% POE weather adjusted coincident MW maximum demand divided by the power factor at the time of coincident maximum demand.

Variable: TOPSD0203 - Transmission System coincident weather adjusted maximum demand 50% POE (MVA)

For this variable, Table 3.4.3.2 has been populated with estimated data. . This field was populated as per the variable 'Transmission System coincident weather adjusted maximum demand 10% POE (MVA)', except using 50% POE values.

Variable: TOPSD0204 - Transmission system non-coincident summated maximum demand (MVA)

RIN Requirements

This section has been completed in accordance with chapter 5, section 5.1 of the Economic Benchmarking RIN Instructions and Definitions. The definition of Transmission System Non-Coincident Summated Maximum Demand set out in chapter 9 of the Economic Benchmarking RIN Instructions and Definitions has been applied.

For this variable, Table 3.4.3.2 has been populated with actual data.

Source

MVA values were sourced from the same data used to populate variable TOPSD0201 (Transmission System coincident maximum demand).

Methodology and assumptions

The reported value is built up of two major components:

- the actual unadjusted (i.e. not weather normalised) summation of actual MVA demands at Powerlink's downstream connection and supply locations irrespective of when they occurred in the year; and
- the highest export value of each interconnector for each year, irrespective of when they occurred (consistent with the definition set out in chapter 9 of the Economic Benchmarking RIN Instructions and Definitions).

Variable: TOPSD0205 - Transmission System non-coincident weather adjusted summated maximum demand 10% POE (MVA)

For this variable, Table 3.4.3.2 has been populated with estimated data. This variable is the summation of the 10% POE weather adjusted non-coincident MVA maximum demand at each of Powerlink's downstream connection points. Where the 10% POE weather adjusted non-coincident MVA maximum demand at each connection point is the 10% POE weather adjusted non-coincident MW maximum demand divided by the power factor at the time of non-coincident maximum demand.

Variable: TOPSD0206 - Transmission System non-coincident weather adjusted summated maximum demand 50% POE (MVA)

For this variable, Table 3.4.3.2 has been populated with estimated data. This field was populated as per the variable 'Transmission System non-coincident weather adjusted maximum demand 10% POE (MVA)', except using 50% POE values.

RIN Requirements

This section has been completed in accordance with chapter 5, section 5.1 of the Economic Benchmarking RIN Instructions and Definitions.

For this variable, Table 3.4.3.3 has been populated with actual data.

Source

The variable has been populated with actual information from the same source used for variables in Table 3.4.1 (Energy Delivery).

Methodology and assumptions

A revised methodology has been applied for the 2014/2015 year.

Previously, power factor was calculated by dividing:

- variable TOPSD0101 (Transmission System coincident maximum demand – MW); by
- variable TOPSD0201[22] (Transmission System coincident maximum demand – MVA).

Powerlink has adopted a revised approach to calculate the power factor, which now takes account of the phase-angle at each connection point. This provides a better indication of the overall power factor supplied by the transmission system.

$$PF = \frac{\text{MW Coincident Maximum Demand}}{\sqrt{(\text{MW Coincident Maximum Demand})^2 + (\text{MVAr Coincident Maximum Demand})^2}}$$

Where:
- MW Coincident Maximum Demand = a summation of the MW load at each connection point at the time of Transmission System coincident maximum demand. It is calculated in the same manner as TOPSD0101, and uses the same data source, but does not exclude interconnector import.
- MVAr Coincident Maximum Demand = a summation of the MVAr load at each connection point at the time of Transmission System coincident maximum demand. It is calculated in the same manner as MW Coincident Maximum Demand, and uses the same data source.

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[22] As MW is much greater than MVAr at the time of regional coincident MW peak, MW and MVA coincident peaks at a regional level invariably occur at the same time.

Variables: TOPSD0302 to TOPSD0312: Average power factor conversion at each transmission voltage level

RIN Requirements

This section has been completed in accordance with chapter 5, section 5.1 of the Economic Benchmarking RIN Instructions and Definitions.

For these variables, Table 3.4.3.3 has been populated with actual data.

As permitted under the RIN[23], values of zero have been provided for the following variables as Powerlink does not have any lines of this voltage:

- TOPSD0302 (500 kV lines)
- TOPSD0305 (220 kV lines)
- TOPSD0308 (88 kV lines)
- TOPSD0312 (6.6 kV lines).

Source

The variable has been populated with actual information from the same source used for variables in Table 3.4.1 (Energy Delivery).

Methodology and assumptions

Each connection point has been assigned its voltage level as seen at its respective settlement location (as per AEMO's annual List of Regional Boundaries and Marginal Loss Factors report). This is the same voltage classification as for variables TOPCP0201 – TOPCP0212.

Previously, power factor was calculated for each voltage level (variable) by dividing:

- the summated total MW for all connection points of that voltage at the time of coincident maximum demand; by
- the summated total MVA for the same connection points at the same time.

As per TOPSD0301, Powerlink has adopted a revised approach to calculate the power factor, which now takes account of the phase-angle at each connection point. This provides a better indication of the overall power factor supplied by the transmission system.

$$PF = \frac{\text{MW for Voltage at Coincident MD}}{\sqrt{(\text{MW for Voltage at Coincident MD})^2 + (\text{MVAr for Voltage at Coincident MD})^2}}$$

Where:
- MW for Voltage at Coincident MD = a summation of the MW load at each connection point of that voltage, at the time of Transmission System coincident maximum demand. It is calculated in the same manner as TOPSD0101, and uses the same data source, but does not exclude interconnector import.

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[23] Australian Energy Regulator (2013a). p.6.

- MVAr for Voltage at Coincident MD = a summation of the MVAr load at each connection point of that voltage, at the time of Transmission System coincident maximum demand. It is calculated in the same manner as MW for Voltage at Coincident MD, and uses the same data source.

Sheet: **3.5 Physical Assets**

Table: **3.5.1 Transmission System Capacities**

Sub-table: **3.5.1.1 Overhead network length of circuit at each voltage**

Variables: *TPA0101 to TPA0109*

<u>RIN requirements</u>

This sub-table has been completed in accordance with chapter 6, section 6.1 of the Benchmarking RIN Instructions and Definitions.

