# Jemena Gas Networks (NSW) – Access Arrangement Information - Appendix 7.4

## PB: Review of JGN Capital Expenditure – 2010-11 – 2014-15 Jemena Gas Networks Access Arrangement Review

26 August 2009

Jemena Pty Ltd

# 2010/11 – 2014/15 JEMENA GAS NETWORKS ACCESS ARRANGEMENT REVIEW

## Review of JGN Capital Expenditure

AUGUST 2009

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PB 100 YEARS ®

# Review of Jemena Gas Networks Capital Expenditure 2010/11 - 2014/15 Access Arrangement Period

August 2009

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# Abbreviations and Terms

| ABBREVIATION OR TERM | DEFINITION |
|---|---|
| Access Arrangement | The further final decision revised Access Arrangement for AGL Gas Networks in NSW, June 2005. |
| AER | Australian Energy Regulator |
| AMP | Asset Management Plan |
| CCE | Conforming Capital Expenditure, as defined by Rule 79(1) of the NGRs |
| CDA | Collaborative Delivery Agreement |
| Contract Customers | An end use customer who is supplied with more than 10TJ of natural gas per year. |
| DEA | Data Envelope Analysis. |
| DFT | Department of Fair Trading. |
| DWE | Department of Water and Energy |
| EA | Engineering assessment |
| ESC | Essential Services Commission |
| FRC | Full Retail Contestability which commenced on 1 January 2002. |
| FY | Financial year. |
| GJ | Gigajoule ($10^9$ Joules). |
| IMS | Incident Management Strategy. |
| Incident | Any situation involving gas company operations that could lead to a possible unacceptable increase in risk to people or property. |
| IPART | The Independent Pricing and Regulatory Tribunal of NSW. |
| JAM | Jemena Asset Management Pty Ltd |
| JGN | Jemena Gas Networks (NSW) Ltd |
| JPM | Jemena pricing model |
| kPa | Gauge pressure in kilopascals. |
| MAOP | Maximum allowable operating pressure. |
| Metering Facilities | The meter(s) and the associated filter(s), regulator(s), or other equipment, and pipe work, by which the gas delivered to the User is conditioned, controlled, and metered. |
| Network | The JGN system of pipes and associated facilities including meters and meter sets. |
| NGR | National Gas Rules |
| PB | Parsons Brinckerhoff. |
| PJ | Petajoule ($10^{15}$ Joules). |
| POTS | Packaged off-take stations |
| PRS | Primary regulator station. |
| SAOP | Safety and operating plan. |
| SCADA | System Control And Data Acquisition. |
| SRS | Secondary regulator set. |
| Tariff Customer | Any person who is supplied with natural gas at a rate of < 10TJ per year by means of an authorised reticulator's distribution system. |
| TJ | Terajoule ($10^{12}$ Joules). |
| TRS | Trunk receiving station. |
| Trunk Mains | That part of the Network being the pipe system that extends from Wilton to trunk |

| ABBREVIATION OR TERM | DEFINITION |
|---|---|
| | receiving stations and is licensed under the Pipelines Act 1967. |
| Type B Appliance | An appliance, with gas consumption in excess of 10 MJ/h, for which a certification scheme does not exist. |
| UAG | Unaccounted for gas is gas lost due to leaking mains, metering errors, theft and operational losses. |
| User | A person to whom JGN provides a service under a Service Agreement. |

# Executive Summary

Jemena Gas Networks (JGN) engaged Parsons Brinckerhoff (PB) to review JGN's actual capex over the 2005–2010 access arrangement period and proposed capex for the 2010-15 period. The review is to provide PB's opinion of whether JGN's capital expenditure plans are prudent and comply with National Gas Rules 74 and 79.

PB found that JGN's governance processes are robust and provide a sound framework for assessing/making expenditure decisions. The Asset management Plan clearly sets out agreed performance targets and life cycle management planning as would be expected of a prudent and efficient service provider.

High-level benchmarking indicated that JGN's expenditure compares well against a group of similar operators around Australia. While by itself benchmarking is not evidence of prudent or efficient expenditure, it enables significant differences from the industry norms to be identified and investigated. PB's opinion is that JGN's capex during the 2005-10 periods reflects the expenditure of a prudent and efficient operator, complying with rule 79 of the NGRs.

The actual Capital Expenditure over the current period is 5.7% less than the value agreed by IPART in 2005 as a result of variation in expenditure across categories. There were also differences in the value of spending in each regulatory area; however the reasons for these differences are documented appropriately. It is PB's opinion that the expenditure has been managed in a prudent and efficient manner.

Where detailed assessment of completed projects has been undertaken, PB found that the projects have been developed and delivered in an efficient and prudent manner. Where actual project costs have exceeded forecast costs, a review of the factors contributing to the higher expenditure provided adequate explanation. The post implementation review for the Sydney Primary Loop highlighted significant changes in the scope for the project which were not included in the IPART approved expenditure.

JGN's proposed Capital Expenditure over the next AA period is $851m, a 66% real increase on the current period. This increase arises due to increases across the regulatory areas. PB assessed the reasons for differences in each category and found they are generally due to:

- forecast increases in unit rates.
- development of projects postponed from the current Access Arrangement period.
- facility upgrades to enable higher transmission line pressures and improved condition monitoring of trunk mains.
- policy changes arising from experience during the current access arrangement period.

PB's opinion is that the drivers for increases in capital expenditure are reasonable and in alignment with the Asset Management Plan, and the governance processes enable projects to be developed in compliance with Rules 74 and 79. Therefore, provided component projects, and unit rates used for estimating those projects, within the expenditure forecasts comply with the governance processes, the proposed increase in forecast capital expenditure is reasonable, and reflective of a prudent and efficient operator.

In undertaking detailed review of projects forecast within the 2010-2015 Access Arrangement period, PB found that the proposed expenditure in all projects reviewed is considered conforming capital expenditure, in compliance with National Gas Rule 79.

Evaluation of the basis for the forecast estimate found that, where completed, the basis for forecast estimates is sound. While the economic evaluation of the Wakehurst Parkway project has not yet been completed, PB recognises that the outcomes of the ongoing engineering investigations will have a strong influence on the project cost. PB therefore accepts that completing the economic evaluation following completion of the ongoing engineering investigations is prudent and reasonable.

A statement of the basis of estimate is required for compliance with National Gas Rule 74. On this basis, PB's opinion is that where JGN's governance processes are followed, project forecasts comply with Rule 74. All forecast projects reviewed by PB were assessed to comply with Rule 74.

# 1. Introduction and scope

## 1.1 Introduction and purpose

Parsons Brinckerhoff (PB) has been engaged by Jemena Gas Networks (JGN) to provide consulting services for the review of capital expenditure of the JGN gas networks in New South Wales for compliance with the relevant capital expenditure provisions of the National Gas Rules (NGR).

This study is an independent review of the capital expenditure and asset management practices of Jemena Asset Management (JAM) to:

- Assess compliance with rule 74 and rule 79 of the NGR; and
- Suggest further improvements where PB considers these necessary or desirable.

The review will assist JGN to prepare its revised Access Arrangement (AA) proposal to the Australian Energy Regulator (AER).

## 1.2 Objectives and scope of work (Instructions)

The Terms of Reference (ToR) document for this engagement has been included in Appendix E of this report.

The objectives of this engagement are to assess, using the defined security of supply and service standards, the JGN gas network in NSW for:

- The prudency of capital expenditure for the period from 2005/06 to 2009/10 in order to determine compliance with NGR rule 79.
- The efficiency of JGN capital planning practices and the reasonableness of estimates of capital expenditure for the period from 2010/11 through to 2014/15 in order to determine compliance with NGR rules 74 and 79.
- Benchmarking the JGN gas distribution business against readily available key performance indices from other gas and electricity distribution businesses in order to determine compliance with NGR rule 74.

'Prudent', in its ordinary sense, means "careful of one's own interests; provident, or careful in providing for the future"[1].

For the purposes of this Total Cost Review, the prudency test is intended to determine whether the expenditure was reasonable[2] given the information available at the time of the expenditure. That is, the review has been conducted on the basis that the investment decision was prudent at the time it was made – not with hindsight. PB has assessed prudency against identified drivers and whether service standards have been maintained. The consultant has also assessed the drivers of additional expenditure.

The assessment of prudency is based on the final outcomes, with consideration given to the quality of, and commitment to, the planning and evaluation procedures. The procedures have been benchmarked against industry practice for the planning, provision and utilisation of assets and service standards.

[1] [Macquarie Dictionary Online

[2] By reference to the provisions of NGR rule 79.

'Efficient', in the ordinary sense of the word is "functioning or producing effectively and with the least waste of effort". For the purposes of this Total Cost Review, a test of efficiency requires an assessment of capital expenditure from a 'lowest sustainable cost' perspective over the life-cycle of the assets as required by NGR rule 79(1)(a).

Efficiency has been assessed on the basis that the projected expenditures will deliver the identified outcomes and service standards, and takes into consideration network and non-network options. Over time, efficient investments should minimise costs for the expected outputs and ensure that resources are allocated appropriately.

In achieving the above-listed objectives, PB would thus be able to form an opinion whether JGN's historical and forecast capital expenditure satisfy National Gas Rule 79 and the Conforming Capital Test (CCT) as defined by that rule.

## 1.3 Facts, matters and assumptions

The following are the facts, matters and assumptions (and their sources) upon which PB's opinion is based. (Instructing source: Guidelines for Expert Witnesses in Proceedings in the Federal Court of Australia clauses 2.2 and 2.5, and Expert Terms of Reference Review of JGN Capital Expenditure (AA10-SA-01101) Section 5 bullet point 3).

- The projects reviewed by PB, historical and forecast, accurately demonstrate the processes adopted in developing other similar JGN projects.
- The information provided by JGN to PB for the purposes of completing the review is accurate.

Where the review team have formed an opinion, we will provide the reason(s) for the formation of the opinion and the limitations, incomplete matters, and qualifications to the opinion. (Instructing source: Guidelines for Expert Witnesses in Proceedings in the Federal Court of Australia clause 2.9.)

Where nominal costs have been converted to real costs, an annual CPI figure based on the weighted Average of Eight Capital Cities has been used. The Index Numbers (base year 1989-90 = 100.0).

For all forecast costs, an escalation rate of 2.5% has been assumed.

## 1.4 Reference material

PB collected and reviewed all readily available relevant data including:

- JGN's Asset Management Plan (AMP) for 2010/11 – 2014/15, revision 2.
- JGN's Historical Expenditure Report for 2005/06 – 2009/10.
- 'State of the Energy Market' reports for 2007 and 2008.
- IPART access arrangement decisions and benchmarking reports.
- Reports associated with the Victorian ESC review of the gas access arrangements in 2007.
- Reports associated with the New Zealand Commerce Commission review of regulated gas businesses.

JGN and JAM also provided:

- general information including annual reports, organisation charts, corporate plans and policies, asset management plans and policies, long-term network development plans,

procurement and construction standards and specifications, network performance reports, network plans and maps.

- information on assets in service, including age and condition.
- network performance data and statistics.
- demand forecasts.
- actual and projected capital and operating expenditure.

A full list of reference material is provided in Appendix A.

## 1.5 Methodology

JGN and JAM staff were interviewed to overcome data gaps and provide a thorough understanding of asset management systems, condition and performance of existing assets, growth forecasting procedures and long-term network development planning processes.

The evaluation of asset management systems and policies and development planning processes involved structured interviews with key personnel to review objectives and targets, as well as to determine the appropriateness and effectiveness of the systems in place. The interviews were used to challenge current JGN systems and processes with the aim of prompting further improvements where possible.

Capital expenditure for the current access arrangement period (2005/06 – 2009/10) and forecasts for the next submission to AER (2010/11 – 2014/15) were assessed on an overall basis (total capital expenditure). Further to this, a detailed assessment of capital expenditure was made for selected projects across each area of spend (growth capacity development, security of supply, facilities renewal and upgrade, and meter renewal and upgrade) Seven projects were assessed in detail, two historic projects and five future projects. The assessment focused on the appropriateness of processes and systems and the meeting of established performance indicators. Performance was benchmarked against readily available data on other utilities.

Historical project assessments considered how the actual spend compared with the forecasts and examined the justification for any discrepancies between them.

Future project assessments compared the scope of works to the forecast spend, to determine whether expenditure is prudent and efficient in accordance with rule 79.

In undertaking the study, PB has considered the requirements of the National Gas Rules and the following factors where relevant to each expenditure item:

- current and projected gas network capacity
- appropriate asset utilisation levels benchmarked against best practice
- current demand and likely future demand (as measured by customer number, energy sales and maximum demand)
- current condition of assets and renewal requirements
- existing operational requirements
- opportunities for demand management and non-network solutions to cope with growth
- current safety and planning standards accepted by the industry or imposed through regulatory obligations
- current and likely future customer service standards
- relevant industry standards.

In carrying out this review, PB has developed an opinion of whether the expenditure made or planned is justified when considered in view of Rule 79. For projects initiated before the introduction of the National Gas Rules, an assessment of the prudency of the investment was made, however may not necessarily relate specifically to a clause within the National Gas Rules. For these projects, PB has formed an opinion using rule 79 as a guide for assessment of prudent expenditure.

PB considers that rule 79 is equivalent if not more onerous than the equivalent section, 8.16(a), of the gas code. Therefore it is reasonable to infer that if capex meets rule 79 it meets the code equivalent.

## 1.6 Areas not covered

Review of the following is excluded from the scope of works of this engagement:

- operating expenditure
- non-network capital expenditure.

## 1.7 Review team credentials

This section describes the experience and qualifications of the individuals involved in this capital expenditure review for the formation of an independent expert opinion on the matter(s) posed in the ToR document. (Instructing source: Guidelines for Expert Witnesses in Proceedings in the Federal Court of Australia clauses 2.1 and 2.3.).

CVs of members of the review team are in Appendix D.

***Ian Sharp***

Ian has more than 30 years' of international experience that covers all aspects of gas, water, wastewater and solid waste infrastructure projects from inception through to commissioning and operations. He has been involved with gas network productivity reviews, across Australia, including completion of due diligence work for gas networks, IPART submissions, independent engineering reports, and prudency reviews of the operational and capital expenditure for gas networks.

***Malcolm Young***

Malcolm is a well-recognised gas industry expert, who provides business management services incorporating engineering due diligence assessments, gas distribution total cost reviews, technical regulatory advice and audits, gas distribution management consulting and technical project management.

