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# 2010 OPERATIONAL REFURBISHMENT PLAN

Volume 1

Powerlink QUEENSLAND

## Network Strategy and Performance

# Overview

# Contents

## 1. Document Security

The 2010 Operational Refurbishment Plan contains information that is the property of the Queensland Electricity Transmission Corporation (Powerlink). This report contains information that has commercial value to Powerlink. It qualifies as Confidential Information under the National Electricity Rules (NER), and is not a public document.

The NER provides that Confidential Information:

- must not be disclosed to any person except as permitted by the NER;
- must only be used or copied for the purpose intended in this report (namely the replacement of assets within the transmission network by Powerlink); and
- must not be made available to unauthorised persons.

## 2. Introduction

The 2010 Operational Refurbishment (OR) Plan provides an synopsis of the operational refurbishment needs of Powerlink's transmission network and incorporates information from all network asset types, as well as alignment with Powerlink's Non-Load Driven Plan (NLDP).

The OR Plan consists of two volumes. Volume 1 of the OR Plan describes the background and approach taken to identify the refurbishment project needs, including the categorising of the refurbishment activities. Volume 2 of the OR Plan provides a summary and timing of committed and forecast OR projects by asset type.

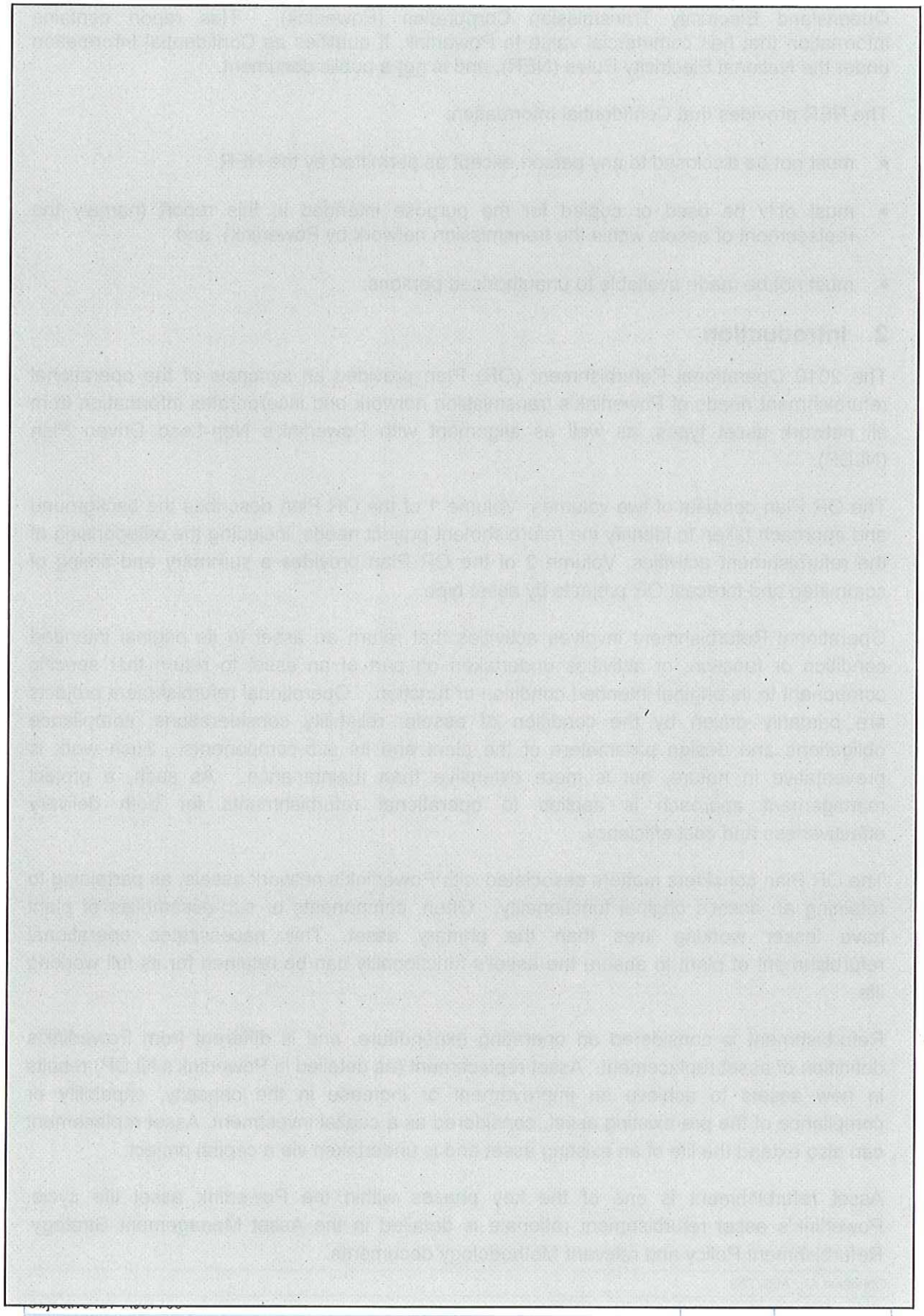
Operational Refurbishment involves activities that return an asset to its original intended condition or function, or activities undertaken on part of an asset to return that specific component to its original intended condition or function. Operational refurbishment projects are primarily driven by the condition of assets, reliability considerations, compliance obligations and design parameters of the plant and its sub-components. Such work is preventative in nature, but is more extensive than maintenance. As such, a project management approach is applied to operational refurbishments for both delivery effectiveness and cost efficiency.

