



## **Appendix A6**

# **Revised Forecast Network Capital Projects**





# **Revised Forecast Network Capital Projects**

**1 July 2008 to 30 June 2013**

**18 January 2008**

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## 1. Introduction

ElectraNet's revised capital expenditure forecast (capex) for the 1 July 2008 to 30 June 2013 regulatory period is presented in chapter 4 of its revised Revenue Proposal. The Submission Guideline templates accompanying the revised Revenue Proposal include a full list of the capital projects included in the revised capex forecast.

Appendix G of ElectraNet's Revenue Proposal (May 2007) includes project summaries for augmentation, connection and replacement projects with an estimated capital cost greater than \$1 million.

This document includes project summaries for asset replacement projects associated with assets that provide transitional services under Rule 11.6.11(a), which were not included in ElectraNet's Revenue Proposal (May 2007), but should now be added in the AER's final revenue determination. Section 4.4 of the revised Revenue Proposal explains the rationale for this change. Project summaries are included for:

- Morgan-Whyalla #1 and #2 Pumping Stations; and
- Mannum-Adelaide #1, #2 and #3 Pumping Stations.

This document also includes amendments to some project summaries included in ElectraNet's Revenue Proposal (May 2007) to reflect changed timings, corrections, or to provide further clarification. These amendments can be summarised as follows:

- Whyalla Terminal – Commissioning date deferred from 2011 to 2013 to reflect proposed amendments to the Electricity Transmission Code (ETC) by ESCOSA that would delay reclassification of this connection point from Category 3 to Category 4 by two years;
- Wudinna – Commissioning date deferred from 2011 to 2012 to reflect proposed amendments to the Electricity Transmission Code (ETC) by ESCOSA that would delay reclassification of this connection point from Category 1 to Category 2 by one year;
- Ardrossan West – ETC load category corrected from Category 4 to Category 2 and additional information provided on the proposed project timing driven by forecast demand; and,
- Kadina East – Clarification provided stating that irrespective of the revised ETC (that would otherwise drive a 2011 commissioning date), the current load forecast will exceed the substation's current capacity (system normal), by Summer 2010/2011, driving retention of the originally proposed 2010 commissioning date.

Each project summaries includes:

- Details of the project requirement and timing including the Rules capital expenditure objective(s) that the capital project is required to meet;
- A description of the project; and
- Project selection – alternative options considered to address the limitation.

## 2. Morgan-Whyalla #1 and #2 Pumping Station Substation Replacements

**Project Title:** Morgan-Whyalla #1 / Morgan-Whyalla #2  
Pumping Station Substation Replacements

**Project No:** 11317 / 11316

**Commissioning Date:** 2011 / 2011

**Category:** Replacement

**Estimated Cost:** \$8.8m / \$8.8m

### 2.1 Project Requirement and Timing

The four Morgan-Whyalla Pumping Stations were established in 1968 to pump from the River Murray as the sole water supply for many mid-north towns and the large regional centres of Port Pirie, Port Augusta and Whyalla. Unlike the Mannum – Adelaide and Murray Bridge-Hahndorf pipelines, there is only limited water storage available enroute and, therefore, any outage has an almost immediate impact on water supplies.

Condition assessments of the substations supplying these pumping stations have been independently undertaken for ElectraNet. These assessments have identified major asset condition issues associated with all four substations. However, while all four substations are in need of replacement, ElectraNet is only proposing to replace the substations supplying the #1 and #2 Pumping Stations in the 2008-2013 regulatory control period. This is primarily due to the poor condition of the four transformers in these two substations. The remaining two substations are to be replaced as soon as practicable in the following period.

The driver for these projects is the risk associated with the poor condition of the assets.

These projects are required to meet the Rules capital expenditure objective to maintain the quality, reliability and security of supply of prescribed transmission services.

### 2.2 Project Description

The scope of works involves the rebuilding of the entire substations with modern-day equivalents to current ElectraNet standards.