***Victor Petrovski***

Victor Petrovski is a senior consultant and qualified engineer based in Melbourne with 13 years' experience in the energy industry. Victor's area of expertise is electricity infrastructure, with a history of investment planning and asset management in the National Electricity Market environment.

Most recently, Victor has focused on reviewing the prudence, efficiency and deliverability of capital and operating expenditure forecasts – working across Australia and internationally for regulators and the businesses owning the assets. His work has extended across electricity and gas, and transmission and distribution networks. The context of these expenditure reviews is within a regulatory framework strongly influenced by efficiency incentives and service standards aligned to key business drivers.

Before joining PB, Victor was employed as a principal planning engineer with a Victorian transmission network service provider, where he was responsible for technical and economic assessments for various electricity transmission investment projects in accordance with jurisdictional obligations, the National Electricity Rules and the regulatory test.

***Uldis Clarson***

Uldis Clarson is a project manager with 10 years' experience in the delivery of infrastructure design and industrial engineering projects. With experience gained in Australia and the United Kingdom, he has developed a strong understanding of the different requirements and market drivers in the two countries.

He seeks to ensure that the project needs are identified at the outset, and retains a particular focus on ensuring that projects are delivered that meet those needs and objectives. Throughout, Uldis ensures good client relations and communications are maintained to ensure successful delivery.

Uldis is currently undertaking a Masters in Business Administration and has also developed particular skills in identifying new opportunities to deliver services to new and existing clients in the water industry and other sectors.

***Li-Anne Tung***

Li-Anne is a chemical engineer with experience in gas and water and wastewater infrastructure projects. Her water and wastewater engineering experience includes concept and detailed design of pipelines and process audits. She also has experience in supporting reviews of capital and operating expenditure, and productivity reviews for gas distributors in NSW and ACT.

Li-Anne's recent projects include a Review of AGL Gas Networks Capital and Operating Expenditure, AGL Gas Network Productivity Review and the Review of ActewAGL Gas Network Capital and Operating Expenditure.

# 2. Business overview

## 2.1 Ownership

The JGN network is owned by Jemena Gas Networks (NSW) Ltd, formerly named AGL Gas Networks Limited, and Alinta AGN Ltd. Ownership of JGN changed in October 2006, with Alinta Limited's acquisition of Australian Gas Light Company, including AGL Gas Networks Limited. The company was then renamed Alinta AGL Ltd. Ownership changed again on 31 August 2007, when Singapore Power International acquired a portion of Alinta's assets including Alinta AGN Ltd. The company was subsequently renamed Jemena Gas Networks (NSW) Ltd.

## 2.2 Management

JGN has one Reticulator's Authorisation for the operation of the NSW gas distribution network and five pipeline licences in NSW. JGN has appointed JAM as the asset manager for these assets. The JGN AMP is a rolling 6-year plan with the current planning period covering April 1 2009 to March 31 2015.

Due to the ownership arrangements, JGN's capital expenditure investment program is planned around the Singaporean financial year, which runs from April 1 – March 31. The difference between the Australian financial year (July 1 – June 30) upon which the Access Arrangement period is based, required inclusion of forecast cost data over 6 financial years to ensure coverage of the access arrangement period.

## 2.3 Assets

JGN's gas distribution assets supply natural gas to just over one million customers and are made up of the assets listed in Table 2-1, extracted from the AMP.

**Table 2-1 JGN gas distribution assets**

| Asset Class | Volume |
|---|---|
| Trunk mains (km) * | 267 |
| Primary mains (km) | 143 |
| Secondary mains (km) | 1,417 |
| Medium and low pressure mains (km) | 22,078 |
| Trunk receiving stations (including POTS) (No.) | 53 |
| Primary regulating stations (PRS) (No.) | 14 |
| District regulator sets (SRS, MPRS, LPRS) (No.) | 575 |
| Residential gas meters (No.)** | 969,348 |
| I & C meter sets (No.) | 28,903 |

Source: JGN advice August 2009.

* This value includes the Wollongong 500mm main currently operating at Primary Pressure.

## 2.4 Network Structure

Natural gas is supplied to JGN's network from several sources, and is in turn supplied by JGN to its customers via different mechanisms and at different pressures. The network is summarised below, however all gas supplied to JGN's Sydney, Wollongong and Newcastle/Central Coast (i.e. the non-country) networks is via connections to JGN's trunk

mains. The JGN trunk main extends north from Wilton to Newcastle and south to Wollongong.

The Moomba to Sydney transmission pipeline, owned by APT, supplies JGN's trunk main via the Wilton Custody Transfer Station.

The Eastern Gas Pipeline (EGP), supplies JGN's Trunk main at Port Kembla and Horsley Park and interconnection at the network level at Port Kembla.

Sydney Gas Limited (SGL) supplies small quantities of coal seam gas directly into the JGN Trunk main at Rosalind Park.

The GasNet owned pipeline (GPU) which transports gas into NSW from the Longford and Iona plants in Victoria. The pipeline interconnects with the APT pipeline at Culcairn. The gas is mixed with Moomba gas at Young.

JGN's Trunk main operates at an MAOP of 6,895kPa and supplies five large industrial customers (via individual meter sets) and JGN's primary, secondary, medium and low pressure mains.

APT's Moomba to Sydney transmission pipeline also provides a direct supply to JGN's country customers via local TRSs or POTS. These assets, owned by JGN, lower the pressure to enable supply to JGN's medium or low pressure country networks in towns located in the Central West, Central Tablelands, South Western, Southern Tablelands, Riverina and Southern Highlands regions of NSW.

# 3. Independent review of planning, asset management and investment processes and capital expenditure governance

## 3.1 Introduction

The purpose of this section is to provide a high-level description of the asset management processes undertaken by JAM and JGN and to present PB's opinion on these processes. The basis for forming an opinion was whether JGN's asset management processes (as managed by JAM) support historical and planned capital expenditure projects and programs that comply with NGR Rule 79. We have also looked for any areas that can be modified and/or improved.

As part of this review, PB:

- Reviewed capital expenditure strategies, policies, procedures and plans, and developed a view on whether the framework is effective at promoting capital expenditure efficiency and is based on sound governance principles that are consistent with accepted good industry practice.
- Considered the reasons for and the way in which the strategies, policies, procedures and plans have changed over the current regulatory period.
- Assessed the long-term network development strategies and application of planning criteria and asset management principles.
- Assessed policies and procedures relating to:
  - identifying network constraints, replacement of assets; and non-network needs
  - developing investment proposals
  - analysing alternative investment options and identifying the optimal cost option
  - ensuring that investment projects take place on a timely basis, with minimum network disruption and at least cost.
- Assessed the integration and consistency of policies and procedures across investment categories.
- Reviewed the economic basis and framework for investment decisions.
- Assessed the businesses monitoring and reporting during project implementation, and how effectively continuous improvement initiatives are captured.
- Assessed whether the governance frameworks used by JGN and JAM are appropriate and efficient.

## 3.2 Jemena Asset Management Plan

The Jemena Asset Management Plan (2009) has been prepared by JAM to outline the proposed long-term technical management strategy of JGN assets. Its stated focus is to achieve the best balance between the key elements of asset management – levels of service, cost and risk. The plan sets out JGN's proposed capital expenditure plans and asset management practices relating to the management, review and approvals of capital expenditure.

The AMP follows the International Infrastructure Management Manual framework and summarises a number of other supporting documents. It includes the following sub-plans:

### 3.2.1 Asset Performance Levels of Service

This sub-plan specifies the agreed Asset Performance Targets to be achieved by the Management of Assets.

### 3.2.2 Capacity Development

This sub-plan details the projects required to support the on-going load growth on the JGN network. The projects are identified through the JGN network validation and planning process, with a risk assessment approach used to determine the timing of each project.

### 3.2.3 Lifecycle Management

This sub-plan describes the strategy for managing the asset lifecycle, from creation, maintenance and renewal to disposal. It summarises the current status of assets and outlines the strategies, programs and action plans to be implemented for the asset to be managed and operated at agreed levels of service and optimised lifecycle costs. It details identified asset renewal and upgrade projects.

### 3.2.4 Technical Regulatory Compliance Plan

This sub-plan summarises the technical regulatory obligations and strategies for dealing with all licences, regulations, standards, codes of practice and reporting requirements. It also identifies opportunities and risks arising from new or changing legislation.

The AMP includes a section on 'Compliance' for each asset type to address OH&S issues. JGN aim to ensure, as much as possible, that designs of all assets are as standardised as possible, and incorporate consideration of OH&S issues. JGN have not experienced an increase in capital costs as a result of addressing OH&S issues, as so far these issues have been addressed by doing things differently and more efficiently.

## 3.3 Technical policies, performance validation and integrity management

JAM has established a Technical Policy Review Committee (TPRC). The TPRC objective is 'to ensure that appropriate technical policies are in place for assets under management by Jemena Asset Management and that they are periodically reviewed in order to ensure regulatory compliance, efficiently manage asset technical risk and to optimise asset technical performance.'[3]

The policy on Distribution Network Operating and Metering Pressures (TPG.DES.010) defines the normal operating pressure limits as well as the emergency pressure limits for the distribution network of differing maximum allowable operating pressures (MAOP). The performance of the distribution networks is audited through reporting of telemetry alarms and the network validation process.

Network Supply Validation and Long Term Capacity Planning (TPG.DES.020) technical policy prescribes that computer models of each gas network are established and maintained within three (3) months of construction of the network. These models are used for network performance validation and verification, and for long-term capacity planning; and are to be revised annually following winter (during peak demand) using recorded

[3] TPG.ADM.010 Technical Policy Review Committee Operating Charter, Rev 7, 31/12/2008

pressure monitoring results. There are two network revision levels with guidelines for selecting the appropriate revision level.

Where the network model verification process identifies network enhancement work is required, or where a request for design work is identified, the Distribution Network Capacity Planning Criteria (TPG.DES.040) requires the network to be designed with provision for projected loads for 5-year growth, with design elements that cannot be efficiently staged designed to existing and requested contract loads and projected 20-year demands. Long-term strategic plans must also be developed for the gradual implementation of design to meet market demands for five-yearly periods up to 20-years. These strategic plans are to be revised before implementation, to reflect the network enhancement requirements and opportunities available for improving reliability and security of supply.

Asset capability planning includes analytical tasks to develop short and long term infrastructure plans to maintain supply performance reliability and to develop capacity for growth in an efficient and prudent manner. (AMP section 2.4.2)

Integrity planning includes analytical tasks to ensure the asset's ability to operate in a safe, efficient and reliable manner, such as monitoring, risk assessments and reviews. (AMP section 2.4.2)

## 3.4 Project governance and control

JAM has in place a gating process that provides project governance throughout the life of all JGN projects, from inception through to delivery and project close-out. It consists of seven gates, with the first four gates (Gates 1 to 4) governing project initiation, planning and design up to the asset owner (JGN) business case approval, while Gates 5 to 7 apply to the construction, handover and close-out phases of the project.

Project cost estimates are produced at each of the first three gates, with narrowing order of accuracy, reflecting the incremental development of the project.

**Gate 1** – Confirm there is a requirement. Approval to proceed to Feasibility or direct to Committed Estimate;

At the Gate 1 stage, the project needs are defined and options identified and assessed. The cost estimates developed at this stage are 'rules-of-thumb' with accuracy of ±50%. Potential projects are identified through JGN's network supply validation and capacity planning, and asset integrity assessment processes, in addition to customer-initiated works, such as connection requests.

**Gate 2** – Feasibility estimate of ±30%. Approval to proceed to committed estimate;

**Gate 3** – Committed estimate of ±10%. Review of scope, cost, time and quality deliverables that will be included in the final business case;

**Gate 4** – Client approval of business case. Development, review and approval of business case which includes assessing of options, economic evaluation and project benefits;

**Gate 5** – Approval to commence construction. Review approved business case and construction related documents;

**Gate 6** – Operations and maintenance handover; and

**Gate 7** – Project completion and close-out.

## 3.5 Capital planning framework

JGN's capital planning framework defines the planning process for individual projects, within a two- to three-year timeframe as well as for the overall project program over a five-year cycle.

JGN network capital projects are identified through:

- supply performance validation (winter field monitoring/gauging and network modelling)
- long-term capacity planning procedure
- long-term asset and integrity management strategy
- customer connection requests.

These projects are then incorporated into the AMP, prioritised based on a number of factors, including commercial, environmental, and safety risks, as well as the intangible, such as loss of reputation. These are then ranked into the five-year AMP, and put into two- to three-year planning cycle. Simple projects generally fit into two-year cycle, complex projects fit into three-year cycles. This is a change from the current access arrangement period which had projects fitting into one-year planning cycles, which were found to be too tight.

## 3.6 PB opinion

We consider the capital governance frameworks provided by JGN by its Asset Management Plan, and supported by technical policies, performance validation, integrity management, its gating process and capital planning framework:

- Allow for the consideration of all issues and information relevant to investment projects;
- Provide confidence that the capital expenditure programs are based on sound governance;
- Are in-line with the applicable capital expenditure strategies, policies and procedures.

Assuming these processes are diligently followed; and we have found no reason within the bounds of this study to believe they are not; capital expenditure on projects and programs prepared on these bases will, in our opinion, meet the requirements of Rule 79.

# 4. Inter-business, high-level benchmarking of capital expenditure

PB conducted high-level comparative analysis of actual capital expenditure by JGN against forecast expenditure over the same period by other Australian gas distribution businesses.

Based on the size of divergence between JGN's forecast and actual capital expenditure over that period, (-5.7%) PB considers this is an appropriate approach. Data on actual capital expenditure by the other Australian gas distribution businesses was not readily available.

In order to provide a fuller assessment of JGN's performance, PB has included data for JGN's proposed capital expenditure over the next AA period.

The benchmarking presented is intended to provide a comparison with the capital expenditure forecasts of JGN's peers, to highlight any significant differences.

It is important to note that comparison with peers alone is not sufficient to determine conforming expenditure under rule 79. Benchmarking based on peer comparisons assumes that members within the selected peer group are operating as prudent service providers, acting efficiently in accordance with good industry practice. Capital expenditure of a business that falls significantly outside the natural variation of the peer group is not necessarily indicative of "nonconforming" capital expenditure under rule 79.

There are a range of factors that can contribute to variations in a business' capital expenditure. High-level benchmarking can highlight significant differences which may require detailed investigation. A comparative benchmarking study together with a detailed analysis of project and capital expenditure, as described in sections 5 and 6, gives an indication of whether capital expenditure complies with rule 79.

PB recognises that difficulties arise in direct comparisons between gas distribution business investment performances, due to inherent differences in the businesses such as; customer density, network age, size and condition, gas delivered per customer, climate, asset management strategies and local cost differences. Each of these factors influence the actual capital spend.