Table 3.5.1.1 has been populated with actual data.

As permitted under the RIN, zero values have been provided where the voltage information is not applicable.

<u>Source</u>

Information has been sourced from Powerlink's enterprise resource planning database, SAP. All data was prepared using dates "as-commissioned".

<u>Methodology and assumptions</u>

The voltage used for the variable is the "as constructed" voltage.

The RIN template has been populated with data extracted from Powerlink's enterprise resource planning database, SAP. The extraction is based on a list of all prescribed in-service, above ground, built sections[24] and the "as constructed" voltage associated with each built section. Data extracted for each built section includes voltage and circuit length.

Sub-table: **3.5.1.2 Underground cable circuit length at each voltage**

Variables: *TPA0201 to TPA0211*

<u>RIN requirements</u>

This sub-table has been completed in accordance with chapter 6, section 6.1 of the Benchmarking RIN Instructions and Definitions.

Table 3.5.1.2 has been populated with actual data.

As permitted under the RIN, zero values have been provided where the voltage information is not applicable.

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[24] Powerlink uses "built sections" as the basic building block against which transmission line circuit and easement information is recorded. A "built section" is defined as a collection of structures, conductors and easements with common characteristics as listed in SAP.

<u>Source</u>

This data has been sourced from Powerlink's enterprise resource planning database, SAP.

<u>Methodology and assumptions</u>

The voltage used for the variable is the "as constructed" voltage.

The RIN templates have been populated with data extracted from Powerlink's enterprise resource planning database, SAP. The extraction is based on a list of all prescribed in-service, underground, built sections[25]and the "as constructed" voltage associated with each built section. Data extracted for each built section includes voltage and circuit length.

Sub-table: 3.5.1.3 Estimated overhead network weighted average MVA capacity by voltage class

Variables: TPA0301 to TPA0312

<u>RIN requirements</u>

This sub-table has been completed in accordance with chapter 6, section 6.1 of the Benchmarking RIN Instructions and Definitions.

Table 3.5.1.3 has been populated with actual data.

<u>Source</u>

The data is sourced from Powerlink's internal ratings database, the Transmission Network Database (TNDB) and Powerlink's enterprise resource planning database, SAP. The TNDB is used as the source for loading Powerlink's Energy Management System with ratings information for operating the transmission network.

<u>Methodology and assumptions</u>

For actual summer normal MVA capacity by voltage data, corresponding ratings data was extracted from TNDB. SAP was used to source the length of the transmission lines in kilometres. The summer weighted MVA was derived by multiplying total circuit kilometres by summer normal MVA. For each voltage class the sum of the Summer Weighted MVA was divided by the sum of the total circuit kilometres to arrive at the Weighted Average MVA capacity.

Powerlink's ratings database records information on system voltage, not rated voltage. Normal summer ratings have been provided in the templates in accordance with section 6.1 of the Benchmarking RIN Instructions and Definitions[26] as Powerlink's transmission network experiences its maximum demand during summer.

The thermal ratings used are based on the summer normal thermal limits applied to individual lines/cables which is the maximum that would be permitted under normal operating conditions. Transient and voltage stability limits are managed from a system perspective, rather than on individual line/cable, with constraint equations applied to different

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[25] Ibid.
[26] Australian Energy Regulator (2013a). p.26.

grid sections, consisting of many lines at different voltages, of the system which may introduce limitations on thermal ratings.

Sub-table: 3.5.1.4 Estimated underground network weighted average MVA capacity by voltage class

Variables: TPA0401 to TPA0411

RIN requirements

This sub-table has been completed in accordance with chapter 6, section 6.1 of the Benchmarking RIN Instructions and Definitions.

Table 3.5.1.4 has been populated with actual data.

Source

The data is sourced from Powerlink's internal ratings database (TNDB). This database is used as the source for loading Powerlink's Energy Management System with ratings information for operating the transmission network.

Methodology and assumptions

For actual MVA capacity by voltage data, corresponding ratings data was extracted from TNDB including total circuit kilometres and summer normal MVA. The summer weighted MVA was derived by multiplying total circuit kilometres by summer normal MVA. For each voltage class the sum of the summer weighted MVA was divided by the sum of the total circuit kilometres to arrive at the weighted average MVA capacity.

Powerlink's ratings database records information on system voltage, not rated voltage. Normal summer ratings have been provided in the templates in accordance with section 6.1 of the Benchmarking RIN Instructions and Definitions[27], as Powerlink's transmission network experiences its maximum demand during summer.

Powerlink's ratings database records information on system voltage, not rated voltage.

Sub-table: 3.5.1.5 Installed transmission system transformer capacity

Variables: TPA0501, TPA0502, TPA0503

RIN requirements

This sub-table has been completed in accordance with chapter 6, section 6.1 of the Benchmarking RIN Instructions and Definitions.

Table 3.5.1.5 has been populated with estimated data.

Source

The data has been sourced directly from Powerlink's corporate enterprise resource planning database, SAP.

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[27] Australian Energy Regulator (2013a). p.26.

<u>Why an estimate is required</u>

Unlike some other jurisdictions, where the TNSP generally connects directly to the DNSP busbar, the Queensland network has a large number of instances where DNSPs take supply from Powerlink at 132kV or 110kV. The DNSPs then own the 132kV or 110kV feeders that supply the DNSPs remote substation. In other instances an end-user will take supply from a Powerlink 132kV busbar to their own remote substation either via feeders owned by the end-user or by Powerlink owned feeders that provide non-regulated services. As a result Powerlink has previously reported quite a low capacity for variable TPA0502 compared to the maximum demand supplied through the Powerlink network.

To compensate for this characteristic of the industry in Queensland Powerlink has developed a methodology to reallocate a proportion of the transformer capacity in variable TPA0501 to variables TPA0502 and TPA0503 to reflect the proportion of this upstream capacity that is used to supply DNSPs and other end-users at voltages below 275kV. This methodology has been developed to ensure that there is no double counting of this reallocated capacity with capacity that would already be reported under variable TPA0502 and TPA0503.