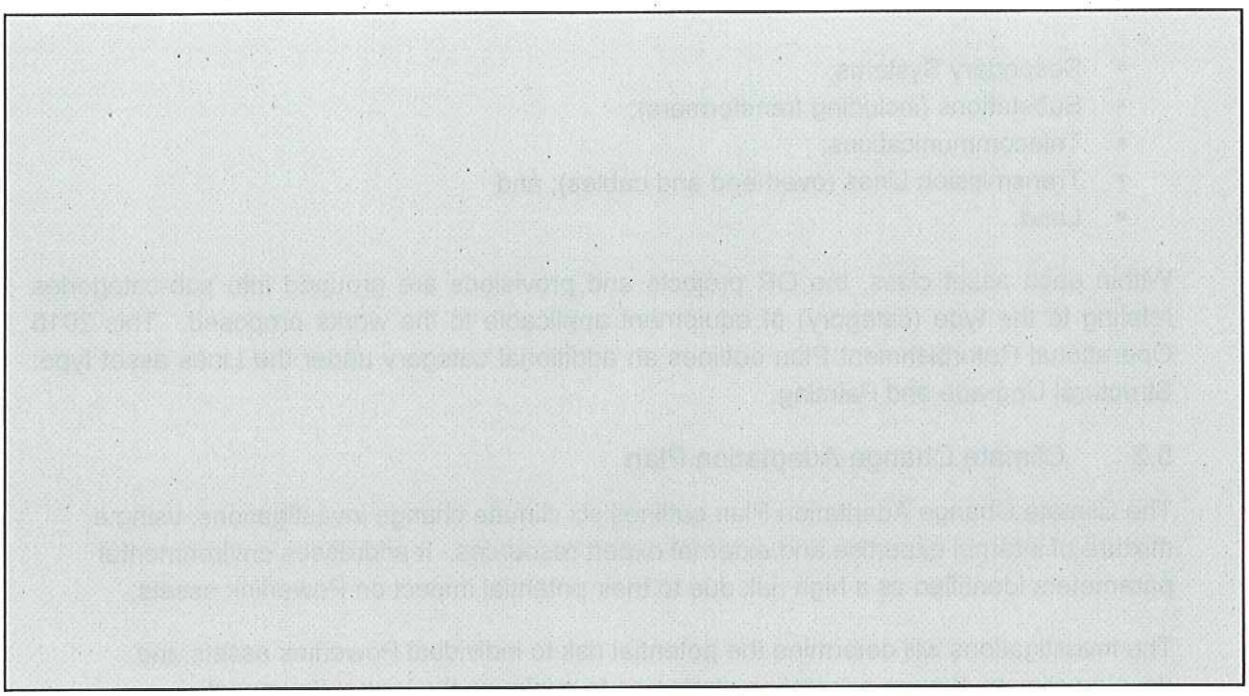
The OR Plan considers matters associated with Powerlink's network assets, as pertaining to retaining an asset's original functionality. Often, components or sub-assemblies of plant have lesser working lives than the primary asset. This necessitates operational refurbishment of plant to ensure the asset's functionality can be retained for its full working life.

Refurbishment is considered an operating expenditure, and is different from Powerlink's definition of asset replacement. Asset replacement (as detailed in Powerlink's NLDP) results in new assets to achieve an improvement or increase in the capacity, capability or compliance of the pre-existing asset, considered as a capital investment. Asset replacement can also extend the life of an existing asset and is undertaken via a capital project.