## **2.3 Project Selection**

Alternative options considered were as follows:

- Do nothing – this was not considered a viable alternative as it does not address the condition of the assets nor the implications on the water supply to the many South Australian towns and regional centres that rely on this pipeline in the event of failure of any one or multiple substations.

The selected option is therefore considered to be only option capable of addressing the asset condition and associated risk.

### **3. Mannum-Adelaide #1, #2 and #3 Pumping Station Substation Replacements**

**Project Title:** Mannum–Adelaide #1 / Mannum–Adelaide #2 / Mannum–Adelaide #3 Pumping Stations Substation Replacements

**Project No:** 11313 / 11314 / 11315      **Commissioning Date:** 2012 / 2013 / 2013

**Category:** Replacement      **Estimated Cost:** \$8.9m / \$8.4m / \$8.5m

#### **3.1 Project Requirement and Timing**

The three Mannum–Adelaide Pumping Stations were established in 1968 to pump water from the River Murray to the Torrens River Valley and associated reservoirs supplying water for the Adelaide metropolitan area.

Condition assessments of the substations supplying these pumping stations have been independently undertaken for ElectraNet. These assessments have identified major asset condition issues associated with all three substations. ElectraNet is therefore planning to replace these substations in the 2008-2013 regulatory control period.

The driver for these projects is the risk associated with the poor condition of the assets.

These projects are required to meet the Rules capital expenditure objective to maintain the quality, reliability and security of supply of prescribed transmission services.

#### **3.2 Project Description**

The scope of works involves the rebuilding of the entire substation with a modern-day equivalent to current ElectraNet standards.

#### **3.3 Project Selection**

Alternative options considered were as follows:

- Do nothing – this was not considered a viable alternative as it does not address the condition of the assets nor the implications on Adelaide water supplies in the event of failure of any one or multiple substations.

The selected option is therefore considered to be only option capable of addressing the asset condition and associated risk.



## 4. Whyalla Terminal

**Project Title:** Whyalla Terminal Rebuild and Transformer Capacity Increase

**Project No:** 10509

**Commissioning Date:** 2013

**Category:** Connection and Replacement

**Estimated Cost:** \$49.3m

### 4.1 Project Requirement and Timing

#### Connection

Whyalla Terminal supplies an ETSA Utilities distribution network.

The new ETC, which takes effect from 1 July 2008, classifies the Whyalla Terminal connection point as a Category 4 load.

The reliability standard that applies to Category 4 loads requires ElectraNet to have in place N-1 equivalent line and transformer capacity to meet 100% of the Agreed Maximum Demand (AMD). N-1 is defined as the ability to continue to supply without interruption should any one element of the transmission system fail (typically an outage of a transmission line or transformer).

This is a higher standard than applies to the Whyalla Terminal connection point under the current ETC, which allows the provision of N-1 transmission line and transformer capacity in an interruptible, non-continuous manner.

The introduction of the new standard means that N-1 transformer capacity at this connection point will be exceeded from 1 July 2008 under all demand forecasts provided by ETSA Utilities.

Specifically, the loss of a single connection point transformer will result in the thermal overloading and tripping of the remaining unit disconnecting the entire load. The peak load currently exceeds the continuous N-1 transformer rating by more than 30 MV.A and is restored by disconnecting other industrial load and restoring supply utilising that load's transformer.

The new ETC standard from 1 July 2008 would have triggered a requirement for ElectraNet to use its best endeavours to ensure that the equivalent line and transformer capacity meets the required standard within 12 months and in any case within 3 years (i.e. during 2011). However ESCOSA has extended this until 2013 by specifically deferring Whyalla Terminal's shift to a Category 4 load from a Category 3 load until 1 July 2010.

The connection component of this project is required to meet the Rules capital expenditure objective to comply with all applicable regulatory obligations associated with the provision of prescribed transmission services.

