



## **FINAL REPORT**

# **NEWPORT LOAD AREA 11kV NETWORK DEVELOPMENT**

**20 March 2009**

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## TABLE OF CONTENTS

<b>EXECUTIVE SUMMARY .....</b>	<b>3</b>
<b>1. BACKGROUND.....</b>	<b>4</b>
<b>2. ISSUES .....</b>	<b>5</b>
2.1. Applied Service Standards.....	5
2.2. Description of Network Constraints .....	6
2.2.1. Newport Zone Substation .....	6
2.2.2. Newport Zone 11kV Network.....	7
<b>3. TYPE OF AUGMENTATION .....</b>	<b>7</b>
<b>4. OPTIONS CONSIDERED.....</b>	<b>8</b>
4.1. Demand Management .....	8
4.2. Option 1 – One new 11kV feeder from Mona Vale zone .....	8
4.3. Option 2 – One new 11kV feeder from Careel Bay zone .....	9
<b>5. ANALYSIS OF OPTIONS.....</b>	<b>9</b>
5.1. Base Case Analysis .....	9
5.2. Sensitivity Analysis .....	9
5.2.1 Variations in Load Growth Rates.....	9
<b>6. CONCLUSION .....</b>	<b>10</b>
<b>7. APPENDIX A – ECONOMIC ANALYSIS OF BASE CASE.....</b>	<b>11</b>

## EXECUTIVE SUMMARY

This paper has been prepared to report on upgrade project that is proposed to develop the electricity supply network in the Newport load area in accordance with Clause 5.6.2 (h) of the National Electricity Rules. The work proposed by this report is classified as a new small distribution asset.

A Distribution Network Service Provider does not need to consult on an option which would be a new small network asset. Accordingly, EnergyAustralia has not previously consulted on this project.

To provide a safe and reliable electricity supply for existing customers and provide capacity for future loads, EnergyAustralia is faced with a primary need to provide additional supply system capacity to meet forecasted load demands. The provision of additional capacity is required to meet network performance requirements set by EnergyAustralia in accordance with Schedule 5.1 of the Rules.

This report covers the following issues:

**Section 1** of the paper provides a background of the Newport zone substation supply area and the need for augmentation of the 11kV network.

**Section 2** describes the issues associated with the increase in 11kV feeder loading and the projected load forecast. The concept of service standard, as implemented by EnergyAustralia is discussed.

**Section 3** describes the proposed augmentation in relation to the National Electricity Rule (the Rules). Newport zone substation and its associated 11kV distribution network is classified as a distribution system asset by the Rules, and the proposed development is classified as a small network asset as it involves expenditure of below \$10 million.

**Section 4** describes the options that were considered, including Demand Management:

- Option 1 – One new 11kV feeder from Mona Vale zone.
- Option 2 – One new 11kV feeder from Careel Bay zone.

**Section 5** presents a cost analysis of the options presented in Section 4.

**Section 6** concludes the preferred option is Option 1 – One new 11kV feeder from Mona Vale zone.

The conclusion to develop Option 1 is made on the basis that it is the least cost option in accordance with the Regulatory Test to provide increased future capacity and to meet EnergyAustralia's reliability standard. The estimated capital cost for this option is \$4.25 million and is scheduled for completion in February 2010.

## 1. BACKGROUND

This Final Report has been prepared to advise on the upgrade work that is proposed to be carried out on the 11kV network at Newport which is a part of Terrey Hills and Pittwater load area to maintain loading within reliability standards. The information provided includes:

- A discussion of emerging supply system limitations identified by EnergyAustralia that have lead to the necessity for augmentation of the distribution network in the area.
- A discussion of the service standard that has been adopted for planning purposes.
- Descriptions of options for development of the electricity supply in the area.
- Details of the outcomes of cost effectiveness analysis for the options that have been considered.

Newport 33/11kV zone substation was commissioned in 1957 and is equipped with two 19MVA 33/11kV transformers. It is supplied by Sydney East Bulk Supply Point via Warriewood subtransmission switching station.

Newport zone supplies the suburbs of Mona Vale, Newport, Avalon, Bilgola Plateau, Clareville, Taylors Point, Bilgola and Newport Beach. Currently, several 11kV feeders from Newport zone substation are approaching EnergyAustralia service standard load limit in the normal state and any contingency outages on these feeders at times of high or peak loading can not be adequately restored in accordance with the Design Planning Criteria.

Action is required to ensure loading on the constrained 11kV feeders remains within the service standard.