<u>How the estimate was produced</u>

A list of Powerlink owned transformer equipment records, associated commissioning and decommissioning dates, and capacity information was extracted for each power transformer from SAP. For each transformer in the list, Powerlink used its high voltage system operating diagrams to identify which variable category was appropriate (consistent with Benchmarking RIN Instruction and Definitions, chapter 9[28]).

The key steps in the methodology to calculate the estimate are:

1. Only applies to substations where there is direct transformation from 275kV or higher to 132kV or lower includes 330/132kV, 275/132kV, 275/110kV, and 275/66kV;

2. Limited to 132kV and lower connections only;

3. Consider multiple bus sections as a single electrical bus when the sections are tied together under system normal conditions;

4. Ignore connections of reactive plant at the busbar;

5. Ignore connections to the transformation back to the higher voltage;

6. Ignore connections to generators;

7. Include connections to transformation to a lower voltage;

8. Include connections to feeders to remote substations;

9. For each included connection categorise it as either Powerlink, DNSP or end-user based on the ownership of the equipment at the remote end of the connection – if Powerlink owns the outgoing feeder but it connects to a DNSP / end-user substation then count as a DNSP /end-user connection respectively;

10. Calculate the proportion of the total number of connections that are categorised as DNSP connections and end-user connections;

11. Multiply the total transformer capacity from 275kV or higher to that busbar by the proportion of DNSP connections and the proportion of end-user connections at that busbar;

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[28] Australian Energy Regulator (2013a). p.38.

12. These are the capacities that are reallocated from variable TPA0501 to variables TPA0502 and TPA0503 respectively.

Historic values for TPA0501, TPA0502 & TPA0503 have been calculated based on the ratio of TPA0501, TPA0502 & TPA0503 in 2014/15 and applied to the total transformer capacity previously reported in Powerlink's RIN submissions. These revised values are presented in the table below.

		2006	2007	2008	2009	2010	2011	2012	2013	2014
TPA0501	MVA	6062	6482	7032	8061	8325	8388	8861	9433	9595
TPA0502	MVA	14335	15326	16627	19059	19685	19834	20952	22304	22686
TPA0503	MVA	1341	1434	1556	1784	1842	1856	1961	2087	2123
TPA0504	MVA	2351	2406	2480	2674	2901	2901	3166	3173	3338

Variable: TPA0504 - Transformer capacity for directly connected end–users owned by the end–user

RIN Requirements

This section has been completed in accordance with chapter 6, section 6.1 of the Benchmarking RIN Instructions and Definitions.

For this variable, Table 3.5.1.5 has been populated with an estimate.

Source

The data is sourced from Powerlink's high voltage system operating diagrams.

Why an estimate is required

Estimates are provided as historical data on end-user transformer ratings is not required to operate Powerlink's transmission network and has therefore not been collected.

How the estimate has been produced

Ratings data from Powerlink's high voltage system operating diagrams have been used to develop an estimate.

Powerlink considers that this methodology provides its best estimate for end-user transformer capacity.

Where an end-user has already been allocated a proportion of the capacity of Powerlink's upstream transformer capacity (see Variables TPA0501, TPA0502 and TPA0503) no additional capacity is added to this variable.

Variables: TPA0505 and TPA0506

RIN requirements

This sub-table has been completed in accordance with chapter 6, section 6.1 of the Benchmarking RIN Instructions and Definitions.

Table 3.5.1.5 has been populated with actual data.

<u>Source</u>

The data has been sourced directly from Powerlink's corporate enterprise resource planning database, SAP.

<u>Methodology and assumptions</u>

A list of Powerlink owned transformer equipment records, associated commissioning and decommissioning dates, and capacity information was extracted for each power transformer from SAP. For each transformer in the list, Powerlink used its high voltage system operating diagrams to identify which variable category was appropriate (consistent with Benchmarking RIN Instruction and Definitions, chapter 9[1]).

Since the network connection from Millmerran to Middle Ridge was established in 2004, Powerlink's 330/275kV transformers are embedded within the transmission network and are included as part of variable TPA0501, not TPA0505.

Given the large number of SVC transformers on Powerlink's network, a separate SVC transformer variable category has been included in the RIN template to improve granularity as these transformers do not fit well into the other template variable categories provided.

Sub-table: 3.5.1.6 Cold Spare Capacity

Variable: TPA06

<u>RIN requirements</u>

This sub-table has been completed in accordance with chapter 6, section 6.1 of the Benchmarking RIN Instructions and Definitions.

Table 3.5.1.6 has been populated with actual data.

<u>Source</u>

The data has been sourced directly from Powerlink's corporate enterprise resource planning database, SAP.

<u>Methodology and assumptions</u>

A list of Powerlink-owned transformer equipment records, installation status and capacity information was extracted for each power transformer from SAP to identify the transformers kept as cold spares.

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[1] Australian Energy Regulator (2013a). p.38.

Sheet: 3.6 Quality of Service

Table: 3.6.1 Service Component

Sub-table: 3.6.1.1 Service Parameter 1 – Average Circuit Outage Rate

Variables: *TQS0101 - Lines outage rate - fault*
         TQS0102 - Number of Lines fault outages
         TQS0103 - Number of defined Lines
         TQS0104 - Transformers outage rate - fault
         TQS0105 - Number of Transformer fault outages
         TQS0106 - Number of defined Transformers
         TQS0107 - Reactive plant outage rate - fault
         TQS0108 - Number of Reactive plant fault outages
         TQS0109 - Number of defined Reactive plant
         TQS0110 - Lines outage rate – forced outage
         TQS0111 - Number of Lines forced outages
         TQS0112 - Transformer outage rate – forced outage
         TQS0113 - Number of Transformers forced outages
         TQS0114 - Reactive plant outage rate – forced outage
         TQS0115 - Number of Reactive plant forced outages

RIN requirements

This sub-section has been completed in accordance with chapter 7, section 7.1 of the Economic Benchmarking RIN Instructions and Definitions. Section 7.1 states that:

> Quality of services must be reported in accordance with the definitions specified in the December 2012[29] electricity transmission network service providers service target performance incentive scheme (STPIS) documents.[30]

Table 3.6.1.1 has been populated with actual data for calendar year 2014.