### Replacement

The Whyalla Terminal 132/33 kV substation was established in 1964 and provides a point of supply for significant loads at both Whyalla Terminal itself and the remainder of the Eyre Peninsula. These loads represent some 200 MW at times of peak demand. A detailed condition assessment shows that the substation is at the end of its useful life. If allowed to deteriorate further, the Whyalla Terminal will represent an unacceptable reliability risk for the connected loads.

The replacement component of the project is required to meet the Rules capital expenditure objective to maintain the quality, reliability and security of supply of prescribed transmission services.

## **4.2 Project Description**

The condition of the substation and the old standards to which it was designed are such that rebuilding the entire 132 kV switchyard, including the necessary protection and control equipment represents the most viable solution.

The scope of works is to rebuild the substation with 2x120 MV.A 132/33 kV transformers and to reconfigure the network, moving some of the existing functionality to Cultana substation.

This would allow for a simpler rebuilding of Whyalla Terminal without having to accommodate two additional line entries. It would also provide the opportunity to shift the entire radial Eyre Peninsula load from Whyalla Terminal to Cultana, away from a highly polluting environment. The proposed solution would, therefore, turn the Playford to Whyalla Terminal #1 132 kV transmission line into Cultana and create a direct Cultana-Middleback-Yadnarie line.

Another advantage of this proposed arrangement is that it will increase the reliability of the Eyre Peninsula network by connecting the radial line into a breaker-and-a-half arrangement rather than via a circuit breaker that relies on a transfer bus for operational requirements and will also assist with the rebuilding of Whyalla Terminal by placing less load at risk.

## **4.3 Project Selection**

Alternative options considered were:

- Do nothing – This is not considered a viable alternative as it does not address either the ETC reliability standard or the asset condition.
- Permanent or rapid automatic distribution load shift – No alternative distribution system exists.
- Demand Side Management (DSM) – Any DSM schemes at the distribution level are incorporated into the ETSA Utilities AMD. ElectraNet is currently unaware of any suitably sized loads that could viably address the emerging limitation. This option does not address the asset condition.

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- Load side power factor improvement – The load power factor is already compliant with the connection agreement and Rules thresholds and there is no additional benefit of further improvement. This alternative does not address the asset condition.
- Generation network support – This alternative does not address the asset condition and would require a new generator connection point in addition to a substation rebuild making this option more costly.
- Alternative Transmission - The condition of the existing transformers precludes them being reused with the installation of a third 50 MV.A transformer. Therefore, this option has not been considered further as it would require the more costly purchase of three new 50 MV.A transformers and additional works to make the 132 kV and 33 kV connections.

The selected option is considered to be the only viable cost effective option capable of addressing the emerging limitation.

## 5. Wudinna

**Project Title:** Wudinna Transformer Reinforcement

**Project No:** 11102

**Commissioning Date:** 2012

**Category:** Connection

**Estimated Cost:** \$9.2m

### 5.1 Project Requirement and Timing

Wudinna 132/66 kV substation is supplied via some 250 km of radial 132 kV network and supplies a further 200 km of 66 kV distribution network owned by ETSA Utilities, that supplies Streaky Bay and Ceduna on the far west coast of Eyre Peninsula.

The substation currently comprises a single 25 MV.A 132/66 kV transformer with minimal associated 132 kV and 66 kV infrastructure. It has no communications, other than leased Telstra lines, no SCADA and no supervisory capability.

Wudinna substation is a Category 1 connection point in the current ETC. To date this reliability standard has only obliged ElectraNet to provide system normal transmission line and transformer capacity with no requirement for any redundancy.

In the new ETC which will come into effect on 1 July 2008, the Wudinna connection point reliability is upgraded to the new Category 2 standard. While this still allows a radial transmission line connection with no transmission line redundancy requirement, it does require N-1 equivalent transformer capacity to meet 100% of the Agreed Maximum Demand (AMD).

The introduction of the new standard means that this connection point will have inadequate transformer redundancy from 1 July 2008 under all demand forecasts provided by ETSA Utilities.