Despite these differences, the businesses can still be compared by developing composite parameters for standardisation of comparison. Rather than direct comparison of capital expenditure between the businesses, PB has used a composite factor[4] to account for differences in network characteristics. For comparative purposes a 'composite size variable' was created for each gas distribution business taking into account number of customers (C), length of mains (L) and annual throughput (U) of each business to enable more meaningful use of the data. The composite size data of each business was then analysed by comparison of total capital expenditure versus composite size data. Use of the composite size variable in capital expenditure comparisons accounts for more than a single size factor which typically influences capital expenditure. It also allows for more meaningful trends to be identified within the data (e.g. presence or absence of economies of scale)

[4] The composite factor method used, is as described in the October 2008 Review of Proposed Expenditure of ACT and NSW Electricity DNSPs, prepared by Wilson, Cook & Co for the AER

## 4.1 Sources of information

There are thirteen gas distribution networks within Australia and New Zealand[67]. PB has selected a representative group of six of the larger Australian gas distribution businesses for comparison with JGN.

In the context of the required level of this review, PB has been pragmatic in selecting peers which PB believes provide a representative sample group. The largest operators in each state have been selected because they operate under a similar regulatory framework, are comparable to JGN in terms of asset value and data is readily available. Gas distribution businesses owned by SPI have been excluded from the peer group for comparison.

The parameters used to develop the capital expenditure as part of the comparative analysis, together with the total capital expenditures of these gas distribution businesses, are as shown in Table 4-1. The parameters used in the benchmarking study are measures of the size or value of the business, which are two significant influences or factors affecting the total capital expenditure of a business.

Most recent available statistical information for the selected comparators, i.e. annual throughput, customer numbers and total length of mains, have been sourced predominantly from the latest annual reports. All regulatory asset base and capital expenditure values have been adjusted for CPI (as per 1.3), where required, and referenced to real 2007/08 dollars. Capital expenditure on market expansion and non-system assets has been included in the total capital expenditure.

**Table 4-1 Total capital expenditures and normalising factors of selected gas distribution business for comparative analysis**

| Gas distribution business | Regulatory asset base[1] (2008$'000) | Annual throughput (TJ/annum) | Number of customers | Total length of mains (km) | Total capital expenditure[10] (2008$'000) |
|---|---|---|---|---|---|
| ActewAGL | 258,140 | 8,097[2] | 112,738[2] | 4,484[2] | 51,210 |
| Multinet gas | 928,049 | 61,504[3] | 646,597[3] | 9,413[7] | 262,320 |
| Envestra (Vic) | 897,741 | 55,441[4] | 523,326[4] | 9,267[4] | 411,769 |
| Envestra (SA) | 889,380 | 36,050[4] | 386,450[4] | 7,709[4] | 213,200 |
| Envestra (QLD) | 245,599 | 16,468[4] | 79,727[4] | 2,480[4] | 104,510 |
| Alinta | 739,931 | 30,802[3] | 540,000[3] | 12,157[8] | 164,081 |
| Jemena Gas Network | 2,218,443 | 98,100[5] | 995,074[6] | 24,434[9] | 509,215 |

Sources:

1. JGN RAB value is as supplied by JGN for June 2008 for total assets (incl. transmission pipelines, distribution and non-distribution assets). RAB for other GDBs sourced from Table 10.1 of State of the Energy Market 2008 (AER, 2008) based on opening RAB for current regulatory period adjusted to June 2008 dollars.
2. 2007-08 data presented in Appendix of ActewAGL Annual and Sustainability Report 2008.
3. 2006 data presented in Table 1 of Benchmarking Multinet's Gas Distribution Operating and Capital Costs Using Partial Productivity Measures (Meyrick, March 2007).
4. 2008 data presented in inside back cover of Envestra Annual Report 2008.
5. 2007-08 data as presented in Table 2-6 of JGN 2009 Asset Management Plan draft revision 2 (Jemena Asset Management Pty. Ltd., March 2009).
6. JGN advice August 2009.
7. Section 2.2 of Multinet Access Arrangement Information (Multinet, March 2007).
8. Table 10.1 of State of the Energy Market 2008 (AER, 2008).
9. JGN advice August 2009.

10. JGN actual capital expenditure data supplied by JGN for current access arrangement period (2005/06-2009/10) in 2008$ (actual capital expenditure to Feb. '09 and forecast capital expenditure to June '10). Total capital expenditure for other GDBs sourced from Table 10.1 of State of the Energy Market 2008 (AER, 2008) based on forecasts for current asset arrangement period, adjusted to June 2008 dollars.

## 4.2 Capital expenditure benchmarking

In order to draw useful comparisons of capital expenditure between businesses that differ in size and value, PB made three assessments of capital expenditure. These assessments included:

1. A comparison of investment as a proportion of regulatory asset base.
2. Comparison of expenditure per connection as a function of connection density (distance per customer).
3. Comparison of total expenditure as a function of composite size factor.

### 4.2.1 Investment as a proportion of regulatory asset base

Similar levels of investment would be expected for the businesses when expressed as a percentage of RAB regardless of total RAB value since they are largely linear businesses. Allowing for distance per customer, a similar level of investment per customer would be expected to be observed. The composite size factor used in the final assessment enables direct comparisons of total capital expenditure between businesses, because the factor is a function of the three size measures of the business, length of network, number of customers, and annual throughput.

Figure 4-1 presents JGN's average annual capital expenditure at an aggregate level (including growth, non-growth and non-network expenditure). This indicates a comparable spend to that of the peer group. JGN's capital expenditure at approximately 5.3% of RAB value falls within the middle of the range of the peer group.

Due to the significantly larger size of the JGN network relative to other networks, economy of scale efficiencies arising from purchasing power may be expected to be observed. This may be offset, however by the condition of many of JGN's assets which are approaching their design life, requiring increased capital expenditure to maintain required levels of service. In addition JGN's capital expenditure during the last access arrangement included a major security of supply project.

Based on the discussion above, the results presented in Figure 4-1 indicate JGN's expenditure reflects well compared to the other operators.

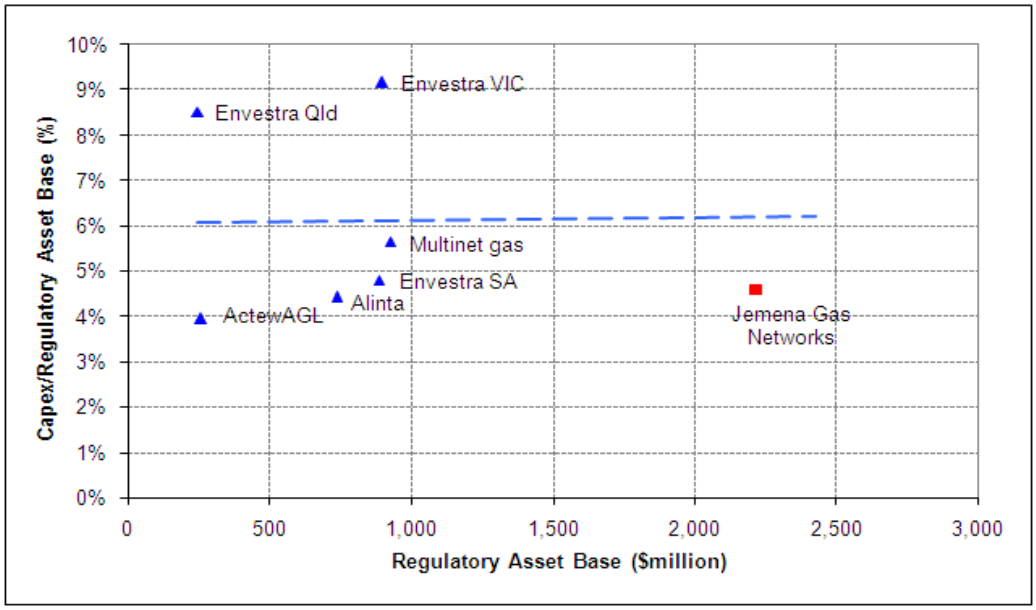


**Figure 4-1 Average annual capital expenditure as a proportion of RAB value**

Source: PB analysis, based on JGN supplied data and State of the Energy Market 2008, converted to 2008$ Note that the JGN data has not been used in the development of the trend line.

### 4.2.2 Expenditure per connection as a function of connection density

A second mechanism is to compare the capital expenditure as a function of the number of corrections and connection density. Density provides a means for accounting for differences in the networks arising from the number of connections per km of main.

While the absolute capital expenditure per customer is high for JGN, networks with a higher connection density would be expected to show lower cost per connection because of the smaller length of mains required to serve each customer.

Figure 4-2 indicates that the density of customers on JGN's network is relatively low, and when an allowance for density is made, the expenditure per connection compares favourably with other network operators.

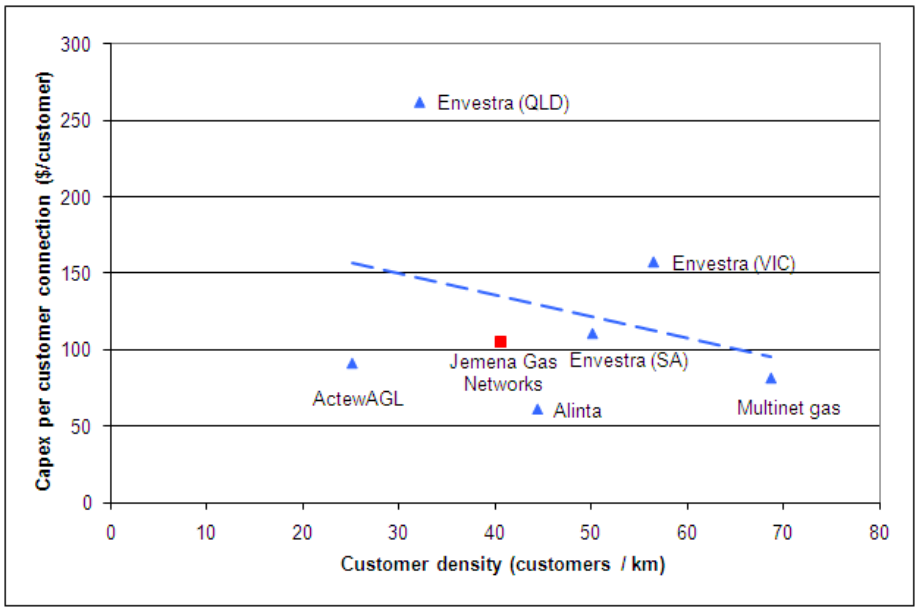


**Figure 4-2 Capital expenditure per customer connection versus customer density**

### 4.2.3 Expenditure as a function of composite size factor

The comparison of total capital expenditure versus composite size seeks to account for differences in the size, number of customers and amounts of gas delivered between the networks. The validity of the composite size as a unit of measure is supported by the figures presented in Appendix B.

**Figure 4-3** presents the capital expenditure v composite size data, and suggests that JGN's spend compares favourably with the other operators**.**

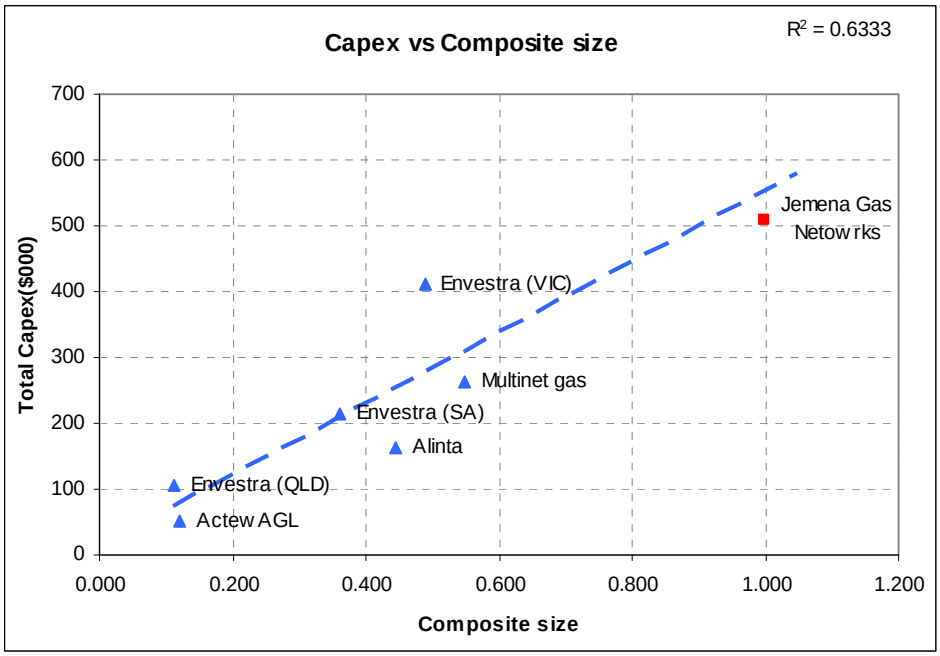


**Figure 4-3 Capital expenditure vs composite size**

## 4.3 PB's opinion

Based on the benchmarking assessment presented above, JGN's capital expenditure compares favourably with the peer group of gas distribution businesses. While this assessment assumes that the expenditure of the other network operators complies with rules 74 and 79 of the NGR and indicates that the overall level of JGN's expenditure is broadly in line with that of a prudent operator.

Since high-level benchmarking of the capital expenditure does not provide an indication of the prudency of individual projects, it is not possible to determine from benchmarking alone whether each of JGN's capital expenditure project complies with rules 74 and 79.

It is PB's opinion the level of capital expenditure is in line with what would be expected for an operator of this network, and more detailed benchmarking is not required.

# 5. High-level historical expenditure prudence and efficiency review

A high level comparison has been made of the IPART approved capital expenditure and the actual expenditure over the last access arrangement period 2005/06 to 2009/10. All dollar values have been converted to real 2008 dollars using the CPI adjustment defined in Section 1.3. Original data in 2005 dollar values as submitted to IPART are presented in appendix C, and these figures were used as the basis of figures in Table 5-1 and Table 5-2.

A high level assessment of the capital expenditure of two historic projects is also presented. The projects reviewed, Sydney Primary Loop project and the Rehabilitation of the Bathurst Low Pressure Network, were selected due to their significant contributions to the capital expenditure.