Below is a geographic overview of the Newport zone substation load area.

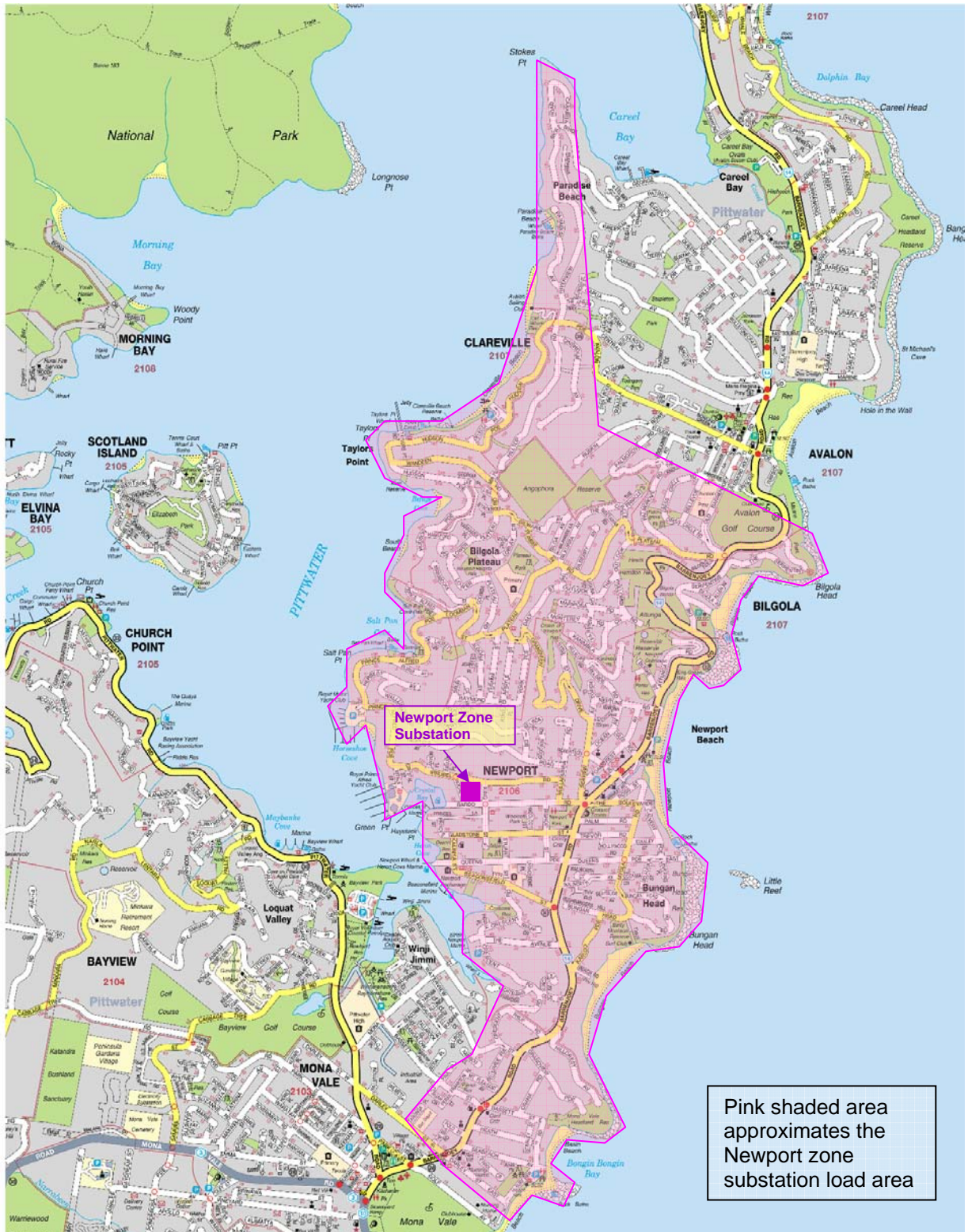


Figure 1: Geographic Overview of Newport Zone Load Area

## 2. ISSUES

### 2.1. Applied Service Standards

EnergyAustralia is required to comply with service standards that are specified in the 'Design, Reliability and Performance Licence Conditions' (Licence Conditions), which were imposed on

NSW distributors by the Minister for Energy on 1 October 2007. The design planning criteria are specified in Schedule 1 of the Licence Conditions and reliability standards are specified in Schedules 2 and 3. For existing network, a distributor must be as compliant as practicable with these requirements by 1 July 2014 and fully compliant by 1 July 2019. All new network elements must comply with these requirements.