For clarification, all data reported in the sheet 3.6 templates on the quality of services, except for the sub-section 3.6.3 System losses, relates to calendar year 2014, consistent with the AER's STPIS reporting periods[31]. The sub-section 3.6.3 System losses relates to financial year 2014/15.

Source

Information has been sourced from Powerlink's internal network operating systems. Powerlink collects, records and maintains defined transmission circuit outage data and transmission circuit counts, consistent with the AER's STPIS. The information provided in this RIN has been prepared using the actual dataset upon which Powerlink's annual STPIS report from calendar year 2014 was based.

Actual data for calendar year 2014 has been used to determine fault outage and forced outage rates.

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[29] This is referred to as Version 4 (V4) of the AER's STPIS.
[30] Australian Energy Regulator (2013a). p.29.
[31] Economic Benchmarking RIN STPIS Variables, email from the AER, 6 December 2013.

Powerlink's historic transmission element outage data has been used as the source for the number of events per annum.

The total number of elements for each reporting year was determined by averaging the number of elements as at 1 January and 31 December of each reporting year.

For clarification, Powerlink is currently subject to Version 3 of the STPIS up to 30 June 2017, and Version 5 of the STPIS will be applied to Powerlink from the next regulatory control period starting 1 July 2017.

Methodology and assumptions

The average circuit outage rate data is based on a calendar year measurement period, for consistency with the AER's STPIS reporting years.

The methodology applied is as follows:

- The AER requires that transmission element outage records exclude any outages of elements as per the STPIS Average element outage rate parameter definition exclusions[32].

- Powerlink has assessed each element outage record against the AER's STPIS V4 criteria for a "fault outage" or "forced outage" using the following approach:

  - A "Fault Outage" is:

    - Any element outage that occurs as a result of unexpected automatic operation of switching devices. That is, the element outage did not occur as a result of intentional manual operation of switching devices.

  - A "Forced Outage" is:

    - Any element outage that occurs as a result of intentional manual operation of switching devices based on the requirement to undertake urgent and unplanned corrective activity where less than 24 hours' notice was given to affected customers and/or AEMO. The notification time is determined by:

      - Time between "Actual Element Outage Start Time" and time advised to affected customers identified by Powerlink's "Application for Work (AFW)[33] Created Time", including
      - Time between "Actual Element Outage Start Time" and time advised to AEMO identified as "AEMO NOS Submit Time[34]",

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[32] Australian Energy Regulator (2012). Final Decision – Electricity Transmission Network Service Providers Service Target Performance Incentive Scheme, December, p22. Note – for clarity, given that the AER's STPIS references to 'circuits' actually comprise various 'elements' (eg. lines, transformers and reactive plant), Powerlink has referred to these as 'elements' in this document.
[33] An Application for Work (AFW) is an internal Powerlink document which is created for all planned works associated with Powerlink plant and equipment.
[34] In AEMO's NOS system, Powerlink submits notification of outage and the submitted time is recorded.

- The actual number of *fault* outages per annum and the actual number of element counts were used to calculate the *fault* outage rate for each of the element transmission types – line, transformer and reactive plant.

- The actual number of *forced* outages per annum and the actual number of element counts were used to calculate the *forced* outage rate for each of the element transmission types – line, transformer and reactive plant.

Sub-table: 3.6.1.2 Service Parameter 2 – Loss of Supply Event Frequency

Variables: *TQS0117 - Number of events greater than 0.1 system minutes per annum*
                TQS0130 - Number of events greater than 0.75 system minutes per annum

RIN requirements

This sub-section has been completed in accordance with chapter 7, section 7.1 of the Economic Benchmarking RIN Instructions and Definitions. Section 7.1 states that:

> Quality of services must be reported in accordance with the definitions specified in the December 2012 electricity transmission network service providers service target performance incentive scheme (STPIS) documents.[35]

Table 3.6.1.2 has been populated with actual data for calendar year 2014.

Source

Information has been sourced from Powerlink's internal network operating systems. Powerlink collects, records and maintains defined transmission circuit outage data and transmission circuit counts, consistent with the AER's STPIS. The information provided in this RIN has been prepared using the actual dataset upon which Powerlink's annual STPIS report from calendar year 2014 was based.

Powerlink's historic transmission circuit outage data has been used as the source for the number of events per annum.

For clarification, Powerlink is currently subject to Version 3 of the STPIS up to 30 June 2017, and Version 5 of the STPIS will be applied to Powerlink from the next regulatory control period starting 1 July 2017.

The loss of supply event records have been used as the source for the loss of supply event duration and event counts.

Methodology and assumptions

The methodology applied is as follows:

- The AER requires that loss of supply event records exclude any outages of circuits as per the STPIS Loss of supply event frequency parameter definition exclusions[36].

- Each loss of supply event record contains a "System Minutes Lost" value. If the value of "System Minutes Lost" of any loss of supply event exceeds the "x system minute" and/or "y system minute" thresholds, then a count of "1" is added to each applicable threshold, indicating one count for the applicable reportable loss of supply event threshold. Powerlink's historic loss of supply event "Number of Events" data were used to count the number of reportable events for each loss of supply event frequency threshold category that is required by the RIN template.

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[35] Australian Energy Regulator (2013a). p.29.
[36] Australian Energy Regulator (2012). p24.

Sub-table: **3.6.1.3 Service Parameter 3 – Average Outage Duration**

Variable: *TQS0118 - Average outage duration*

RIN requirements

This sub-section has been completed in accordance with chapter 7, section 7.1 of the Economic Benchmarking RIN Instructions and Definitions. Section 7.1 states that:

> Quality of services must be reported in accordance with the definitions specified in the December 2012 electricity transmission network service providers service target performance incentive scheme (STPIS) documents.[37]

Table 3.6.1.3 has been populated with actual data for calendar year 2014.