## 5.1 Overall historical capital expenditure

**Table 5-1 IPART 2005 Determination - Capital expenditure 2005/06 to 2009/10 in Real 2008$**

| Real 2008$'000 | 2005/06 | 2006/07 | 2007/08 | 2008/09 | 2009/10 | Total |
|---|---|---|---|---|---|---|
| CPI conversion | 1.109 | 1.109 | 1.109 | 1.109 | 1.109 | |
| Non-system assets | 8,872 | 8,872 | 8,872 | 10,203 | 10,757 | 47,576 |
| Market expansion | 60,773 | 59,664 | 58,444 | 58,777 | 59,221 | 296,879 |
| System upgrade | | | | | | |
| Growth capacity development | 18,155 | 9,512 | 3,828 | 4,543 | 4,787 | 40,825 |
| Security of supply | 15,582 | 15,387 | 19,775 | 5,163 | - | 55,907 |
| Mines subsidence | 1,171 | - | - | - | - | 1,171 |
| Mains & services renewal | 11,138 | 4,972 | 4,883 | 277 | 287 | 21,558 |
| Facilities renewal & upgrade | 7,218 | 2,488 | 3,015 | 3,125 | 2,361 | 18,208 |
| Meter renewal & upgrade | 7,844 | 11,013 | 8,278 | 10,873 | 9,831 | 47,838 |
| Government authority work | 5,331 | 1,215 | 1,704 | 1,752 | 1,700 | 11,702 |
| **Total (with SPL project)** | 136,084 | **113,123** | **108,799** | **94,713** | **88,944** | **541,663** |
| Total (without SPL project) | 120,502 | 97,736 | 89,024 | 89,550 | 88,944 | 485,756 |

Note: Figures may not add up to sub-total and total due to rounding.

**Table 5-2 Actual capital expenditure 2005/06 to 2009/10 in Real 2008$**

| Real 2008$'000 | 2005/06 | 2006/07 | 2007/08 | 2008/09* | 2009/10* | Total |
|---|---|---|---|---|---|---|
| CPI conversion | 1.067 | 1.045 | 1.00 | 1.00 | 1.00 | |
| Non-system assets | 2,025 | 619 | 18,141 | 13,408 | 10,757 | 44,967 |
| Market Expansion | 43,065 | 36,344 | 37,252 | 42,754 | 61,900 | 221,315 |
| System Upgrade | | | | | | |
| Growth capacity development | 2,565 | 787 | 3,331 | 8,596 | 14,766 | 30,045 |
| Security of supply | 12,616 | 60,444 | 16,705 | 563 | - | 90,328 |
| Mines subsidence | 3,315 | 7,416 | 4,905 | 1,494 | 1,853 | 18,982 |
| Mains & services renewal | 7,420 | 3,920 | 4,717 | 2,660 | 2,923 | 21,639 |
| Facilities renewal & upgrade | 5,831 | 3,948 | 5,379 | 8,197 | 12,215 | 35,569 |
| Meter renewal & upgrade | 8,314 | 7,958 | 6,454 | 9,198 | 13,543 | 45,467 |
| Government Authority Work | 449 | 393 | 231 | 487 | 500 | 2,059 |
| **Total (with SPL project)** | **92,447** | **130,082** | **87,846** | **84,152** | **118,457** | **512,980** |
| Total (without SPL project) | 79,831 | 69,638 | 71,141 | 83,589 | 118,457 | 422,652 |

* Actual expenditure figures up to and including February 2009 only. Forecasts are to June 2009. Figures are in 2008$.

Note: Figures may not add up to sub-total and total due to rounding.

The total forecasted capital expenditure over the 2005 to 2010 period was compared against JGN total actual capital expenditure, as shown in

**Table 5-3 Forecast versus actual capital expenditure for 2005/06 to 2009/10 Access Arrangement Period**

| Real 2008$'000 | Forecast | Actual* | Difference (F-A) | % difference |
|---|---|---|---|---|
| Non-system assets | 47,576 | 44,967 | 2630 | 5.5% |
| Market expansion | 296,879 | 221,315 | 75,564 | 25.5% |
| System upgrade | | | | |
| Growth capacity development | 40,825 | 30,045 | 10,780 | 26.4% |
| Security of supply | 55,907 | 90,328 | -34,421 | -61.6% |
| Mines subsidence | 1,171 | 18,982 | -17,811 | -1521.0% |
| Mains & services renewal | 21,558 | 21,639 | -82 | -0.4% |
| Facilities renewal & upgrade | 18,208 | 35,569 | -17,361 | -95.3% |
| Meter renewal & upgrade | 47,838 | 45,467 | 2,371 | 5.0% |
| Government Authority Work | 11,702 | 2,059 | 9,642 | 82.4% |
| **Total (with SPL project)** | **541,664** | **510,371** | **31,312** | **5.7%** |
| Total (without SPL project) | 485,757 | 420,043 | 65,733 | 13.5% |

* Actual expenditure figures up to and including February 2009 only. Forecasts are to June 2009. Figures are in 2008$.

The total JGN actual capital expenditure over the Access Arrangement period was $31.3 million (5.7%) less than forecast, in real year 2008 dollars.

While the overall expenditure is similar to that forecast, there is variance in the expenditure within individual expenditure categories, which warrant further discussion. These differences between actual and forecast expenditure identified by PB are detailed in the following sections.

### 5.1.1 Items where actual capital expenditure was above forecast

#### Security of supply – Sydney Primary Loop project

The sole security of supply project for the 2005 to 2010 Access Arrangement period is the Sydney Primary Loop (SPL) project.

The forecast estimate for this project, as submitted to IPART, was developed from a desktop analysis only and was based on limited field information.

The subsequent feasibility estimate for this project identified significant differences from the desktop cost estimate, with the estimate increasing by $34.4 million, from $51.6 million to $91.3 million (nominal dollars).

The actual capital expenditure for this project is within 10% of this revised cost estimate.

In 2005, JGN commissioned Energy Consulting Group (ECG) to review the robustness of the Sydney Primary Loop (SPL) project cost estimate and assess the reasons for the cost increase. A detailed review of the project is provided in Section 5.3.1.

#### Mines subsidence works

JAM advised that the scope and impact of mine subsidence was not clearly understood or defined at the time of preparation of the 2005 to 2010 Access Arrangement, such that only a minimal allowance was made for mine subsidence work. While the scope and cost of this work increased relative to expectations at the time of the 2005 to 2010 Access Arrangement, JGN received a commensurate increase in capital contributions from third parties to fund these capital works.

PB's opinion is that the increase in cost is reasonable due to the nature of the work.

#### Facilities renewal and upgrade

JAM advised that allowance for capital expenditure relating to facilities renewal and upgrade was based on a limited scope for the projects identified in the 2005 to 2010 Access Arrangement. Significant scope changes to these projects were identified as a result of subsequent detailed planning, resulting in higher capital expenditure. This resulted in a $17M (95%) overspend on the capital expenditure forecast.

#### Mains and services renewals

The increase in mains and services renewals expenditure of $0.8 million was predominantly due to greater than forecast number of ad-hoc rehabilitation and renewals projects. JAM advised that the 2005 to 2010 Access Arrangement had not allowed for rehabilitation works of some networks. Performance issues and/or customer complaints, when assessed against predefined performance criteria, subsequently identified the need for additional minor ad-hoc rehabilitation or renewal works.

### 5.1.2 Items where actual capital expenditure was below forecast

#### Market expansion

Market expansion expenditure is driven by the demand for new connections not served by the existing network infrastructure, and the cost of delivery of infrastructure to serve those connections. Between 2005/06 and 2008/9, the number of new connections was 38% less than forecast in the access arrangement, while the expenditure incurred was 32% less than forecast. Therefore, while the overall expenditure was less than forecast, the expenditure per connection was higher than forecast.

Market expansion involves the construction of different types of assets, including primary and secondary mains, as well as low and medium pressure network mains. JGN provided

documentation outlining the component costs for market expansion expenditure[5]. This documentation provided clear explanations for the variation between forecast and actual expenditure.

The unit cost of delivery for mains and meters was shown to be lower than expected as a result of increased efficiency of construction. These savings have been partly offset by increases in restoration costs set by councils, and contractor costs.

The main driver for higher costs per connection than forecast was costs for obtaining approvals and compliance with developer requirements during connection of services.

### Growth capacity development

PB has identified that JGN reduced expenditure on growth capacity development programs. The reduction in this item is in the order of $10.8 million over the 2005 to 2010 Access Arrangement period.

JAM advised that the decrease in expenditure was due in part to a generally slower than anticipated growth in certain areas of metropolitan Sydney and the Central Coast, allowing for the deferral and/or staging of projects. Evidence of lower than expected demand was provided in an assessment of service connections from 2005-10[6]. There is a connection between the rate of market expansion and the rate of capacity development required.

JGN also advised that alternative capacity management options, where available, were implemented so as to compensate for the greater than expected SPL capital expenditure requirements while maintaining adequate levels of supply reliability and/or risk levels.

### Meter renewal & upgrade

Actual expenditure on the meter renewal and upgrade program is $2.4 million less than forecasted expenditure over the 2005 to 2010 Access Arrangement period. JGN advised that the reduction in expenditure is mainly due to the forecasted cost estimates for the 2005 to 2010 Access Arrangement being based on conservative assumptions, either in the volume of meters or in the unit rates.

### Government authority work

JGN received IPART endorsement for capital expenditure of $11.7 million for various projects where network modifications at JGN's expense are required due to government authority work, but has spent $2.0 million during the current Access Arrangement period. JGN only undertake network modifications on an as-needs basis[7]. Government Authority work has not been reviewed in any further detail because it is difficult to predict.

## 5.2 Overall comment on capital expenditure in Access Arrangement period 2005/06 to 2009/10

Expenditure on the SPL project accounted for 19% of the total actual capital expenditure for this Access Arrangement period and was the largest single item, Since the total allocated for capital expenditure projects was fixed by IPART's 2005 determination, the 62% overspend in the security of supply was offset by reductions in expenditure in other categories.

[5] JGN Distribution Market Exppansion Unit Rates – FY05 to FY10, Revision A.

[6] JGN Distribution Market Exppansion Unit Rates – FY05 to FY10, Revision A.

[7] JAM advised that in additional to GAW capital expenditure, significant opex was incurred during the review period for preparations of special events, like APEC and WYD08 in conjuction with various NSW state emergency planning authorities.

Capital was allocated from growth capacity development projects to meet the greater than expected capital requirements for the SPL project. This was also in response to, and enabled by, the slower than expected growth rates in certain areas. Alternative demand management strategies have helped to defer some projects; however, this may only be a short-term measure and may increase capital expenditure requirements on growth capacity development in future access arrangement periods.

During the current access arrangement period, capital was allocated to the programs and works that, if deferred to the next Access Arrangement period or later, could result in an increase in operating cost, or greater extent of rectification works, or expose JGN to unacceptable risks.

Overall the variations in actual capital expenditure have occurred through:

- increases and decreases in scope during project development.
- deferrals and advancement of various works to accommodate logical changes in priority.
- adjustment to allow for lower than expected growth rates; and
- refinement of preliminary estimates.

PB's opinion is that the capital expenditure during the 2005 to 2010 Access Arrangement period has been managed in a prudent and efficient manner. While there are differences in expenditure for individual categories, variations have been well documented and justified and actual expenditure meets the requirements of Rule 79.

## 5.3 Detailed assessment of selected projects

This section presents PB's high level assessment of two projects with actual capital expenditures of greater than $1 million to determine whether, in PB's opinion, the capital expenditure conforms to the specific criteria in NGR Rule 79.

The SPL project was immediately identified as one project that should be reviewed by PB due to its significance to the JGN network and the relatively large difference between the planned and actual capital expenditure.

The Rehabilitation of Bathurst Low Pressure Network was nominated for review also, as an example of the many low pressure network rehabilitation projects that were undertaken by JGN during this access arrangement period.

The list of documentation for both projects that are available for review are as listed in Appendix A.

### 5.3.1 Sydney Primary Loop project

This project review is focussed on historical capital expenditure made by JGN in 2005 to 2008 associated with the construction of the Sydney Primary Loop (SPL), which involved the construction of approximately 28 km of 500 mm diameter steel primary gas main and ancillary works. The historical capital expenditure associated with this project is as presented in Table 5-4.

**Table 5-4 Historical capital expenditure associated with Sydney Primary Loop (SPL) project**

| Year | 2004/05 | 2005/06 | 2006/07 | 2007/08 | 2008/09 | 2009/10 |
|---|---|---|---|---|---|---|
| Expenditure (nominal $'000) | 1,210.2 | 11,826.3 | 57,836.7 | 16,705.0 | 563.4 | - |

Source: JGN 2005-10 Historic Capital expenditure 25March09.xls, supplied by JGN 25 March 2009.

Before construction of the SPL, the natural gas supplies to approximately 500,000 of JGN's customers in the Sydney basin east of the trunk main were from a single feed, 550 mm primary main extending from Horsley Park to Botany.[8] The SPL project is intended to provide security of supply across Sydney by mitigating the risk associated with the loss of the then single set of supply infrastructure (in the form of the Sydney Primary Main and Horsley Park TRS).[9] JGN undertook a risk assessment that defined the risk of loss of supply as 'High' in accordance with AS2885 and thus considered unacceptable. The completed ring main also increases the capacity of the existing primary main to meet the needs of Sydney's growing population.

### Project selection and planning

PB accepts that there was clear driver for investigating the construction of the SPL, based on the information presented by JGN relating to the risk assessment conducted by Granherne in 1999, and Connell Wagner's review of this risk assessment and the risk mitigation strategy.

The risk assessment identified seven hazards with the potential to cause a loss of supply to the primary main. According to a frequency analysis of the hazards, a loss of supply incident would occur once every 88 years. The consequence of this risk, based on year 2005 information, would vary throughout the year between moderate and very high, depending on system demand.[10]

After consideration of alternative risk mitigation options; alternative pipe diameters; load shedding regimes; and issues relating current and possible changes to operation and maintenance practices, constructing the SPL with 500 mm diameter pipes was found to be the most effective risk mitigation option at the least cost, in terms of net present value.[11]

The SPL was required in order for JGN to maintain its capacity to meet existing levels of demand in the event of loss of supply to the Sydney Primary Main. On this basis, PB agrees that this capital expenditure is justifiable as it complied with clause c(iv) of Rule 79(2).

In mitigating the risk of loss of the then single set of supply infrastructure, JGN has avoided the costs associated with large-scale loss of supply to its customers. In a consequence assessment, JGN had identified that gas supplies to the Sydney basin would take months to restore if the Horsley Park Trunk Receiving Station or a section of the primary main was taken out of service for repair. The resulting claims against JGN could be in the order of hundreds of millions to over a billion dollars.[12] There would also be the additional costs to JGN associated with the loss of reputation.