The new ETC standard from 1 July 2008 would have triggered a requirement for ElectraNet to use its best endeavours to ensure that the equivalent line and transformer capacity meets the required standard within 12 months and in any case within 3 years (i.e. during 2011). However ESCOSA has extended this until 2012 by specifically deferring Wudinna's shift to a Category 2 load from a Category 1 load until 1 July 2009.

This project is required to meet the Rules capital expenditure objective to comply with all applicable regulatory obligations associated with the provision of prescribed transmission services, and to maintain the quality, reliability and security of supply of prescribed transmission services.

This development presents the opportunity to provide for vastly improved radial reliability to a remote area of South Australia. The lack of fault discrimination between the 66 kV and the 132 kV networks in the recent past has been the cause of several extended outages.

## **5.2 Project Description**

This scope of works involves the expansion of the existing Wudinna substation and the installation of a second 25 MV.A 132/66 kV transformer, the establishment of a 132 kV bus and the installation of secondary systems with the provision for remote control, data collection and national grid metering.

## **5.3 Project Selection**

Alternative options considered were as follows:

- Do nothing – This was not considered a viable alternative as it does not address the ETC reliability standard.
- Permanent or rapid automatic Distribution load shift – No alternative distribution system exists with adequate capacity to supply the AMD.
- DSM – The only DSM alternative that could meet the ETC requirements would require contracting the entire load to be disconnected in the event of a transformer failure. This is not a practical solution.
- Generation – The only Generation option that could meet the ETC reliability standard would have to be dispatched at all times to prevent any load from being disconnected in the event of a transformer failure. This is not a practical solution.

The selected option is considered to be the only viable option capable of addressing the emerging limitation.

## 6. Ardrossan West

**Project Title:** Ardrossan West Asset Replacement and Transformer Capacity Increase

**Project No:** 10615

**Commissioning Date:** 2011

**Category:** Connection and Replacement

**Estimated Cost:** \$17.1m

### 6.1 Project Requirement and Timing

Ardrossan West 132/33 kV substation was established in 1973 and is supplied via one 132 kV transmission line from Hummocks and additionally supplies a radial 132 kV transmission line to Dalrymple.

The substation currently comprises a minimalist 132 kV bus and two 10 MV.A 132/33 kV transformers supplying into a 33 kV distribution system owned by ETSA Utilities.

#### Connection

In the current ETC, Ardrossan West substation is a Category 1 connection point. To date this reliability standard has only obliged ElectraNet to provide system normal transmission line and transformer capacity with no requirement for any redundancy.

In the revised ETC which will come into effect on 1 July 2008, the Ardrossan West connection point reliability is upgraded to the new Category 2 standard. While this still allows a radial transmission line connection with no requirement for transmission line redundancy, it does however require N-1 equivalent transformer capacity to meet 100% of the Agreed Maximum Demand (AMD).

Under the current 2007 load forecast provided by ETSA Utilities (High, Medium or Low), the transformer reliability capacity at this connection point will be exceeded by 2009, 2009 and 2011 respectively.

Specifically, this means that the loss of a single connection point transformer at times of peak load will result in the thermal overloading and tripping of the remaining unit disconnecting the entire load.

However, after record loads were experienced across Yorke Peninsula during heatwave conditions in the latter part of December 2007, ETSA Utilities has advised ElectraNet that the 2008 load forecasts will advance the need for this project. Based on this information, ElectraNet had retained the commissioning date at 2011 as per its original proposal. This fully utilises the maximum allowed time from when it is expected the AMD will first violate the ETC.

The connection component of this project is required to meet the Rules capital expenditure objectives to meet the expected demand for prescribed transmission services over the period and to comply with all applicable regulatory obligations associated with the provision of prescribed transmission services.

Replacement

The current layout of the 132 kV bus is difficult to manage operationally and the transformers and the entire secondary systems are at the end of their useful lives.

This replacement component of this project is required to meet the Rules capital expenditure objective to maintain the quality, reliability and security of supply of prescribed transmission services.

**6.2 Project Description**

This scope of works involves the installation at Ardrossan West substation of two 25 MV.A 132/33 kV transformers, the meshing of the 132 kV bus and the replacement of the entire secondary systems.