Source

Information has been sourced from Powerlink's internal network operating systems. Powerlink collects, records and maintains defined transmission circuit outage data and transmission circuit counts, consistent with the AER's STPIS. The information provided in this RIN has been prepared using the actual dataset upon which Powerlink's annual STPIS report from calendar year 2014 was based.

Powerlink's historic transmission element outage data has been used as the source for the number of events per annum.

For clarification, Powerlink is currently subject to Version 3 of the STPIS up to 30 June 2017, and Version 5 of the STPIS will be applied to Powerlink from the next regulatory control period starting 1 July 2017.

The loss of supply event records have been used as the source for the loss of supply event duration and event counts.

Methodology and assumptions

The methodology applied is as follows:

- Powerlink's loss of supply event records exclude any outages of elements as per the AER's STPIS Average outage duration parameter definition exclusions[38].

- The loss of supply event data contains "Supply Outage Duration in minutes" data and the longest duration record for each event was used to sum all reportable loss of supply outage event duration times annually. This record was also used to count the number of all reportable loss of supply outage events annually.

- The annual average outage duration was calculated by dividing the cumulative summation of the loss of supply event duration time for the period by the number of loss of supply events.

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[37] Australian Energy Regulator (2013a). p.29.
[38] Australian Energy Regulator (2012). p25.

Variable: TQS0119 - Failure of Protection System

RIN requirements

This sub-section has been completed in accordance with chapter 7, section 7.1 of the Economic Benchmarking RIN Instructions and Definitions. Section 7.1 states that:

> Quality of services must be reported in accordance with the definitions specified in the December 2012 electricity transmission network service providers service target performance incentive scheme (STPIS) documents.[39]

For this variable, Table 3.6.1.4 has been populated with actual data for calendar year 2014.

Source

Information has been sourced from Powerlink's internal network operations systems. Powerlink analyses the performance of protection systems as part of its analysis of unplanned outage events. The performance of the protection systems is recorded with the associated unplanned outage event data.

The unplanned outage event records provided in response to Table 3.6.1.1 of the RIN template were used as the source for the protection system failure event counts.

Methodology and assumptions

The methodology applied for the failure of protection system data is as follows:

- Any recorded failure/s of a protection system in an unplanned outage event record associated with assets that are not providing prescribed transmission services were excluded as per the STPIS Proper operation of equipment parameter definition exclusions[40].

- Any recorded failure/s of a protection system in an unplanned outage event record associated with a force majeure event were excluded as per the STPIS Proper operation of equipment parameter definition exclusions[41].

- As part of Powerlink's unplanned outage event analysis and recording process, the operation of systems providing a protection function to high voltage plant and equipment is analysed and recorded. This protection system operation analysis data was used to identify the protection system failure event counts in accordance with the following definition in the AER's December 2012 STPIS Final Decision:

  - … 'protection system failure events' are those events where the relevant protection equipment does not operate for a fault event as designed or where the relevant equipment operates when there is no relevant fault event.[42]

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[39] Australian Energy Regulator (2013a). p.29.
[40] Australian Energy Regulator (2012). p26.
[41] Australian Energy Regulator (2012). p26.
[42] Australian Energy Regulator (2012).p.26.

- The unplanned outage event records were used to identify the counts of the number of protection system failures for each event.

- Any failure of primary equipment such as circuit breakers to respond to signals sent by protection or control equipment was not counted as a protection system failure event, as per the Failure of protection system parameter exclusions[43].

- The annual number of protection system failure events was calculated by summing the number of protection system failure events for that year identified for the RIN reportable unplanned outage events.

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[43] Australian Energy Regulator (2012). p27.

Variable: *TQS0120 - Material Failure of the Supervisory Control and Data Acquisition (SCADA) System*

RIN requirements

This sub-section has been completed in accordance with chapter 7, section 7.1 of the Economic Benchmarking RIN Instructions and Definitions. Section 7.1 states that:

> Quality of services must be reported in accordance with the definitions specified in the December 2012 electricity transmission network service providers service target performance incentive scheme (STPIS) documents.[44]

For this variable, Table 3.6.1.4 has been populated with actual data for calendar year 2014.

Source

Powerlink receives the SCADA Minutes Lost report from AEMO on a monthly basis. The SCADA Minutes Lost data from AEMO has been used as the source for the SCADA system failure event counts.

Methodology and assumptions

The methodology applied for the material failure of SCADA system data is as follows:

- The SCADA Minutes Lost data from AEMO was used as the source for the material failure of the SCADA system parameter.

- The annual number of SCADA failure events from AEMO's report was counted and used to populate this variable.

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[44] Australian Energy Regulator (2013a). p.29.

Variable: TQS0121 - Incorrect Operation Isolation of Primary or Secondary Equipment Data

RIN requirements

This sub-section has been completed in accordance with chapter 7, section 7.1 of the Economic Benchmarking RIN Instructions and Definitions. Section 7.1 states that:

> Quality of services must be reported in accordance with the definitions specified in the December 2012 electricity transmission network service providers service target performance incentive scheme (STPIS) documents.[45]

For this variable, Table 3.6.1.4 has been populated with actual data for calendar year 2014.

Source

Data has been sourced from Powerlink's internal network operating systems associated with recording the incidence of incorrect operational isolation. The records include:

- The occurrence of incorrect operational isolation resulting in an unplanned outage of the transmission network. Actual records of this type are available for the full period of the RIN requested information; and

- The occurrence of incorrect operational isolation that did *not* result in an unplanned outage of the transmission network. Estimates have been used for the occurrence of incorrect operational isolation not resulting in an unplanned outage of the transmission network for the full period of the RIN requested information.

Methodology and assumptions

The methodology applied for the incorrect operational isolation of primary or secondary equipment data is as follows:

- Powerlink assessed each incorrect operational isolation incident record against the AER's definition below:

  > … 'incorrect operational isolation events' are those events where primary or secondary equipment was not been properly isolated during scheduled or emergency maintenance, irrespective of whether an outage occurred as a result[46].