PB's opinion is that JGN acted prudently, efficiently and in accordance with good industry practice, in investigating the construction of the SPL and, following consideration of various risk mitigating options and alternative solutions and configuration, had selected the least cost risk mitigation solution. PB thus concurs that JGN had complied with Rule 79(1) clause (a).

[8] Supply Security Assessment – Sydney Primary Loop Project Review, July 2005, Agility Management Pty. Ltd.

[9] Item for Approval – The construction of the Sydney Primary Loop, submission paper to Board Meeting December 2005, AGL Gas Networks Limited.

[10] Ibid, Attachment 2 – Summary of risk assessment for Sydney Primary Main and Horsley Park TRS.

[11] Ibid. 2, Section 3.

[12] Ibid. 4.

### Project delivery

Delivery of the SPL included the following[13]:

- 28 km of 500 mm steel main from Moorebank to Tempe
- 5 Automatic Line Break Valves (ALBV)
- a trunk receiving station (TRS) at West Hoxton
- a primary regulator station (PRS) at Moorebank
- pig launcher and receiver
- cathodic protection system and SCADA facilities
- upgrade of the 550 mm diameter West Hoxton to Moorebank primary main to piggable standard
- tie-in to existing 860 mm diameter trunk main at West Hoxton, 550 mm diameter primary main at Marrickville and secondary main at Moorebank.

JGN entered into various contractual arrangements to deliver the program of works[14]. Pipes, pipe coating, ALBVs, pressure regulating stations, horizontal directional drilling and other items were procured by a combination of lump sum and schedule of rates. PB did not review the documentation of the reasons for adopting this combination of procurement methodologies and the resultant overall benefits. However, PB considers that JGN's standard procurement policy (reviewed in Section 7.3) which is followed for all projects, ensures the resources have been procured at the lowest sustainable cost. Open cut trenching was delivered under a Project Alliance Agreement with two contractors. The reasons behind selecting these two contractors and the decision to adopt an alliance approach are unclear; however, the alliance arrangement was a 'three-limb' model[15] where the contractors and JGN would share the financial pain or gain according to actual results compared with pre-agreed targets. In PB's opinion, this alliance arrangement creates a financial incentive for all involved parties to collaborate to seek the best outcomes for the project.

The initial estimate for this project, which was submitted to the Independent Pricing and Regulatory Tribunal (IPART) as part of JGN's 2005 to 2010 Access Arrangement, was $51.6 million (2004 $). The revised 2005 cost estimate was $91.3 million. The basis for this increase was a combination of increase in project scope, changes to the route alignment, design requirements and changes to cost of materials and labour.

A review of the revised estimate found the cost estimating process is robust and the difference in the cost estimate is mainly due to changes in scope of the project and pipeline routes.[16] This is evident in the breakdown of cost estimates and in the unit rates in JGN's SPL project presentation for Gate 3B approval[17].

The project was delivered to budget, with the actual project cost of $88.8 million in 2007/08 dollars, being within 10% of the forecast estimate of $97.4 million in 2007/08 dollars ($91.3 million in 2004/05 dollars). This is evidence of the level of detail that was entered in

[13] Sydney Primary Loop project – post implementation review workshop, February 2008, The Australian Centre for Value Management.

[14] Ibid.

[15] Item for approval – Construction contract's for the Sydney Primary Main Loop, submission paper to Board Meeting May 2006, AGL Gas Networks Limited.

[16] Agility's proposal for the Sydney Primary Loop Project, October 2005, ECG Pty Ltd. Section 6.

[17] Sydney Primary Loop Project for Gate 3B (Presentation), July 2005, Agility Asset Management Pty. Ltd.

the revised cost estimate, and the robustness of the adopted cost estimating methodology, where an external consultant was engaged to prepare an independent cost estimate of the project for comparison with JGN's estimate.

On the basis of the adopted procurement strategy and the delivery of the project to within forecasted estimate, PB considers that JGN had complied with Rule 79(1).

**PB's opinion**

PB's opinion is that the SPL project is conforming capital expenditure as defined by Rule 79. An assessment undertaken on the Sydney Primary Main revealed that the risk of large-scale loss of supply to the Sydney basin was high in accordance with AS2885 and thus unacceptable by JGN's standards. The objective of the SPL project was to mitigate this risk, allowing JGN to continue supplying gas to customers in the Sydney basin even when there is a loss of supply to the Sydney Primary Main, and thus avoiding the possibility of being exposed to the resulting compensation claims and lawsuits.

### 5.3.2 Rehabilitation of Bathurst Low Pressure Network

This project review is focussed on historical capital expenditure (capital expenditure) undertaken by JGN in 2005 and 2006 associated with rehabilitating the low pressure network supplying the city of Bathurst, as shown in Table 5-5.

Table 5-5 Historical capital expenditure associated with Bathurst low pressure network

| Year | 2004/05 | 2005/06 | 2006/07 | 2007/08 | 2008/09 | 2009/10 |
|---|---|---|---|---|---|---|
| Expenditure (nominal $'000) | 502.8 | 1,911.3 | 17 | 11 | - | - |

Source: JGN 2005-10 Historic Capital expenditure 25March09.xls, supplied by JGN 25 March 2009.

The results of a leakage survey done in 2003, compared with the regional average, indicated the Bathurst low pressure distribution network was in poor condition. This was consistent with the level of publicly reported leaks, which was also above that of the Bathurst medium pressure network and the average figures for the NSW country region and the whole of JGN gas networks.[18]

**Project selection and planning**

PB accepts there was a clear driver for investigating the rehabilitation of Bathurst low pressure network, based on the information JGN presented that relates to the following:

- The extremely high leakage rate (compared with similar assets within JGN's distribution networks).
- The associated high levels of unaccounted-for-gas (UAG).
- The associated environmental concerns.
- The outcomes of the risk assessment comparing unrehabilitated and rehabilitated networks; and
- Operation and supply issues relating to water ingress.

PB agrees this capital expenditure is justifiable as rehabilitation of the Bathurst low pressure network was required to maintain and improve the safety of services; to maintain the integrity of services; and to maintain JGN's capacity to meet levels of demand for

[18] Integrity assessment report – Programmed mains & services renewal review, July 2004, Agility Management Pty. Ltd., Section 2.1.2

services existing at the time; and thus complied with clauses c(i), c(ii) and c(iv) of Rule 79(2).

JGN assessed the following options as part of its risk assessment and economic evaluation:

- rehabilitating the network
- 'do-nothing,' which would entail ad-hoc leak repairs as required.

In assessing the two options, JGN undertook an economic assessment that compared the net present value (NPV) of the two options, taking into consideration the costs associated with ad-hoc repairs and UAG. As a sensitivity analysis on the economic assessment, three scenarios, with different forecast annual rate of repairs, for the 'do-nothing' approach were considered.[19]

In PB's view, JGN selected the appropriate course of action at the time, on the basis of the combined semi-qualitative risk assessment and the economic assessment outcomes. Given the internal rate of return (IRR) for rehabilitating the network ranging from 10.3% to 11.2% across the three 'Do-nothing' scenarios considered, and JGN's weighted average cost of capital (WACC) was 9.63%[20], PB concurs that in selecting the option to rehabilitate the low pressure network, JGN has acted prudently and efficiently in achieving the lowest sustainable cost of providing the necessary reference services. On this basis, PB considers the relevant historical capital expenditure is conforming capital expenditure that satisfies Rule 79(1) clause (a).

### Project procurement and delivery

Rehabilitation works were to include:

- insertion of nylon and polyethylene pipes into the existing cast iron mains
- direct laying of modern medium pressure equivalents
- upgrading of existing nylon mains to the higher pressure; and
- removal of several regulators.

Three of JGN's preferred contractors were approached for a quotation, including the local minor works contractor for the Bathurst area. (JGN usually prefer to award contracts to local contractors.) Price was a factor in the tender evaluation, as the successful contractor's tender price was substantially lower than that of the local minor works contractor.[21]

All pipes and fittings required for the rehabilitation were procured by the contractor through JGN.

Total project cost was forecast as $3,176,000 ± 10% in 2007/08 dollars ($2,977,259[22] ± 10% in 2004/05[23] dollars). Actual project cost was $2,532,936 in 2007/08 dollars, a saving of approximately 20% of the forecasted budget.

[19] Cost comparison spreadsheet of 'Do-nothing' and 'Rehabilitation of network' options for AGN 2 kPa Low Pressure Network Bathurst, file number: PLN-00025-01

[20] Ibid.

[21] Project closeout report – Bathurst Low Pressure Network Rehabilitation C300/0038, 13 July 2006, Agility Asset Management Pty. Ltd.

[22] Additional service request – Bathurst 2 kPa network rehabilitation, 7th May 2005, Agility Management Pty. Ltd.

[23] Assumed, as available project documentation can only be dated to March and May 2005.

The rehabilitation project was delivered below budget despite an increase in contractors scope, with the rehabilitation of an additional area of the low pressure network that was not included in the original project brief[24]. While this would suggest that the project cost was initially over estimated, PB recognises that there were contingencies allowed in the budget for cost risks associated with restoration costs and internal cleaning of mains that were mitigated or that did not eventuate. The savings in these contingencies would be equivalent to 7% of the forecasted budget.

On this basis and considering the accuracy of the forecasted budget, PB considers that JGN had complied with Rule 79(1) clause (a) in the procurement of rehabilitation works; and that the cost forecast was arrived at on a reasonable basis and represented the best estimate possible in the circumstances, in compliance with Rule 74(2).

### PB's opinion

Following PB's detailed review of the supplied project documentation, we are of the opinion that the $2.6 million capital expenditure undertaken to rehabilitate the Bathurst low pressure network in 2005 and 2006 is conforming capital expenditure in accordance with Rule 79 of the National Gas Rules. This is on the basis that after comparison of the net present value of this option with that of the 'do-nothing' case, it was demonstrated that the overall costs to operate and maintain the Bathurst low pressure network were minimised, after considering the poor condition and performance of the existing assets. This is supported by the risk assessment presented in the project documentation, and justifies that this project capital expenditure complies with clauses a, c(i), c(ii) and c(iv) of Rule 79(2).

PB notes however, that the documentation submitted by JGN provided only limited insights into the options considered, the selected project timing, and the basis of the cost estimation. A more rigorous discussion and documentation of these matters would have supported the case further, and more clearly justified the conforming nature of the capital expenditure.

[24] Ibid, 15.

# 6. Forecast expenditure prudence and efficiency review across key regulatory categories

## 6.1 Forecast capital expenditure

PB undertook a high level review of the forecast capital expenditure to establish an opinion as to whether the expenditure could be regarded as conforming capital expenditure under the NGR.

JGN's forecast capital expenditure for the next Access Arrangement period, 2010/11 to 2014/15, is as shown in Table 6-1. JAM advises that these forecast figures are the direct escalated costs and includes overheads and margins.

**Table 6-1 Forecast capital expenditure for system upgrade**

| Real 2008$'000 | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | Total |
|---|---|---|---|---|---|---|
| Market expansion | 62,184 | 72,657 | 77,602 | 73,886 | 70,436 | 356,765 |
| Non-system assets | 24,744 | 19,356 | 17,437 | 32,879 | 33,655 | 128,070 |
| **System upgrade** | | | | | | |
| Growth capacity development | 30,267 | 15,404 | 9,172 | 8,589 | 19,222 | **82,655** |
| Security of supply | 0 | 0 | 0 | 0 | 0 | **0** |
| Mains & services renewal | 3,495 | 9,474 | 11,841 | 7,399 | 5,307 | **37,516** |
| Mines subsidence | 1,606 | 3,675 | 0 | 0 | 0 | **5,281** |
| Facilities renewal & upgrade | 20,453 | 18,033 | 18,616 | 24,059 | 28,185 | **109,346** |
| Meter renewal & upgrade | 23,092 | 21,511 | 26,104 | 26,584 | 31,262 | **128,553** |
| Government Authority Work | 578 | 588 | 602 | 615 | 626 | **3,009** |
| **Total** | 166,419 | 160,697 | 161,355 | 172,401 | 178,019 | **851,195** |

As shown in Figure 6-1 an increase in JGN's proposed capital program is proposed for the 2010-2015 current Access Arrangement period. The five-year forecast total is $851 million (real 2008$), representing a real increase of $338m, or 66% over the actual expenditure for the current Access Arrangement period ending June 30 2010.

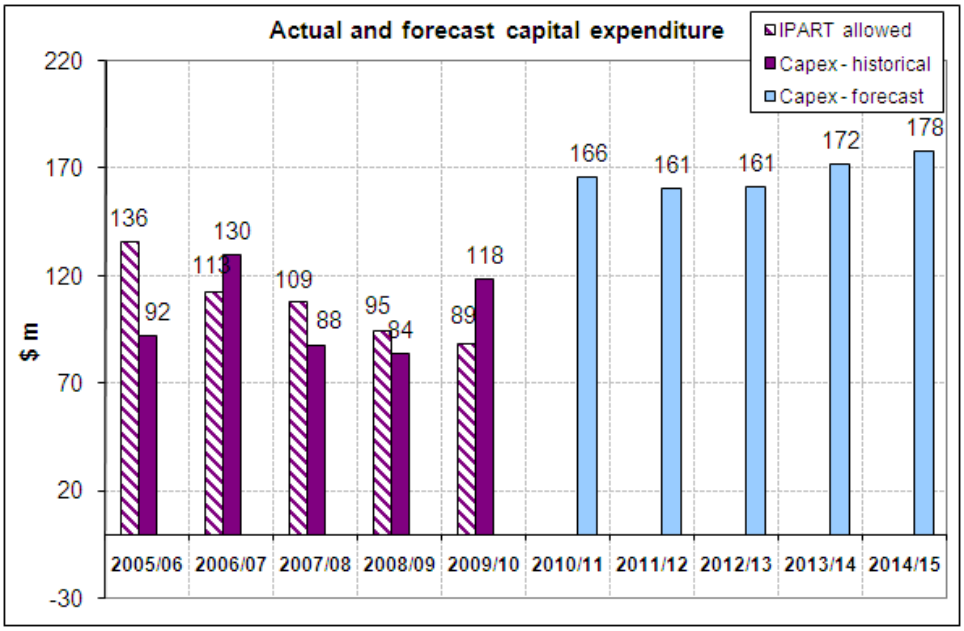


**Figure 6-1 JGN actual and forecast capital expenditure (Real 2008$)**

As shown in Figure 6-2, JGN has proposed an increase in capital expenditure in all categories except for mains and services renewal and government authority work.