**6.3 Project Selection**

Alternative options considered were as follows:

- Do nothing – this was not considered a viable alternative as it does not address the ETC reliability standard and does not address the inadequate 132 kV bus arrangement or the asset condition.
- Permanent or rapid automatic Distribution load shift – This was not considered a viable alternative as it does not address the inadequate 132 kV bus arrangement or the asset condition, (and the existing distribution network has insufficient capacity, given that it was overlaid with the 132 kV in 1973).
- DSM – This was not considered a viable alternative as it does not address the inadequate 132 kV bus arrangement or the asset condition.
- Load side Power Factor improvement – The load power factors are already compliant with connection agreement and NER thresholds and there is no additional benefit of improving them further. This was not therefore considered a viable alternative as it does not address the ETC reliability standards and does not address the inadequate 132 kV bus arrangement or the asset condition.
- Generation – This alternative does not address the inadequate 132 kV bus arrangement or the asset condition.
- Alternative Transmission - The condition of the existing transformers precludes their reuse in addition to the installation of a third 10 MV.A transformer. Therefore this option has not been costed as it would require the purchase of three new 10 MV.A transformers and additional works to make the 132 kV and 33 kV connections, which is clearly a more costly option.

The selected option is considered to be the most cost effective option capable of addressing the emerging limitations.

## 7. Kadina East

**Project Title:** Kadina East Transformer Reinforcement

**Project No:** 11401

**Commissioning Date:** 2010

**Category:** Connection

**Estimated Cost:** \$17.6m

### 7.1 Project Requirement and Timing

Kadina East 132/33 kV substation is supplied via a radial 132 kV network from Hummocks and supplies into a 33 kV distribution network owned by ETSA Utilities, ultimately supplying Kadina, Wallaroo, Moonta and Port Hughes on upper Yorke Peninsula.

The substation currently comprises a single 25 MV.A 132/33 kV transformer with minimal associated 132 kV and 33 kV infrastructure. It has no communications, no SCADA and no supervisory capability.

Kadina East substation is a Category 1 connection point in the current ETC. To date this reliability standard has only obliged ElectraNet to provide system normal transmission line and transformer capacity with no requirement for any redundancy.

In the new ETC which will come into effect on 1 July 2008, the Kadina East connection point reliability is upgraded to the new Category 2 standard. While this new standard still allows a radial transmission line connection, with no transmission line redundancy requirement, it does require N-1 equivalent transformer capacity to meet 100% of the Agreed Maximum Demand (AMD).

The introduction of the new standard means that ElectraNet will have up to three years from 1 July 2008 to provide this required reliability (i.e. 2011).

However, irrespective of this new ETC requirement, the loading on Kadina East is currently forecast to exceed the transformer capacity of the substation by the 2010/11 summer.

This project is required to meet the Rules capital expenditure objective to comply with all applicable regulatory obligations associated with the provision of prescribed transmission services, and to maintain the quality, reliability and security of supply of prescribed transmission services.

### 7.2 Project Description

This scope of works involves the expansion of the existing Kadina East substation and the installation of two 60 MV.A 132/33 kV transformers (the next standard size greater than 25 MV.A), the establishment of a 132 kV bus and the installation of secondary systems with the provision for remote control, data collection and national grid metering.



### 7.3 Project Selection

Alternative options considered were as follows:

- Do nothing – This does not address the ETC reliability standard or the system normal capacity limitation.
- Permanent or rapid automatic Distribution load shift – No alternative distribution system exists with adequate capacity to supply the AMD.
- DSM – The only DSM alternative that could meet the ETC requirements would require contracting the entire load to be disconnected in the event of a transformer failure. This is not a practical solution.
- Generation – The only Generation option that could meet the ETC reliability standard would have to be dispatched at all times to prevent any load from being disconnected in the event of a transformer failure. This is not a practical solution.

The selected option is considered to be the only viable option capable of addressing the emerging limitation.