- Where incorrect operational isolation occurred during primary or secondary isolation sequences, the associated record was included in the count for the number of events.

- The number of incorrect operational isolation events was summated for each year.

Powerlink has entered actual data for calendar year 2014 for incorrect operational isolation of primary or secondary equipment events resulting in an unplanned outage.

Powerlink has entered the actual number of incorrect operational isolation of primary or secondary equipment events that did *not* result in an unplanned outage.

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[45] Australian Energy Regulator (2013a). p.29.
[46] Australian Energy Regulator (2012). p.26.

Table: 3.6.2 Market Impact Component

Variable: *TQS02 - Market Impact Parameter*

RIN requirements

This section has been completed in accordance with chapter 7, section 7.1 of the Economic Benchmarking RIN Instructions and Definitions. Section 7.1 states that:

> Quality of services must be reported in accordance with the definitions specified in the December 2012 electricity transmission network service providers service target performance incentive scheme (STPIS) documents.[47]

In preparing this information, Powerlink has also had regard to the AER's Scenario Reference Guide[48].

Table 3.6.2 has been populated with actual data for calendar year 2014.

Source

Powerlink is currently subject to Version 3 of the AER's STPIS. Data that was prepared and verified as part of the Powerlink's annual STPIS reports to the AER, which included Powerlink's original submission for early application of the Market Impact Component (MIC) of the STPIS, forms the basis of the data for this RIN.

The MIC data was sourced from AEMO's Market Management System (MMS), which includes AEMO's Network Outage Scheduler (NOS) and Market Notices published by AEMO.

Methodology and assumptions

Powerlink has populated the RIN template consistent with Version 4 of the STPIS. For additional clarity, the AER's Scenario Reference Guide was used to verify the exclusions.

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[47] Australian Energy Regulator (2013a). p.29.
[48] AER Scenario Reference Guide, email from the AER, 13 December 2013.

Table: 3.6.3 System losses

Variable: TQS03 - System losses

RIN Requirements

This sub-section has been completed in accordance with chapter 7, section 7.1 of the Economic Benchmarking RIN Instructions and Definitions. This requires system losses to be calculated as:[49]

$$\frac{(Electricity\ inflows - electricity\ outflows)\ \times 100}{electricity\ inflows}$$

Electricity inflows is the total electricity inflow into Powerlink's transmission network including from generation, other connected TNSPs at the connection point, and connected DNSPs as measured by revenue meters.

Electricity outflows is the total electricity outflow into the networks of connected distribution network service providers, other transmission networks and directly connected end-users as measured by revenue meters.[50]

Table 3.6.3 has been populated with actual data for financial year 2014/15.

Source

The data for electricity inflows has been built up from three calculable components:

1. 'the total electricity inflow into Powerlink's transmission network including from generation .... and connected DNSPs';
2. 'other connected TNSPs at the connection point'; and
3. 'Pumping and power station auxiliaries'.

The first and third components are derived from the updated annual transmission sent out energy figures from Table 2.4 of Powerlink's Transmission Annual Planning Report 2015 (TAPR 2015). This is comprised of all transmission connected scheduled and non-scheduled generators minus any auxiliary load associated with generators, minus the load on Wivenhoe Pump units 1 and 2. As this value has also previously been corrected for Net interconnector flow, in order to capture total electricity inflow the Net Energy delivered to other connected transmission networks (variable TOPED0101) is added back to this value. This represents the total electricity inflows from Queensland-based sources of energy.

The second component is the gross import component of variable TOPED0101. This represents the total electricity inflows from non-Queensland based sources of energy.

The data for electricity outflows has been built up from two calculable components:

1. 'the total electricity outflow into the networks of connected distribution network service providers' as well as 'and directly connected end-users'; and
2. 'other connected TNSPs at the connection point'.

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[49] Australian Energy Regulator (2013a). p.30.
[50] Australian Energy Regulator (2013a). p.30.

To capture the first component the energy delivery to Distribution networks (variable TOPED102) and to Directly connected end users (variable TOPED103 – TOPED112) are used. This represents the total electricity outflows to Queensland based consumers of energy.

The second component is the gross export component of variable TOPED0101.   This represents the total electricity outflows to non-Queensland based consumers of energy.

<u>Methodology and assumptions</u>

Losses have been calculated in accordance with the formula set out in chapter 7 of the Benchmarking RIN Instructions and Definitions.

Sheet: 3.7 Operating Environmental Factors

Table: 3.7.1 Terrain Factors

Variable TEF0101 - Total number of vegetation maintenance spans

RIN requirements

This section has been completed in accordance with chapter 8, section 8.1 of the Benchmarking RIN Instructions and Definitions.

For this variable, Table 3.7.1 has been populated with estimated data.

Source

The data has been sourced from Powerlink's enterprise resource management system, SAP.

Why an estimate is required

Powerlink manages its easements by built section and not by individual spans. As Powerlink's systems do not collect information on which individual spans had maintenance performed, Powerlink has applied judgment in interpreting the work order information to develop an estimate of the number of vegetation maintenance spans.

How the estimate has been produced

A list of work orders relating to vegetation maintenance was retrieved from SAP. Each work order was inspected to determine relevance according to chapter 8, section 8.1 of the Benchmarking RIN Instructions and Definitions. Where a specific ground span has not been specified, an estimate of the spans affected by the work order was made based on the description of the maintenance activity and the costs booked against it, which is a minor enhancement on the previous year's methodology. Where more than one maintenance activity occurred on a span, the duplicates are removed so that each maintenance span was only counted once.

Variable TEF0102 - Average vegetation maintenance span cycle

RIN requirements

This section has been completed in accordance with chapter 8, section 8.1 of the Benchmarking RIN Instructions and Definitions.

For this variable, Table 3.7.1 has been populated with estimated data.

Why an estimate is required

Powerlink manages it easements by built section and not by individual spans. As Powerlink's systems do not collect information on which individual spans had maintenance performed, an estimate was required. This estimate uses vegetation span data which required judgment in interpreting work order information.