The service standards that are applicable to a consideration of supply constraints affecting the Newport zone substation load area are summarised below. For further details refer to the Licence Conditions or to EnergyAustralia's Network Management Plan.

#### **Zone substations and subtransmission network (urban/non-urban)**

With all elements in service, the thermal capacity is required to meet at least 115% of forecast demand.

Following a failure of a single critical element (i.e. N-1 conditions), the network must be designed to recover supply within one minute for systems supplying >10MVA, and otherwise, within best practice repair times. For systems that supply >10MVA, the forecast demand of a zone substation or overhead feeder network may exceed the N-1 capacity for up to 1% of the year i.e. a total aggregate time of 88 hours per annum, up to a maximum of 20% above the N-1 capacity; and the forecast demand of an underground feeder network may not exceed the N-1 capacity.

#### **11kV distribution network**

The planning criteria applied to 11kV networks are determined by the type of load it supplies.

For CBD feeders, there should be no loss of supply to customers following an unplanned failure of a single network element (i.e. N-1 conditions).

For urban feeders, switch-able interconnection to adjacent feeders is required to enable restoration following an unplanned failure of a single network element (i.e. N-1 conditions). Recovery of load is determined by the time required to perform manual switching of load in the field and is expected to take less than 4 hours. Under normal system conditions, the expected demand is to be no more than 80% of the feeder thermal capacity.

For non-urban areas, recovery of load is based on best practice repair times for an asset in that location.

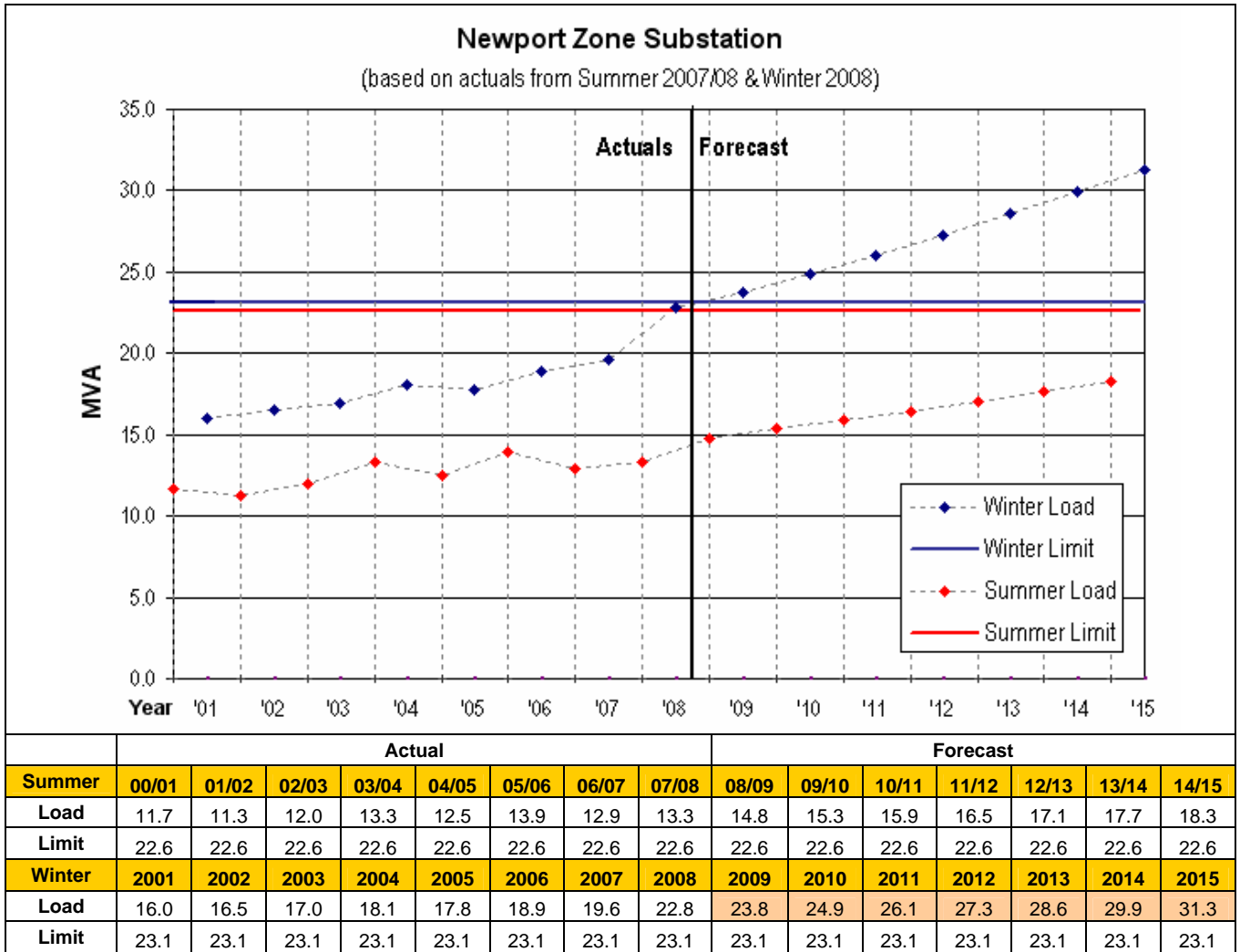
EnergyAustralia may choose to provide a higher level of reliability in order to comply with the reliability standards specified in Schedules 2 and 3 of the Licence Conditions.