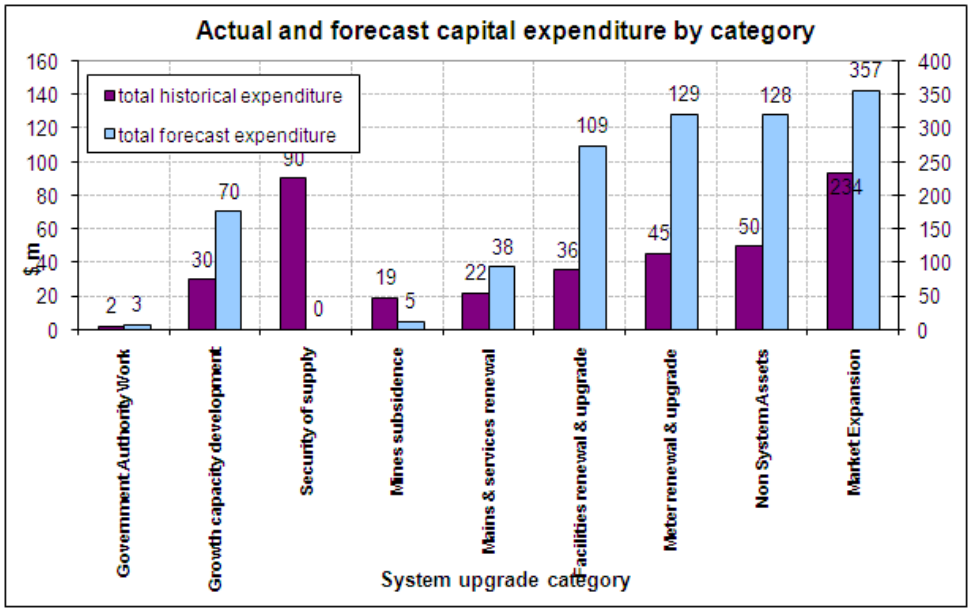


**Figure 6-2 Actual and forecast capital expenditure by system upgrade category (Real 2008$)**

### 6.1.1 Items with significant increase in forecast capital expenditure

#### Non-system assets

Non-system assets include vehicle, IT and, leasehold improvements, SCADA/communications, and planned fixed and mobile plant and equipment. Expenditure is forecast to increase by 170%, with IT and communications, and motor vehicles making up more than 95% of this expenditure. An assessment of the forecast IT and

communications expenditure is beyond the scope of this report, and JGN has advised that a review of this forecast expenditure is being completed by others.

Forecast vehicle expenditure is discussed further in Section 7.4.

### Market expansion

The forecast expenditure for Market Expansion contributes $74m to the forecast increase in expenditure compared to the actual expenditure during the current access arrangement period. As identified in Section 5.1.2, JAM advised that market expansion projects are driven by customer demand. Since demand during the current period was lower than forecast due to projects being postponed, it is anticipated that demand in the Access Arrangement period from 2010-2015 will include projects previously postponed.

In addition, the unit rates for market expansion projects are forecast to increase. These unit rates are discussed further in Section 7.3.

### Growth capacity development

Capacity development projects are required to support the on-going growth of the JGN network, from trunk main through to the medium and low pressure networks. A number of capacity development projects planned for the current Access Arrangement period (2004/05 to 2009/10) were deferred to the 2010/11 to 2014/15 period due to slower than expected growth or to divert capital to the Sydney Primary Loop project, with interim measures in place. The lower demand was reflected in the underspend for growth capacity development during the current access arrangement.

Projects contributing significantly (>5%) to the proposed expenditure for growth and capacity development projects include the PRS and mains extension an Emu Plains (9%) and the Wakehurst Parkway secondary main (13%). The Wakehurst Parkway project is part of JGN's overall long-term strategy to improve capacity and supply reliability in the northern area of Sydney. The strategy addresses the existing capacity constraint issues of the Warringah region, as well as catering for the expected growth of north-western Sydney.

### Facilities renewal and upgrade

The proposed facilities renewal and upgrade projects include the construction of pigging[25] facilities on the trunk pipelines, and integrity assessment of the trunk and primary mains as part of JGN's new lifecycle management strategies for trunk and primary mains.

Under the new lifecycle management strategies, the integrity of trunk mains will be monitored by pigging every five years, in compliance with AS2885.3 (Pipelines – Gas and Liquid Petroleum – Operation and Maintenance). Validation excavations will be undertaken to confirm or challenge the findings of the pigging data for trunk mains. The outcomes of the validation excavation and pigging data will provide the basis for establishing the pipeline conditions and determine if further remedial work on the trunk pipeline is required to ensure its safe operation and confirm its MAOP.

However, pigging facilities are currently not available on older trunk mains, and as such, JGN has proposed to construct two new facilities, one for Licence 8B pipeline and the other for Licence 2B pipeline.

[25] "Pigging" is the sending of a tool ("pig") internally through a high pressure main, usually without disruption to the flow of gas. That is, using the flow of gas and the pressure drop across the "pig" to move the "pig" through the pipeline. This purpose of this may be for cleaning and for ultrasonic in-line inspection to determine metal loss and defects with and end result of determining the integrity of the high pressure main. The "pig" is "launched" at the start of the pipeline and "received" at the end of the pipeline in specially designed facilities.

The majority of primary mains were constructed 25 to 30 years ago and were not designed to allow for pigging. Only the lines constructed recently, the Penrith Primary Main and the SPL are designed to be piggable. The SPL has pigging facilities installed during construction, while the Penrith primary did not. Integrity assessment procedures for these two primary mains will be similar to that of the trunk mains.

JGN proposes to maintain current integrity assessment procedures for the older primary mains, i.e. random integrity excavations supplemented with information gathered during government authority work to extrapolate general condition of primary mains. JGN has also allowed for consideration of hydro testing of the older primary mains to improve the quality of pipeline integrity information gathered. However, one of the issues that would need to be addressed, and thus possibly requiring additional capital works, is how to maintain gas supplies to customers while the primary main is being hydro tested.

Other projects proposed for the next access arrangement period include the upgrade of nine PRS – with JGN intending to develop, as much as possible, a standardised PRS design – and upgrade to the POTS on the Marsden to Dubbo and the Junee to Griffith transmission pipelines. The standardisation of design is expected to lower lifecycle costs of these assets.

The operating pressures in the Marsden to Dubbo and the Junee to Griffith transmission lines will be increased in a phased manner in the next few years by the new pipeline owner (APA) from approximately 7,000 kPa to 10,000 kPa. This new operating pressure will exceed the pressure rating of the existing POTS along the pipelines, thus requiring upgrade.

**Meter renewal and upgrade**

JGN's experience over the current access arrangement period is that meters and regulators have failed on a larger scale than expected. Thus a larger allowance for defective residential and industrial and commercial (I&C) meter replacement has been made in the meter renewal and upgrade capital works.

In addition, JGN has proposed changes to the aged meter replacement policy for residential and industrial and commercial (I&C) meters.

The changes in policy have resulted in a larger population of meters that would require replacement during the next Access Arrangement period. The population would be larger than in future periods due to the compounding effect of past life-extension programs of aged meters.

A detailed assessment of the planned meter renewal an upgrade expenditure is provided in Section 6.3.2.

### 6.1.2 Items with significant reduction in forecast capital expenditure

**Mines subsidence**

Allowance has been made for stress mitigation works on the trunk main at the Westcliff Colliery.

### 6.1.3 Other items

**Government authority work**

JGN only makes network modifications required due to government authority work at its own expense on an as-needs basis. The proposed allowance is similar to the capital expenditure for this type of work during the current Access Arrangement period.

PB's opinion is that this is a reasonable expenditure forecasting method.

## 6.2 Overall comment on forecast capital expenditure for Access Arrangement period 2010/11 to 2014/15

While the forecast capital expenditure is a 64% increase on the actual expenditure during the current Access Arrangement period, PB's opinion is that the reasons for this increase are reasonable, and arise due to increases in capital spend within each expenditure category. These increases are generally driven by:

- Forecast increases in unit rates.
- Development of projects postponed from the current Access Arrangement period.
- Facility upgrades to enable higher transmission line pressures and improved condition monitoring of trunk mains.
- Policy changes arising from experience during the current access arrangement period.

Therefore, provided the forecast costs for individual projects comply with Rules 74 and 79, PB's opinion is that the forecast capital expenditure for the 2010/11 to 2014/15 Access Arrangement period is considered conforming capital expenditure.

## 6.3 Detailed assessment of selected projects

PB evaluated the extent to which four proposed projects with forecast capital expenditures of greater than $1 million over the next access arrangement period conform to the specific criteria in Rule 79.

### 6.3.1 Selection of projects for review

The Industrial and Commercial (I&C) Aged Meter Replacement project was identified as a key project to review, since the expenditure will reflect proposed changes to the refurbishment and replacement policy for I&C meters.

One or two projects from three categories; capacity planning, facilities upgrade, and mains and services renewal; were then selected and sent to JAM for comment. JAM was requested to advise if the nominated projects were not suitable for review, give reason why, and nominate an alternative.

The projects initially nominated for review are:

- Major pipeline amplification/augmentation: Wakehurst Parkway Secondary Main; and The Entrance 210 kPa Capacity Development.
- Facilities upgrade: Wollongong PRS – Regulator/Instrumentation Upgrade.
- Mains and services renewal: Bidwell Mains and Service Area Renewal; and Kurri Kurri Rehabilitation.

JAM agreed that the Wakehurst Parkway Secondary Main project was a representative project that was suitably progressed through the governance and estimation gates to qualify for review. JAM supplied information for PB to review this project.

JAM advised that Wollongong PRS – Regulator/Instrumentation Upgrade is currently not suitable for review as the project is scheduled for late in the next access arrangement period and project documentation are only in the preliminary stages (i.e., Gate 1). JAM nominated the review of Tempe PRS – Regulator/Instrumentation Upgrade as an alternative as the project documentation is more advanced (Gate 1), and subsequent similar projects will follow comparable project development processes.

Similarly, JAM advised that Smithfield-Liverpool Programmed Mains and Services Area Renewal is the most advanced mains and services renewal project and would be better suited for review. Documentation for Bidwell Mains and Service Area Renewal and Kurri Kurri Rehabilitation are only in the preliminary stages.

The list of documentation for both projects that are available for the review are as listed in Appendix A.

PB considers the final list of projects reviewed as being of sufficiently high value and or suitably progressed (by reference to governance gates) to be representative of the manner in which JAM identifies, scopes, estimates and implements capital works projects.

### 6.3.2 Industrial and Commercial Aged Meter Replacement program

Industrial and Commercial (I&C) meters have a statutory[26] life of 15 years, the same as residential meters. However, in accordance with Jemena Technical Policies, which aims to limit the potential financial affects of meter inaccuracy, I&C meters are replaced more frequently as part of the I&C aged meter replacement program.

I&C meter replacement periods are as follows:

- 5 years for turbine meters
- 10 years for rotary meters
- 15 years for diaphragm meters.

Aging meters create inaccuracies in flow measurement, particularly under-registering of gas flowing through the meters.

JAM has proposed several changes to JGN's existing I&C aged meter replacement program so as to overcome these flow measurement inaccuracies.

The current policy on I&C aged meter replacement program are as follows:

- Rotary meters:
  - Scrapping of the rotary meter brands that are not suitable for refurbishment due to excessive meter error.
  - Scrapping of rotary meters when the cost of refurbishment is at least 60% of the cost of a new meter.
  - Refurbishment of all other rotary meters.
- Turbine meters:
  - Downsizing of turbine meters to match current gas consumption.

Proposed changes to the program are as follows:

[26] Gas Supply (Gas Meters) Regulation 2002 Paragraph 9.1.a).

- Rotary meters
  - Scrapping of rotary meters after only one refurbishment.
- Turbine meters
  - Continue with downsizing of meters to match reduced gas consumption.
  - Use new modern turbine meters
  - Replace turbine meters with new rotary meters instead of meter refurbishment.

Forecast capital expenditure for implementing the revised I&C aged meter replacement program is shown in Table 6-2.

**Table 6-2 Forecast capital expenditure for I&C aged meter replacement program**

| Real 2008$'000 | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | Total |
|---|---|---|---|---|---|---|
| Forecast expenditure | 3,863 | 5,427 | 3,675 | 4,353 | 5,292 | 22,610 |

Source: AA10-SA-04102F JGN 2010-2015 Prudent Capex 10 July, supplied by JGN 14 August 2009.

PB's high level assessment of this meter replacement program is based on the information presented in the 'Jemena Asset Management Plan for Jemena (JGN) Gas Network' and the document 'AA10-SA-04109 JGN IC meters Jul2009_Jun2015 ($2008)'.

### Project drivers

PB accepts that the main drivers for the I&C aged meter replacement program are to meet regulatory obligations and to reduce losses in revenue caused by under-measurement of gas flows.

JAM has explained that JGN is at greater risk of having more unaccounted-for-gas (UAG) from I&C customers, particularly the larger customers, than from residential customers. This is partly due to the comparably larger volumes of gas flows through the meters, and also the decreasing accuracy of the meters at low flows.

In PB's opinion, this program is to maintain the integrity of JGN's services, and is in compliance with clauses c(ii) and c(iii) of Rule 79(2).

### Options investigated

PB did not find any evidence of options being investigated for the I&C aged meter replacement program. JAM advised that at this stage other options are not being considered.

### Proposed project scope

The expected number of I&C meters that would require replacement due to age is shown in Table 6-3.

**Table 6-3 Expected number of I&C aged meter replacements**

| I&C aged meter replacement | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | Total |
|---|---|---|---|---|---|---|
| Forecast number of meter replacements | 1,579 | 1,937 | 1,629 | 1,622 | 1,951 | 8,718 |

Source: AA10-SA-04109 JGN IC meters Jul2009_Jun2015 ($2008), supplied by JGN 11 May 2009

Table 6-4 presents the number of I&C meters in service as at December 2008, according to Table 4-45 of the AMP.

**Table 6-4 I&C meters in service as at December 2008**

| I&C meter description | Asset volume |
|---|---|
| Diaphragm meters in service | 28,289 |
| Rotary meters in service | 1,545 |
| Turbine meters in service | 232 |
| Total meters in service | 30,066 |

Over the 5 year access arrangement period, 30% of the total I&C meter population are forecast to be replaced. This broadly corresponds to the proportion of diaphragm meters, the largest group of I&C meters that would be approaching the end of their 15 year statutory life during the next Access Arrangement period.

On this basis, PB considers JAM's estimate of the number of future meter replacement to be reasonable.