How the estimate has been produced

An estimate of the average frequency of cutting cycles is based on Powerlink's asset management policy cycle time weighted by the number of vegetation maintenance spans in each vegetation management zone (urban, rural, tropical).

Variable   TEF0103 Average number of trees per vegetation maintenance span

Why an estimate is required

An estimate is required as Powerlink's vegetation management largely occurs as corridor maintenance. Such maintenance does not include individual tree counts.

Powerlink considers that its best source of data to estimate this variable is its internal land management inspections data.

How the estimate has been produced

The following methodology was applied to estimate the average number of trees from Powerlink's internal land inspection data:

1.   Identified spans with a height category of 4 or greater, which represents an average height of vegetation in the span of 3-5m. This is reasonably consistent with the AER's definition of a tree.
2.   From this set of spans, use the density rating to assign a proportion of the span covered with 100% vegetation of interest. Powerlink uses a density category of 5, to represent 50% coverage.
3.   Assume 1600 stems per hectare for 100% coverage. A stocking of 1600 stems per hectare equates to a nominal "tree" spacing of 2 metres x 3 metres.

      For example, if a span has an area of 2 hectares, a height category of 4 or greater and a density category of 5 – the span is estimated to contain 1600 stems. This number was confirmed with a small number of established plots. Using this hypothesis, Powerlink used spatial mapping to produce an average for the network.
4.   Data for the southern region was extrapolated to develop an estimate for the Queensland transmission network.

The methodology assumes that:

- the density category allocated to a span aligns with the number of stems per hectare;
- the number of stems is scalable up to the area of the span and can be averaged over the state.

Powerlink considers that this methodology provides its best estimate of the average number of trees per vegetation maintenance span using available data.

Variable   TEF0104 - Average number of defects per vegetation maintenance span

RIN requirements

This section has been completed in accordance with chapter 8, section 8.1 of the Benchmarking RIN Instructions and Definitions.

For this variable, Table 3.7.1 has been populated with estimated data.

Source

The data has been sourced from Powerlink's enterprise resource management system, SAP.

Why an estimate is required

Powerlink manages its easements by built section and not by individual spans. As Powerlink's systems do not collect information on which individual spans had maintenance performed, an estimate was required. This estimate of the average number of defects per vegetation maintenance span uses vegetation span data and defect notification information, which required judgement in interpreting the work order and notification information.

How the estimate has been produced

A list of defect notifications was retrieved from SAP with defect codes for "high regrowth" and "midspan hazard". Each notification was inspected to determine relevance according to chapter 8, section 8.1 of the Benchmarking RIN Instructions and Definitions. The total number of defects was divided by the total number of vegetation maintenance spans as determined in TEF0101.

Variable   *TEF0105 - Tropical proportion*

RIN requirements

This section has been completed in accordance with chapter 8, section 8.1 of the Benchmarking RIN Instructions and Definitions.

For this variable, Table 3.7.1 has been populated with estimated data.

Source

The data has been sourced from the Australian Bureau of Meteorology Australian Climatic Zones map. Vegetation spans have been sourced from variable TEF0101.

Methodology and assumptions

Powerlink's prescribed transmission network was overlayed geospatially onto the Australian Bureau of Meteorology Climatic Zones Map, based on temperature and humidity. This allowed Powerlink to develop a count of vegetation maintenance spans that fall within the Hot Humid Summer and Warm Humid Summer regions, consistent with the instructions for Tropical Spans in the Benchmarking RIN Instructions and Definitions[51].

Why an estimate is required

Variable TEF0101 is used as an input to this calculation. As it is an estimate, the output for this variable is also an estimate.

Powerlink records for vegetation management are booked against high level functional locations per built section.

How the estimate has been produced

Powerlink's prescribed transmission network was overlaid with the Australian Bureau of Meteorology Australian Climatic Zones map. The number of vegetation maintenance spans identified in TEF0101 was multiplied by the tropical percentage for each built section.

Variable   *TEF0106 - Standard vehicle access*

RIN requirements

This section has been completed in accordance with chapter 8, section 8.1 of the Benchmarking RIN Instructions and Definitions.

For this variable, Table 3.7.1 has been populated with estimated data.

Source

The data is sourced from Powerlink's geospatial information system.

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[51] Australian Energy Regulator (2013a). p.32.

<u>Why an estimate is required</u>

Powerlink's systems apply a standard of access to most transmission line structures by 4WD in dry weather. Therefore, no internal data is available on accessibility to assets by 2WD vehicles.

<u>How the estimate has been produced</u>

Estimates been derived by estimating prescribed built section spans from commissioning dates and overlaid with road information from Powerlink's geospatial information system.

<u>Methodology and assumptions</u>

Powerlink applied the following methodology:

- Powerlink's approach was underpinned by Queensland road network data from the Queensland Department of Environment and Resource Management (DERM), which was publicly available[52].
- Using its geospatial information system, Powerlink determined what parts of the road network could be considered 2WD accessible, based on whether it was classified as a highway, motorway, main road, secondary road or named local road.
- It was then necessary to determine proximity from these roads to the infrastructure. Spans that were more than 100 metres from the roads identified above were considered not accessible (i.e. not in a reasonable walking distance or for carrying equipment, etc).

Variable   TEF0107 - Altitude

<u>RIN requirements</u>

This section has been completed in accordance with chapter 8, section 8.1of the Benchmarking RIN Instructions and Definitions.

For this variable, Table 3.7.1 has been populated with actual data.

<u>Source</u>

Data has been sourced from Geoscience Australia and Powerlink's geospatial information system.

<u>Methodology and assumptions</u>

Powerlink applied the following methodology:

- Geoscience Australia produces a robust 1 second Digital Elevation Map (DEM)[53]. It records elevation in areas (or cells) of $30m^2$. Powerlink considers that a more appropriate estimate can be obtained by dividing each $30m^2$ cell further into $10m^2$ cells (i.e. there are nine $10m^2$ cells in each $30m^2$ cell).