Asset refurbishment is one of the key phases within the Powerlink asset life cycle. Powerlink's asset refurbishment rationale is detailed in the Asset Management Strategy, Refurbishment Policy and relevant Methodology documents.

## 3. Operational Refurbishment Policy





## 4. Operational Refurbishment Planning Timeframes – Projects and Provisions

OR projects have different planning timeframes than asset replacement and augmentation projects. In the short term, the existing need with specific locations and equipment can be identified. This allows an Operational Refurbishment need to be identified and the development of scopes and estimates.

However, planning timeframes are less certain in the longer term and this varies between asset types. Where the certainty of specific refurbishment activity on specific assets is not able to be identified, and to reflect required future spends, Powerlink has included provisions within the OR Plan. Provisions are forecasted projected spends (beyond the short to medium term planning timeframes) based on history and known behaviour of the assets. Annual provisions are calculated by reviewing the historical quantities and out-turn costs of completed projects. These are then projected forward using forecast future requirements.

## 5. Plan Framework

The Operational Refurbishment needs are identified and managed in groups according to asset classes. Additionally, as part of a Climate Change Adaptation Plan, Powerlink has indentified a wide range of environmental variables related to climate change and parameters for potential electricity supply or demand impacts and extreme events using known characteristics and operating performance of substation and transmission line assets.

### 5.1 Asset Types

It is useful to consider assets by type when assessing their ability to deliver transmission services as they have similar age, condition or obsolescence drivers. The operational refurbishment needs are therefore identified and managed in groups according to asset classes. For this purpose, Powerlink uses 5 major types:

- Secondary Systems;
- Substations (including transformers);
- Telecommunications;
- Transmission Lines (overhead and cables); and
- Land.

Within each asset class, the OR projects and provisions are grouped into sub-categories relating to the type (category) of equipment applicable to the works proposed. This 2010 Operational Refurbishment Plan outlines an additional category under the Lines asset type: Structural Upgrade and Painting.

### 5.2 Climate Change Adaptation Plan

The Climate Change Adaptation Plan outlines six climate change investigations, using a mixture of internal expertise and external expert resources. It addresses environmental parameters identified as a high risk due to their potential impact on Powerlink assets.

The investigations will determine the potential risk to individual Powerlink assets and develop climate change adaptation strategies to minimise the long term impact.

### 5.3 Powerlink's Operational Refurbishment Forecast

Powerlink's OR forecast is summarised in Table 1.

Table 1 - Forecast Operational Refurbishment Expenditure by Asset Type

| *Asset Type ($m, nominal)* | *2009/10* | *2010/11* | *2011/12* | *2012/13* | *2013/14* | *2014/15* | *2015/16* | *2016/17* |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| **Total OR** | **22.19** | **24.42** | **27.04** | **35.62** | **37.41** | **36.67** | **38.98** | **44.98** |

Further details of the OR projects and provisions that make up the OR expenditure detailed in Table 1 are elaborated on in the 2010 Operational Refurbishment Plan Volume 2.

## 6. Secondary Systems Operational Refurbishment Categories

The required secondary systems operational refurbishment projects are further dissected into the following categories:

## 6.1 Automation

Automation systems provide the basic local and remote control and real-time monitoring of the high voltage network. The automation systems also provide functionality to automatically control substation plant such as voltage control, auto-reclose, synch check and cooler control. These projects are based on ensuring existing systems provide the functionality required for a complex power system and providing that functionality at the required level of performance and reliability.

## 6.2 Electrical Work

This is general electrical work on the secondary system electrical infrastructure. The projects reflect the need to perform electrical work as required to ensure plant and equipment are maintained to the required standard of safety and reliability. This may include such elements as vermin proofing equipment panels and refurbishing cables, wiring and terminals.

## 6.3 Metering

Metering is the measurement of electrical energy for financial transactions. Powerlink undertakes the provision of metering services in accordance with the NER. These projects ensure the accuracy and functionality of the metering installation is consistent with NER obligations and performance standards.

## 6.4 Protection Systems and Signalling

Protection systems provide the high-speed protection of high voltage assets to ensure safe and reliable operation of the high voltage system. These protection systems are designed to ensure, under predetermined abnormal conditions, the disconnection of an element of a power system quickly and reliably. Protection signalling schemes are used to transfer information between protection relays at opposite ends of a feeder. The signalling is used to speed up the time taken to detect, identify and clear a fault on the feeder.