### Proposed project costs

JAM has provided the basis of cost estimates within the document 'AA10-SA-04109 JGN IC meters Jul2009_Jun2015 ($2008)'. This provides details based on past replacement costs of the unit rate for replacement of different meter types. While the basis of cost estimates is provided, the presentation of the information is not clear and concise.

JAM has noted in the AMP that the implementation of the new policy would substantially increase capital expenditure for the next Access Arrangement period; however, capital expenditure on this program would be expected to be smaller in future periods. In PB's opinion, this would be a reasonable expectation as the population of meters to be replaced would be higher initially to address the existing backlog of meters.

### Project timing

JAM has proposed to implement the revised I&C aged meter replacement program immediately. This approach appears reasonable to PB as this is an on-going replacement program.

### Alignment with JGN's capital governance framework

The proposed changes to the I&C aged meter replacement program is to reflect proposed changes in the I&C meter replacement policy. JGN advise that the proposed changes in the policy are to address the shortcomings of the current program in an economical manner.

### Accuracy of supplied information

PB considers that there are no reasons to doubt the accuracy of the supplied information.

Information on the methodology used to forecast the number of meters requiring replacement and also on the cost estimating process would have better supported the case.

### Value and timing of project for inclusion in forecast capital expenditure

PB considers the value and timing of this meter replacement program as proposed by JAM is suitable for inclusion in the forecast capital expenditure.

### PB opinion

PB considers that the I&C aged meter replacement program complies with Rule 79. The program addresses JGN's regulatory obligation to maintain its I&C meter assets to within the statutory life of the meters, and aims to maintain or improve the accuracy of gas flow measurements, and thus the integrity of JGN's services.

PB is of the opinion that by implementing this program and the proposed changes, JGN will have acted prudently and efficiently, adopting good industry practices to achieve the lowest sustainable cost of distributing gas.

JGN's case for compliance with Rule 79 could be better supported by a discussion on the potential reduction in unaccounted-for-gas and/or operating costs compared with the increased capital expenditure of replacing the I&C meters at a greater frequency than statutory requirements.

PB considers that the basis of cost estimates is reasonable, and therefore complies with Rule 74, however recommends that the presentation of the information be improved.

## 6.3.3 Wakehurst Parkway Capacity Development Project

Past performance validation has indicated limited capacity in the Warringah Region due to constraints in the primary and secondary mains and facilities. In the past five years, JAM has managed these constraints by small-scale capital works and operational measures, including:

- Renewal projects
- Small to medium-sized network enhancements
- On-going monitoring of network performance, such as by time clock control (TCC); and
- Operating the medium pressure networks to a lower terminal point than the normal minimum pressure limit.

While the construction of the Sydney Primary Loop (SPL) has increased the capacity of the primary network, and thus deferred long-term major enhancement projects planned for the area, work on the secondary mains cannot be deferred further.

JAM has made provisions for the ongoing investigation, design and construction of the Wakehurst Parkway Secondary Main. Forecast capital expenditure during for this project is shown in Table 6-5, with $3.3m forecast to be spent during the current access arrangement period FY09/10.

**Table 6-5 Forecast capital expenditure for Wakehurst Parkway Capacity Development Project**

| Real 2008$'000 | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | Total |
|---|---|---|---|---|---|---|---|
| Forecast expenditure | 3,257 | 7,269 | 755 | - | - | - | 11,282 |

Source: AA10-SA-04102F JGN 2010-2015 Prudent Capex 10 July 09, supplied by JGN 14 August 2009.

PB's review of this project is based solely on the hardcopy of presentation slides which included a number of options for project delivery for JGN NSW on the Wakehurst Parkway Capacity Development Project, dated 25 February, and information provided during interviews with JAM staff. The presentation slides include network simulations and options.

### Project drivers

The stated driver for the Wakehurst Parkway Capacity Development project is to address existing and future network capacity constraints in the Warringah region, therefore enabling JGN to meet existing demand. Since the expenditure will enable future demand on the peninsular be met, the project is being designed to allow for future capacity needs as well.

Capacity constraints to the medium pressure network in the region are predominantly due to constraints in the primary and secondary networks that supply the region.

In recent years, JAM has implemented measures on the medium pressure network, including operating the network at lower than normal pressure levels, to defer work on the primary and secondary mains; however, with the projected growth in the region, there are now limited options for deferring capital works on the secondary network.

The construction of the Wakehurst Parkway secondary main will maintain JGN's capacity to maintain supply to meet existing demand levels, as well as provide capacity for expected growth in the region.

### Options investigated

In the process of developing the project scope, JAM has investigated a range of alternative options for addressing capacity constraints in the Warringah region. These options include:

- capacity enhancement of Willoughby PRS
- installation of new PRS at Lane Cove
- installation of low differential pressure regulators as a short-term measure
- on-going rehabilitation of distribution network
- time clock control (TCC) to manage leakage
- Cromer Capacity Development Project
- Collaroy Plateau Capacity Development Project
- Dee Why Capacity Development Project.

However, JGN has advised that these projects, implemented individually, would not address capacity constraint issues in the region. A combination of capital works in addition to upgrades of the existing secondary mains or a new secondary main would be required.

While PB has not received evidence of economic assessments of the options, and JAM has indicated that a full economic assessment will be completed once investigations as to pipe material are completed, but prior to commencement of construction.

JAM proposes to also evaluate the option of constructing the new secondary main using polyethylene gas pipes (PE100), Identifying polyethylene pipe that is rated for pressures up to 1000kPa is critical to the feasibility of this option. Completion of this investigation will also enable project costs to be estimated and economic evaluation of the options to be completed.

PB is satisfied that JGN had investigated a range of options for increasing supply capacity to the distribution networks in the Warringah region, and has adopted a long-term perspective to the region; however, PB cannot comment on the cost effectiveness of this option.

JGN advise that a more detailed economic assessment, engineering assessment and feasibility assessment is to be completed, in line with the gate process for Gate 2. Undertaking a more detailed assessment will include an increased forecast to due to the construction methodology, which includes physical constraints of the pipe which prevents insertion.

### Proposed project scope

The proposed project scope is to include investigations, design and construction of the Wakehurst Parkway secondary main. This would involve laying 11 km of 200 mm diameter steel pipes along Wakehurst Parkway and installing two secondary regulator sets.

The scope appears reasonable and would ensure continuity of a project from investigations and design through to delivery.

### Proposed project costs

PB is advised that project feasibility cost estimates are in progress, using average unit rates for construction of similar pipelines. Final project cost estimates and economic evaluation will be completed following the completion of the engineering investigations identified above.

### Project timing

JAM advised that the timing of the Wakehurst Parkway secondary main is dependent on the operation and performance of the 15NB main and medium pressure networks in the Warringah region. Based on the capital expenditure plans, it is programmed to start during the 2009/10 financial year.

The project is part of a series of long-term capital works planed to increase gas supply to the region. Completion of this project is necessary before other projects, such as the installation of the new Lane Cove PRS and the capacity enhancement of the Willoughby PRS, to enable JGN's customers to obtain the most benefit. Deferral of this project may result in the implementation of other interim measures, increasing JGN's overall capital expenditure in the region.

In PB's opinion, it is reasonable for JGN to propose starting capacity development capital works in the region early in the next access arrangement period as the distribution networks are already experiencing capacity constraints.

### Alignment with JGN's capital governance framework

The Wakehurst Parkway capacity development project is to address network performance and capacity constraint issues in the Warringah region as identified by JGN's network supply performance validation process. The project is in accordance with JGN's network capacity planning policies.

### Accuracy of supplied information

PB has no reason to doubt the accuracy of the information supplied by JAM on this project. Print-outs of performance models of the distribution networks in the Warringah region demonstrates that supply limitations, already existing, would worsen in future.

### Value and timing of project for inclusion in forecast capital expenditure

PB considers the value and timing of this capacity development project as proposed by JAM are suitable for inclusion in the forecast capital expenditure.

### PB opinion

In PB's opinion, the Wakehurst Parkway capacity development project complies with Rule 79. Specifically, clauses 79(2)(c)(iv).

JAM has adopted a long-term plan for addressing the existing and future capacity constraints in the Warringah region. The construction of the Wakehurst Parkway secondary main would be one of a series of projects in this long-term plan for maintaining and improving JGN's capacity to meet demand levels, and a reasonable number of options

have been evaluated. While the preferred option appears reasonable, the evaluation and selection process is not well documented.

JAM has considered the timing of this project in relation to other necessary capacity development works in region. PB considers that JAM had acted in a prudent and efficient manner, and in accordance with accepted good industry practice, to achieve the lowest sustainable cost of developing the capacity of the distribution networks in the Warringah region.

Based on the range of options investigated, and the ongoing assessment of alternate construction techniques, it is PB's opinion that the project is being investigated prudently.

Evidence of economic assessment of the options, or combination of options, investigated would have reinforced the case for compliance with Rule 79, however PB accept that finalisation of the material options available for construction are required before economic evaluation of the options can be reliably completed.

A basis of cost estimates is required for compliance with Rule 74. PB's opinion is that the methodology for cost estimation is appropriate for this project, and it therefore complies with Rule 74.

### 6.3.4 Smithfield to Liverpool Programmed Mains and Services Area Renewal

This project review is based on the capital expenditure proposed to be made by JAM on 'Sector 1' (northern sector) of the Smithfield to Liverpool network. This is the third and final sector of the network to be renewed, with renewal works for the first two sectors implemented during the current Access Arrangement period. Renewal works for 'Sector 1' were intended for completion in 2009/10; however, works may be deferred to 2010/11. The forecast capital expenditure for renewal works on 'Sector 1' of the Smithfield to Liverpool network is shown in Table 6-6 with $1.7m forecast to be spent during the current access arrangement period FY09/10.

**Table 6-6 Forecast capital expenditure for Smithfield to Liverpool Programmed Mains and Services Area Renewal ('Sector 1')**

| Real 2008$'000 | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | Total |
|---|---|---|---|---|---|---|---|
| Forecast expenditure | 1,660 | 1,136 | - | - | - | - | 2,796 |

Source: AA10-SA-04102F JGN 2010-2015 Prudent Capex 10 July 09, supplied by JGN 14 August 2009.

Rehabilitation of the cast iron mains and services in the Smithfield to Liverpool low pressure network will be by insertion with either nylon or polyethylene pipe.

PB's review of this project is based on the 'Asset Integrity Assessment – Smithfield to Liverpool Low Pressure Distribution Network', which considered renewal works for the overall distribution network (all three sectors); Business Case for the 'Sector 2' rehabilitation works; and the 'Integrity Assessment Report – Programmed Mains & Services Renewal Review'.

It is noted that the 'Asset Integrity Assessment – Smithfield to Liverpool Low Pressure Distribution Network' refers to the northern sector of the network as 'Sector 3', and 'Sector 1' is the southern sector. The reason(s) for the interchange is not documented.

#### Project drivers

The assets within the Smithfield to Liverpool Network consist of both 2kPa cast iron mains and pockets of rehabilitated 7kPa nylon.

The Asset Integrity Assessment of the Smithfield to Liverpool Low Pressure Network established the need for the rehabilitation of the network as presented below:

- The operating history of the aged cast iron mains demonstrates one of the highest leakage rates of all the remaining ferrous networks in Sydney. Publically reported leaks for the Smithfield to Liverpool network are two to three times greater than the overall rate for Western Sydney and are comparable to the pre-rehabilitation figures of the Bathurst Low Pressure Network (recently rehabilitated and converted to medium pressure network).
- The Smithfield to Liverpool Network is associated with a high level of unaccounted-for-gas (UAG) of approx 60.0 TJ for the network annually. The annual cost of UAG within the network has been conservatively estimated at $286, 800.
- Analysis to benchmark the repair and maintenance costs per customers site, indicated a disproportionately high level of repairs in the Smithfield to Liverpool network, compared to the overall Sydney Network.
- A risk assessment on the existing network identified and assessed eleven risks, with the risk profile found to be unacceptably high by JGN risk policy. In comparison, the risk profile of a similar rehabilitated network would be mitigated to moderate to low levels, which are acceptable to JGN.
- The quality of gas supply in unrehabilitated areas is considered to be at a lower standard than the rehabilitated networks. This results in social equity issues for the 5% of customers supplied by the older, unrehabilitated networks.
- The leakage within the Smithfield to Liverpool Network also presents environmental issues with the ‘fugitive emissions’ equivalent to 22,062 tonnes of carbon dioxide emissions.

These factors demonstrate that rehabilitation of the Smithfield to Liverpool LP Network is required for JGN to maintain and improve the safety of services; maintain the integrity of services; and maintain capacity to meet existing demand levels for gas; and complies with clauses c(i), c(ii) and c(iv) of Rule 79(2).

### Options investigated

JAM has assessed two options as part of its risk assessment and economic evaluation:

- Rehabilitation of the network via insertion of nylon or polyethylene pipe.
- The ‘do-nothing’ option, which would entail ‘ad-hoc’ leak repairs.

PB notes that no alternative technical proposals have been reviewed. Rehabilitation by inserting plastic pipes has been shown over many years to be a technically sound and economically efficient.

In assessing the two options, JAM undertook an economic assessment considering the forecast capital and operating costs associated with both options. The net present value (NPV) analysis indicated that the overall expenditure for the option to rehabilitate the network is positive, and is in compliance with clause (a) of Rule 79(2).

Forecasts estimating repair rates, UAG and cost savings presented, satisfy Rule 74, are supported by statements of the basis and have been arrived at using sound methods, and represent conservative estimates, which are the best possible in the circumstances.

### Proposed project scope

JAM proposes to rehabilitate the cast iron mains and services in the northern sector of the Smithfield to Liverpool low pressure network by insertion with either nylon or polyethylene pipe. The rehabilitation works will include the refurbishment of approximately 39km of mains, and is expected to benefit 1,240 customers, 1,204 of whom are residential. The refurbished network is to have capacity to supply 300% of the existing domestic, and 200% of the existing residential demand.

In PB's opinion, the proposed project scope is reasonable.

### Proposed project costs

The proposed project costs outlined in the business case provide unit rates as an indicative cost per metre of rehabilitated pipe.

In PB's opinion, the methodology adopted for costing of 'Sector 2' rehabilitation, as presented in the business case, is reasonable. However, there is no indication that this methodology had been applied for forecasting of 'Sector 1' rehabilitation.

### Alignment with JGN's capital governance framework

In PB's opinion, this project is consistent with JGN's capital governance framework, procedures, and strategies. The project to rehabilitate the overall Smithfield to Liverpool low pressure network was identified through JGN's integrity assessment of its entire network.