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[52] DERM, QLD_RD_Polyline v.6.1.3.
[53] http://www.ga.gov.au/topographic-mapping/digital-elevation-data.html

- Powerlink developed an approach to effectively interpolate between adjacent 30m^2 cells, providing altitude estimates for each of the 10m^2 areas within each of the DEM's 30m^2 cells.
- The contour of an area is relevant to planning the location of network infrastructure. Therefore, Powerlink developed appropriate contour representations, consistent with the RIN definition of Altitude[54].
- The contour map was also cross-checked against a 10 metre contour map produced by DERM, which showed that Powerlink's map was fit-for-purpose.
- Using data from Powerlink's geospatial information system, Powerlink's prescribed transmission network was overlaid to all cells with terrain contours of 600 metres or greater. The result is the combined length of spans across these cells.

Variable   TEF0108 - Bushfire Risk

This section has been completed in accordance with chapter 8, section 8.1 of the Benchmarking RIN Instructions and Definitions. The data was based on Powerlink's bushfire hazard mapping (acquired in 2014) and shows maintenance spans in high bushfire hazard areas.

For this variable, Table 3.7.1 has been populated with estimated data.

Source

The bushfire risk surrounding the transmission line corridor was sourced from the Queensland State Planning Policy requirements (2014). The bushfire hazard mapping was sourced from the Department of Community Safety (DCS) (January 2014).

Methodology and assumptions

Powerlink applied the following approach:

- The number of vegetation maintenance spans in high fire bushfire risk areas was identified from a count of spans which directly interact with DCS's Potential Bushfire Risk dataset.
- Each span was filtered by the highest fire risk and then subsequently filtered until all spans directly interacted with their highest potential fire risk category.
- The identified maintenance spans are those from TEF0101 for each regulatory year.

Why an estimate is required

Variable TEF0101 is used as an input to this calculation. As it is an estimate, the output for this variable is also an estimate.

Powerlink records for vegetation management are booked against high level functional locations per built section.

How the estimate has been produced

Powerlink's prescribed transmission network was overlaid with the DCS's Potential Bushfire Risk dataset. Each vegetation maintenance span was filtered by the highest fire risk and

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[54] Australian Energy Regulator (2013a). p.38.

then subsequently filtered until all spans directly interacted with their highest potential fire risk category. The identified vegetation maintenance spans are those from TEF0101.

Table: 3.7.2 Network characteristics

Variable   *TEF0201 - Route line length*

RIN requirements

This section has been completed in accordance with chapter 8, section 8.1 of the Benchmarking RIN Instructions and Definitions.

For this variable, Table 3.7.2 has been populated with actual data.

Source

This data has been sourced from Powerlink's enterprise resource planning database, SAP. The data is based upon assets "as-commissioned".

Methodology and assumptions

The variable is populated with data extracted from Powerlink's enterprise resource planning database, SAP. The extraction is based on a list of regulated built sections[55]. The variable has been calculated as the sum of route kilometres across all voltage levels.

Variable   *TEF0202 - Variability of dispatch*

RIN requirements

This section has been completed in accordance with chapter 8, section 8.1 of the Benchmarking RIN Instructions and Definitions.

For this variable, Table 3.7.2 has been populated with actual data.

Source

This data has been sourced from Powerlink's Transmission Annual Planning Reports.

Methodology and assumptions

The total sum of non-thermal generation capacity was divided by the total sum of all generation capacity.

Variable   *TEF0203 - Concentrated load distance*

RIN requirements

This section has been completed in accordance with chapter 8, section 8.1 of the Benchmarking RIN Instructions and Definitions.

For this variable, Table 3.7.2 has been populated with actual data.

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[55] Powerlink uses "built sections" as the basic building block against which transmission line circuit and easement information is recorded. A "built section" is defined as a collection of structures, conductors and easements with common characteristics as listed in SAP.

<u>Source</u>

Data for route line length has been obtained from the same source as variable TEF0201 – Route Line Length. Data on sizes of generation and load has been obtained from Powerlink's Transmission Annual Planning Report 2015 (TAPR 2015).

Generation and load connection points were taken from the source data used to determine variables TOPCP0101 – TOPCP0111 (Number of entry points at each transmission voltage level) and TOPCP0201 – TOPCP0212 (Number of exit points at each transmission voltage level) respectively.

<u>Methodology and assumptions</u>

This variable is defined as the:

> Greatest distance (Route Line Length) from node having at least 30 per cent of generation capacity to node having at least 30 per cent of load, where a node is a connection point from a generation source or location to the (transmission) network at source end and a connection point to a load or distribution system at the destination end.

> Where there is no concentrated source or load above 30 per cent, respond relative to the largest concentrated source and load and indicate the generation and load magnitudes.[56]

From the generation capacities in Table 5.1 of TAPR 2015, there is no concentrated generation source greater than 30% of the total. The largest concentrated source is Stanwell Power Station, as the Gladstone Power Station capacity is distributed across two different connection points. Stanwell Power Station capacity is 1460 MW, 12.6% of summer 2014/15 installed capacity.

From Tables A.1 to A.6 of Appendix A of TAPR 2015, there is no concentrated load greater than 30% of the total. The largest concentrated load is South Pine 110kV. The Boyne Island aluminium smelter load, while slightly larger in total, is distributed across two different connection points. South Pine forecast maximum connection point demand for 2015/16 is 905 MW, 11% of summer 2015/16 forecast state peak native demand of 8192 MW.

Having established the source and load nodes, the shortest transmission line circuit length between the two points was identified as Stanwell – Calvale – Halys – Tarong – South Pine.

Variable   TEF0204 Total number of spans

<u>RIN requirements</u>

This section has been completed in accordance with chapter 8, section 8.1 of the Benchmarking RIN Instructions and Definitions.

For this variable, Table 3.7.2 has been populated with actual data.

<u>Source</u>

Powerlink's corporate enterprise resource planning database, SAP.

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[56] Australian Energy Regulator (2013a). p.38.

<u>Methodology and assumptions</u>

The RIN template has been populated with data extracted from SAP. The extraction is based on a list of regulated active ground spans.

References

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