These projects are primarily linked to the performance and reliability of protection equipment and to ensure the functionality of the protection signalling system is consistent with the various statutory and NER obligations and performance standards.

## 6.5 Remote Monitoring

Remote monitoring allows the condition of primary and secondary plant and equipment to be observed and accessed remotely. This capability also includes the provision of fault information to allow rapid remote diagnosis of equipment faults and faster restoration of plant to service. Remote monitoring of both the primary and secondary equipment in Powerlink substations is important to maintaining reliability and managing whole of life costs. These projects refurbish existing equipment that is demonstrating poor performance or coming to the end of its supportable life.

## 6.6 SCADA and EMS

This includes infrastructure to enable network operators to monitor and control power system operation via the control centre EMS. These projects reflect the need to maintain the required functionality and performance standards in relation to the EMS and field equipment that support this operation.

# 7. Substation Operational Refurbishment Categories

The required substation operational refurbishment projects are further dissected into the following categories:

## 7.1 Buildings and Infrastructure

The projects reflect the need to perform refurbishment work as required to ensure buildings, civil works and structures are maintained to the required standard. These activities include vermin proofing buildings, the refurbishment of roads, security systems, battery systems (AC and DC supply), fences, air conditioning and ground works.

## 7.2 Electrical Works

These projects reflect the need to perform electrical work as required to ensure plant and equipment are maintained to the required standard. This includes activities such as substation earthing, buswork reconfiguration and replacement, individual component replacement (to increase substation ratings) and site electrical installation safety wiring.

## 7.3 Environmental and Compliance

Powerlink's assets must be managed to ensure that legislative and NER compliance requirements are met at all stages of an asset's life. It is imperative that compliance with workplace health and safety, electrical safety and environmental issues are considered, managed, documented and communicated effectively throughout the life of an asset.

These projects ensure infrastructure and facilities such as oil containment are meeting the present and future demands of the network.

## 7.4 Instrument Transformers

This includes all high voltage instrument transformers, coupling capacitors and line traps in the Powerlink transmission system. Projects are required for instrument transformer refurbishment or replacement where condition abnormalities are discovered.

## 7.5 Surge Arrestors

Surge Arrestors protect primary substation plant against over voltages caused by incoming power surges, e.g. lightning. These projects replace surge arrestors when condition abnormalities are discovered.

## 7.6 Switchgear

Switchgear (including circuit breakers, earth switches and isolators) provide a fundamental switching function within the transmission network at different voltages. Circuit breakers are regularly required to break full load currents and sometimes onto fault currents. Earth switches and isolators are non-load breaking items of switchgear used to isolate plant and provide a visible 'open point'.

The equipment must be relied on to operate correctly under all system conditions. Industry guidelines provide direction on how Powerlink should operate and maintain switchgear. The projects ensure circuit breakers, earth switches and isolators continue to operate in a compliant and safe manner.

### 7.7 Transformers

This includes all high voltage power transformers, earthing transformers and station supply transformers. Projects are planned to ensure ageing transformers achieve their expected life (where appropriate) and includes mid-life refurbishment. Conditions assessments are used to identify those transformers requiring refurbishment to ensure they reach the end of expected life. This refurbishment is well beyond the normal duration and outage requirements of normal transformers maintenance.

### 7.8 Obsolete Substation Categories

Despite having actual spend in 2009/10, Powerlink's 2010 Operational Refurbishment plan has not made allowances for substation refurbishment relating to the obsolete categories of Assessments, Documentation, Materials and Reactive Components. Substation categories are periodically reviewed in line with Powerlink's transmission network requirements to determine whether a further reduction of or additional categories is required.

## 8. Telecommunications Operational Refurbishment Categories

The required telecommunications operational refurbishment projects are dissected into the following categories:

### 8.1 Buildings and Infrastructure

Typical projects are associated with refurbishment of buildings and infrastructure at telecommunications sites such as air-conditioning improvements, roads, tracks, track drainage and vegetation control.

### 8.2 Communications equipment

Communications equipment includes racks, transmitters, receivers, antennas and similar equipment whose principal purpose is to provide communications capacity for voice, data, communications and third parties. Typical projects include site infrastructure refurbishment activities.