## **2.2. Description of Network Constraints**

### **2.2.1. Newport Zone Substation**

Newport Zone Substation has a firm capacity of 22.6MVA in summer and 23.1MVA in winter. The peak load is forecast to exceed firm capacity in winter 2009.

Load forecast for Newport Zone Substation is detailed as below.



**2.2.2. Newport Zone 11kV Network**

The six year forecast for Newport’s 11kV feeders from panel 1, 3, 5, and 9 shows an average utilisation of 98.5% during the winter night peak, based on the current winter forecast rate of growth of 4.4%.

Under current loading conditions, the 11kV feeders supplied from panel 9 at Newport zone does not comply with Design Planning Criteria with summer and / or winter load levels in excess of 80% utilisation under normal operating conditions. Panel 1 feeder is currently just below 80% average utilisation.

Additionally, any emergency switching at these panels will be restricted following a first contingency 11kV outage at times of peak load. These restrictions would result in load not being able to be supplied via interconnected feeders, or not being able to meet the 11kV network service standard under the N-1 condition.

**3. TYPE OF AUGMENTATION**

The requirements of the National Electricity Rules (the Rules) for new asset proposals are outlined in Section 5.6 and depend on the cost, purpose and function of the new asset.

The 11kV Newport zone development is classified as distribution system assets by the Rules. The Rules (clauses 5.6.2(e) and (f)) require that, where analysis indicates that any relevant technical limits of a distribution system will be exceeded, that the Distribution Network Service Provider (DNSP) must notify any affected Registered Participants of these limitations and of the expected time for corrective action and consult with affected Participants and interested parties on the possible options to address the projected limitations of the relevant distribution system. A Network

Service Provider does not need to consult on a network option that would be a small network asset, or for options that do not augment the system.

Each of the options considered under Section 4 are considered new small distribution network assets as they involve a network augmentation with expenditure less than \$10 million. EnergyAustralia is not required to consult of a project that is a new small distribution asset and accordingly no consultation paper was issued in regards to this project.

The new capacity provided by the proposed augmentation has been necessitated by the need to meet the service standard described in Section 2 and has therefore been treated as a reliability driven augmentation for the purposes of the Regulatory Test. Consequently, EnergyAustralia has used a least cost test to examine the options identified to address projected system limitations.

## 4. OPTIONS CONSIDERED

Considered options include demand management and installation of new 11kV feeders from nearby zones. The option of installing one new 11kV feeder from Newport zone was assessed but was not considered as a feasible option due to the Newport zone substation limit. The peak load in Newport zone substation is forecast to exceed its firm capacity in winter 2009 as stated in section 2.2.1, therefore it is not capable to support an additional feeder under current network configuration. Any new feeder formed will require an upgrade of sub-transmission assets, which significantly increase the capital cost. Mona Vale and Careel Bay are the only two adjacent zones to the Newport load area and they all have spare capacity. Hence, supplies from Mona Vale and Careel Bay were considered as feasible options.

### 4.1. Demand Management

An assessment of demand management opportunities in the Newport area was carried out in October 2008 and further reviewed in December 2008. It found that significant demand reductions would be required to enable a deferral of the need for the project, and the resulting savings would be relatively low. On this basis we concluded that it would not be reasonable to expect that demand management strategies could form a cost effective alternative.

### 4.2. Option 1 – One new 11kV feeder from Mona Vale zone

This option involves installation of a pair of control points and a cable of 2.7km length from Mona Vale zone to the intersection of Basset St and Barrenjoey Rd. This option reduces the average normal state utilisation of the four Newport feeders and brings all four feeders into compliance with the Design Planning Criteria by reducing the number of network switches required to restore power in the event of a single element failure.