### 8.3 DC supplies

Power supply equipment to convert AC power to DC power predominantly for supply to communications equipment. Typical projects include refurbishment or the cyclical replacement of battery systems.

### 8.4 Telecommunication Cables

Telecommunication cables are generally undergrounded and are used for communications purposes. Cables include fibre & coaxial cables. Typical refurbishment projects include optical fibre ground wire (OPGW) refurbishment and the undergrounding of portions of cable runs.

### 8.5 Telecommunication Towers

These components includes towers, poles and structures predominantly used to support communications aerials and dishes, including free standing structures and structures added

to buildings or power line towers. Typical projects are associated with refurbishment of foundations and mechanical aspects of telecommunications towers.

## 9. Transmission Lines Operational Refurbishment Categories

The required transmission lines operational refurbishment projects are dissected into the following categories:

### 9.1 Cables

High voltage cables are generally undergrounded and used for power transfer purposes. These projects facilitate improved maintenance strategies by upgrading cable infrastructure by identifying, mapping and providing signage for existing cables routes and replacing surge arrestors.

### 9.2 Dampers

Dampers are used to reduce the effects of aeolian vibration on the structural built aspects of transmission line assets. Projects typically include programs of installation, removal and replacement of dampers.

### 9.3 Earthing

Earthing includes the works above ground on towers and below ground works associated with earthing on power transmission assets. These projects install grading rings on transmission towers to ensure that built sections are compliant with safety legislation.

### 9.4 Insulators

Insulators provide a method of suspending conductors from tower infrastructure. The primary failure modes of insulators is predominantly pin corrosion for ceramic insulators (porcelain or glass) and brittle fracture for non-ceramic (polymer) insulators, which can impact on (human) safety and network reliability. Projects include replacement of ceramic & non-ceramic disc and post type insulators.

### 9.5 Towers

Transmission towers support the insulators and conductors on transmission lines. Activities typically include refurbishing climbing aids/step bolts (required for maintenance access) and ensuring appropriate foundations and drainage at tower base.

### 9.6 Structural Upgrades and Painting

Structural Upgrades and Painting is an additional category introduced during 2010/11 in response to the requirement to undertake significant condition-related refurbishment of towers. These activities do not extend the technical or economic life of the transmission asset.

Powerlink has a number of new (less than 15 years old) transmission circuits and steel towers located in regions categorised by highly corrosive atmospheric conditions, e.g. within close proximity to coastal and highly industrialised areas. In many instances, factors such as environmental restrictions and urban density make the acquisition of future easements to rebuild additional circuits not possible. Early life tower painting ensures the longevity of

these towers in the harsh environments which they are located and the potential for future life extension works if required.

In addition, older transmission circuits in these regions have been exposed to the harsh corrosive impacts resulting in extensive steel member and bolts replacement. These works are significantly greater than the tower refurbishment works in section 9.5. Painting and replacement of selective tower members and bolts will ensure that the towers reach the end of their asset life.

### 9.7 Obsolete Transmission Lines Categories

Despite having actual spend in 2009/10, Powerlink's 2010 Operational Refurbishment plan has not made allowances for transmission line refurbishment relating to the obsolete categories of Document and Investigation and Lines. Transmission Line categories are periodically reviewed in line with Powerlink's transmission network requirements to determine whether a further reduction of or additional categories is required.

## 10. Land Operational Refurbishment Categories

The required land operational refurbishment projects are further dissected into the following categories:

### 10.1 Access Tracks & Infrastructure

Access tracks provide safe access to Powerlink's substation, communication sites and towers. Typical projects include the upgrading/refurbishment of access tracks, creek crossings and gates to acceptable and safe operational standards, and the realignment/diversion of existing access tracks.

### 10.2 Environment & Compliance Issues

Environmental management requires compliance with numerous legislative and regulatory codes and acts. These projects include easement revegetation, the modification and implementation of training, controls and processes to ensure Powerlink's continued compliance with the relevant environmental codes and legislation.

### 10.3 Erosion

Erosion in and around Powerlink's towers and substation sites can impact on the safety, availability and reliability of Powerlink electrical infrastructure. These projects include rectifying the causes and occurrences of erosion on Powerlink land and easements.

### 10.4 Marginal Tree Removal

Marginal trees are tall trees located off the transmission substation site or line easement (adjacent to the mid-section of the spans). These projects selectively remove high-risk tall trees on the edge of cleared easements which could fall onto the transmission line and cause a safety risk to humans and reduce the reliability of the transmission network.