The following utilisation summary shows the constrained 11kV feeders before and after the proposed work. It considers the inter-related group of feeders – Newport Panel Feeders 1, 3, 5, and 9. The preferred option's proposed feeder out of Mona Vale zone is included in the 'After Selected Option' figures. However, the average normal state utilisation does not reflect the ability of feeders to carry emergency loads, nor the reality that the alternative supply scenarios can often be worse than the percentages indicate.

<b>Average Normal State Utilisation</b>	<b>Do Nothing</b>	<b>After Option 1</b>
Current Utilisation	77.5%	<b>66.5%</b>
Forecast Utilisation – 6 Years	98.5%	<b>75.5%<sup>^</sup></b>

<sup>^</sup>The new feeder from Mona Vale zone, as created in Option 1, is included in this utilisation figure in order to demonstrate its effect on the network. This is appropriate given that the feeder supplies the Newport area network.

This option will also transfer 3.8MVA load in winter, 1.9MVA load in summer from Newport to Mona Vale zone, which will relieve the constraint in Newport zone substation.

The total estimated capital cost of this option is \$4.3M.

### 4.3. Option 2 – One new 11kV feeder from Careel Bay zone

Careel Bay zone is the only other adjacent zone to Newport zone. This option involves a new feeder from Careel Bay zone and associated network augmentation. It provides similar benefit as Option 1.

The total estimated capital cost of this option is \$4.8M.

## 5. ANALYSIS OF OPTIONS

### 5.1. Base Case Analysis

The results of the base case economic analysis are summarised in table 2 below using the base discount rate of 8.5%.

Options	NPC (\$M) *	Capital Cost (\$M)
Option 1: A new feeder from Mona Vale zone substation	4.3	4.3
Option 2: A new feeder from Careel Bay zone substation	4.9	4.8

\* The net present cost includes operation and maintenance cost

Refer to Appendix A for further details of the base case economic analysis.

Under the base case condition, Option 1 is the least cost option.

### 5.2. Sensitivity Analysis

The NPC results for variations in discount factor and capital cost are shown in table 3 below:

Scenario	NPC	
	Option 1 (\$M)	Option 2 (\$M)
7% discount factor	4.4	4.9
10% discount factor	4.3	4.9
25% decrease in capital cost	3.2	3.7
25% increase in capital cost	5.4	6.1

Option 1 is the least cost option under all analysed sensitivity scenarios.

#### 5.2.1 Variations in Load Growth Rates

Variation in load growth rates will not affect the cost of the supply options as the 11kV network is already constrained at time implementation of the preferred option. Hence, it is not included in the sensitivity analysis.

## **6. CONCLUSION**

Option 1 is the least cost option for all analysed scenarios and is thus the recommended course of action to be taken by EnergyAustralia.

EnergyAustralia intends to develop a new 11kV feeder from Mona Vale zone to ensure the service standard is met for the 11kV distribution network in the Newport load area. All works are anticipated to be completed by February 2010.

This service availability date may change if the project is affected by circumstances beyond EnergyAustralia's control, such as changes in the timing of customer load increases or other issues such as: delays in the approval process, equipment supply difficulties, unforeseen technical constraints, acts of God and industrial action.

## 7. APPENDIX A – ECONOMIC ANALYSIS OF BASE CASE

WACC = 0.085

Option 1 – One new 11kV feeder from Mona Vale zone

Actions	NPV (\$m)	CAPEX(\$m)	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17
Total estimated capital cost	4.09	4.25	2.25	2.00							
Operation & Maintenance	0.23		0.00	0.00	0.01	0.05	0.05	0.05	0.05	0.05	0.05
<b>Total</b>	<b>4.32</b>	<b>4.25</b>	2.25	2.00	0.01	0.05	0.05	0.05	0.05	0.05	0.05

Option 2 – One new 11kV feeder from Careel Bay zone

Actions	NPV (\$M)	CAPEX (\$M)	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17
Total estimated capital cost	4.65	4.82	2.55	2.27							
Operation & Maintenance	0.26		0.00	0.00	0.02	0.06	0.06	0.06	0.06	0.06	0.06
<b>Total</b>	<b>4.90</b>	<b>4.82</b>	2.55	2.27	0.02	0.06	0.06	0.06	0.06	0.06	0.06

1) All costs are quoted in 2008/09 real dollars. Year 08/09 refers to 2008/09.