In accordance with JAM and JGN's agreed rehabilitation justification framework, a leakage assessment was carried out covering leak reports and UAG assessment; annual operating costs were estimated; the network capacity considered; and risk assessment and financial analysis were conducted. The capital plan for the project was also developed with the project divided into three stages (or 'sectors') and prioritised.

### Accuracy of supplied information

PB has no reason to doubt the accuracy of the information provided; however, clarification on the project scope and/or forecast cost estimate is required.

In Table 5 of the Sector 2 rehabilitation business case, the total length of mains in Sector 1 is noted as 35,000 m. Application of this total length of mains with the forecasted cost estimate for rehabilitation of Sector 1 would result in a unit rate that would be much less than the unit rates documented in the Sector 2 rehabilitation business case. This would suggest that only a portion of Sector 1 is intended to be rehabilitated.

### Value and timing of project for inclusion in forecast capital expenditure

No justification for prioritising the Smithfield Liverpool LP Network above other networks has been explicitly stated; however it is understood that the network was prioritised highly for the reasons presented in the Integrity Assessment Report and again below:

- The unrehabilitated Smithfield to Liverpool Network is estimated to incur the highest total operating costs and costs per customer.
- The financial assessment of network renewal projects predicts this project will result in the most financial benefits of all, except one other, network renewal projects. This project will return to JGN the second highest IRR of the network renewal projects assessed at the time.

### PB's opinion

PB's opinion is that the Smithfield to Liverpool Programmed Mains and Services Area Renewal is conforming capital expenditure in accordance with Rule 79 of the National Gas Rules.

This is on the basis that JGN, in complying with its rehabilitation justification framework, and in particular undertaking network integrity assessments, had acted in a prudent and efficient manner, in accordance with accepted good industry practice to identify and prioritise the network rehabilitation projects. Through these processes, the Smithfield to Liverpool Programmed Mains and Services Area Renewal project was identified and prioritised. JGN has thus complied with Rule 79(1) clause a, with the drivers for this project complying with clauses a, c(i), c(ii) and c(iv) of Rule 79(2).

The basis of cost estimates outlined within the business case provides a sound methodology for estimating the cost of the project based on previous expenditure, and therefore PB's opinion is that it complies with Rule 74.

### 6.3.5 Tempe PRS – regulator/instrumentation Upgrade

PRSs are gas pressure reduction, metering and filtration facilities located at each off-take on primary mains, reducing the pressure from a MAOP of 3,500 kPa to supply the secondary network with an MAOP of 1,050 kPa. Construction, operation and maintenance of PRS are managed in accordance with the safety and operating plan (SAOP) and AS2885 suite of pipeline standards. Compliance with AS2885 is a regulatory requirement (NSW Gas Supply [Safety Management] Regulation 2002).

14 PRS are installed and there are three main groups or categories as follows:

- **Group 1** Sites commissioned in 1976 when natural gas was introduced to the Sydney market. Includes Tempe PRS.
- **Group 1a** Sites commissioned as part of organic growth post 1976. Includes Horsley Park, Haberfield, Wollongong (Cringila) and Willoughby PRS.
- **Group 2** Sites commissioned as part of the construction of the Eastern Creek to Penrith primary main – Penrith PRS.
- **Group 3** The Moorebank PRS was commissioned in 2007 (part of the Sydney Primary Loop).

Most PRSs are located in Sydney and are situated on public land. Due to limited aboveground space, most PRS are installed in underground concrete pits with lockable lids and alarms. The Supervisory Control and Data Acquisition (SCADA) system remotely monitors these facilities. Nine of the 14 PRS are between 31 and 35 years old. Tempe PRS is 33 years old.

#### Drivers (need or justification) for upgrading Tempe PRS

The Primary Facilities section of the AMP indicates JAM expects the design life of PRSs to be 40 years (the same section also refers to 30 to 35 years). PRS are subject to planned (or preventive) maintenance regimes however unlike 'pipe assets', PRS comprise different components including regulators, meters, valves, filters, pipes and instrumentation, all of which can have different 'lives'. Individual soft components (e.g. associated with filters and regulators) need to be replaced at regular intervals irrespective of the asset life.

Details pertaining to a number of PRS issues which impact upon 'Lifecycle Management'[27] are provided in the AMP. These issues are summarised as follows:

- Many PRSs are over 30 years old. The original Fisher pressure control valves are excessively noisy and resulting vibration has the potential over time to cause serious damage as it did in 2007 when a weldolet on the Auburn PRS failed due to fatigue. The

[27] Asset Lifecycle Phases: Creation-Operation & Maintenance-Renewal & Upgrade-Disposal

excessive noise level presents an OH&S risk for service personnel and also breaches EPA Guidelines for allowable noise levels in adjacent residential/commercial areas. Temporary noise mitigation modifications have been made however they are ineffective when maintenance activities are carried out.

- Operation of the Fisher pressure control valves relies on compressed air and failure rate of the instrument air systems is increasing. Reliance on electricity supply is also proving problematic. In the event of a power failure, bleeding of natural gas to atmosphere can occur. This is environmentally undesirable.
- Due to the age of the assets, vendors are withdrawing technical and spare parts support. Depending on its condition, redundant equipment is used for spare parts. However this has practical limitations.
- A number of installations do not meet mandatory hazardous area standards.
- Many PRS are installed below ground in concrete pits which inherently provide a damp environment.
- Corrosion of pipework and PRS components is an ongoing problem as various measures taken to eliminate dampness have been unsuccessful.
- Below ground pits are classified as confined spaces which require special access/egress measures. Grates are fitted as a precaution against trips and falls during maintenance operations.

JGN completed a comprehensive 'Lifecycle Management' study in 2008. Risk analyses in accordance with AS/NZS 4630 were conducted as follows:

- asset risk (levels of service, maintainability, asset lifecycle-end of life).
- technical risk (asset variation [standardization], maintenance costs, special issues).
- financial risk.
- compliance risks (standards, OHS, environmental).
- security risk.
- untreated risks.

Based on the outcomes of the risk analyses, JGN's priority rating for upgrading the Tempe PRS is 1 (mandatory). It is rated an Extreme risk site, consequences of an incident would be Major and an incident is Likely to occur. Upgrading is planned for completion during the period 2009/10 to 2010/11.

Council received a development application for this site and a number of risk mitigation measures are currently being implemented by JGN to ensure safe and reliable operation of the PRS in a vastly changed environment.

### PRS strategies/JGN recommendations

JGN has developed strategies for each PRS site based on findings and analyses outlined in its 2008 'Lifecycle Management' report. Risk profiles, costs (capital expenditure and operation expenditure) and Levels of Service were reviewed together in order to develop site specific optimum solutions.

Strategies are categorized in line with asset lifecycle phases:

- acquisition (new sites)
- use and maintenance support (existing sites)
- renewal and adaptation (sites requiring capital upgrade, e.g. Tempe PRS)
- disposal (none currently planned).

An engineering assessment: 'Tempe PRS Reliability & Noise Upgrade', also referred to as 'Tempe PRS Upgrade', was completed in 2008. This EA also took into account issues identified in a 2004 Tempe EA. The 2008 EA examined six options:

1. do nothing
2. upgrade using existing concrete pit
3. install an above ground PRS on the existing concrete footprint with floor extension
4. upgrade by extending the existing concrete pit – GHD Proposal
5. upgrade based on the SPL Moorebank PRS
6. new technology: 'Cocon 6'
7. An options assessment matrix was used to rank options to assist in identifying which option best met JGN's requirements. Options were assessed against defined criteria that cover risk analyses, compliance with Australian Standards, JGN policies, OH&S noise and personnel safety obligations, zero incident tolerance, cost savings due to standardisation versus site-specific PRS design, and expected benefits. Indicative capital expenditure was derived for each option and the range of estimates varies from $0 (do nothing) up to $2.5 million for option number 5. JGN's recommended option for Tempe PRS is number 2, costing $1.1 million. As noted previously, upgrading is planned for completion during 2009/10 to 2010/11.

### Tempe PRS upgrading cost estimate

The Jemena Pricing Model (JPM)[28] and the Gate Process were used for determining estimated capital expenditure for each option. The JPM is designed to standardise methods as far as possible across JAM for establishing and calculating prices. The process is aligned with JAM's Project Life Cycle Management (PLCM) approach which involves three review processes:

- gate (checks and balances at critical stages of the project)
- technical (integrity of project – 'fit-for-purpose')
- project (review of actual operation).

The definitions of the gates have been discussed previously and the reader is referred to Section 3.4.

Indicative capital expenditure for Option 2 is $1.1 Million (+/-50%). The breakdown of this estimate is summarised in Table 6-7.

The Lifecycle Management Report indicates that JAM has done Whole of Life Costing analysis that confirms upgrading to be economic. JAM advises that sensitivity analysis (NPV) indicates that an additional capital expenditure of $0.5 Million (Year 1) requires an operation expenditure saving of $40,000 a year over 30 years.

The analysis also found that initial capital expenditure is of prime importance when developing strategies. Capital savings through standardisation strategies well offset any perceived savings compared with individual design.

It is outside PB's scope to review and validate JAM's Whole of Life Costing analysis.

[28] It is outside PB's Project Brief to review and validate Jemena's JPM.

**Table 6-7 Tempe PRS upgrading cost breakdown**

| Item | Cost ($) | % of Total |
|---|---|---|
| Materials | 245,000 | 22.7 |
| External contractors | 555,000 | 51.4 |
| **Direct delivery cost** | **800,000** | **74.1** |
| Indirect delivery cost (Fees & charges) | 109,000 | 10.1 |
| **Project delivery cost** | **909,000** | |
| Corporate overhead recovery | 170,188 | 15.8 |
| Sub-total | 1,079,188 | 100.0 |
| Rounding | 20,812 | |
| **Total** | **1,100,000 +/-50%** | |

## Project drivers

The AMP and the Lifecycle Management Report comprehensively outline the need for, and the basis of the project. The engineering assessment (EA) assumes it is not a capacity driven project. Although primary gas facilities have a nominal asset life of 30-40 years, it is widely accepted within the gas industry that it is more likely that major facilities (or their components), such as PRS, will require changes or replacement much more frequently due to changing capacity requirements and/or technological obsolescence. Technological obsolescence includes unavailability of spare parts and lack of manufacturer support.

It is considered that JAM and JGN should adopt a 'standard nominal asset life' for PRS. The period nominated for this class of asset is not critically important; however, the recommendation is made for consistency reasons. Currently the AMP refers to 30-35 years and 40 years. The Lifecycle Management Report refers to 30 years. Different figures have the potential to create reader doubt and/or present unanswered questions.

JGN's decision to upgrade Tempe PRS is soundly based on formal technical and financial risk assessments in accordance with the appropriate Australian Standard. The decision is also based on a pressing need to eliminate equipment vibration and to reduce noise levels to within limits specified by EPA Guidelines and OH&S legislation. There is also a pressing need for mandatory hazardous area standards to be met.

PB agrees with the recommendation in the Lifecycle Management Report that planning for the replacement of the 30 year old PRS needs to be started immediately.

## Options investigated

It is apparent that JAM has considered a wide range of options before selecting Option 2 (upgrade using existing concrete pit) as the preferred option. While an aboveground option could satisfy all specified criteria, the Tempe PRS EA clearly demonstrates this is not technically or economically feasible.

JAM has not limited its investigations to known/proven technology, but has considered new technology 'Cocon 6' which is undergoing trials overseas. PB understands the pressure regulating equipment with this technology is located in a below ground surface mounted 'box' accessible via ground level 'box' lids. These 'boxes' are not classified as confined spaces and service/maintenance tasks can be performed at ground level. Furthermore, there are other important considerations and PB agrees it is premature to introduce this new technology. It may be more suited to new PRS installations that do not involve costly retrofitting.

### Proposed project scope

The overall project scope is to upgrade Tempe PRS to mitigate current risks and ensure continued safe and reliable operation. Table 6-8 indicates key assumptions and constraints[29].

**Table 6-8 Key assumptions and constraints**

| Number | Description | Implications | Criticality |
|---|---|---|---|
| 1 | Not capacity driven. | Timing not subject to supply restrictions, except during implementation/change-over. | High |
| 2 | Land easement not secured for existing PRS. | Land acquisition cost or compensation payment 'major' cost impact. | High |
| 3 | Existing pit is sound for re-use as is. | Cost impact on project. | High |
| 4 | Project funding. | Project deferred. | Moderate |

The overall project scope is considered reasonable; however comments and recommendations relating to the Key Assumptions and Constraints are made in the following sections of this report.

### Proposed project costs

The indicative cost of the preferred option is $1.1 Million +/- 50%. This is the Gate 1 (Rule of Thumb) estimate. Tempe PRS is the first in a series of planned upgrades and new installations and the aim is to use Tempe as a benchmark for design standardisation and actual cost purposes. Unlike distribution mains and services for example, external benchmarking for primary facilities has significant practical limitations due to wide variations in design and mix of below and above ground installations.

JGN has prepared the ± 50% cost estimate in line with their gate process. PB considers this level of cost estimate is reasonable due to uncertainties for land easement, compensation costs and meter replacement uncertainty. JGN is assuming that removal of minor partition walls inside the concrete pit will not compromise structural integrity of the pit. JGN plans to assess this matter at the detailed design stage. PB accepts the Gate Process and its application for internal planning and client management purposes. However PB considers the revised Access Arrangement process warrants a more accurate estimate, particularly as the aforementioned 'contingency' items are material and Tempe PRS upgrading is the fore-runner of a number of similar projects.

The Summary of Recommendations in the Lifecycle Management Report includes a recommendation for metering accuracy requirements for PRS to be defined (± 1% or ± 5%) and makes the point that this has a significant impact upon the design (length) of a PRS. PB considers that JGN should be in a position to make this decision at Gate 1 stage. If meter replacement is required it seems highly unlikely that Option 2 is feasible due to design length. JGN should be in a position to estimate indicative land easement or compensation costs. Also if it is found that existing concrete pits are structurally unsuitable, then JGN may need to consider other options. PB considers preliminary investigations are warranted.

### Project timing

The project is scheduled to be implemented over 2 years, commencing in 2010/11 and continuing into 2011/12. Timing of the project may change prior to implementation, if risk /

[29] Source: Engineering Assessment Report.

priorities change and other projects need to be implemented first. Timing is not subject to supply restrictions except during implementation/change over, i.e. implementation/change over should not occur in winter. Timing becomes significantly more critical for projects where capacity is a critical driver.

### Alignment with JGN's capital governance framework

Based on a review of source documentation, PB is satisfied that the project aligns with JGN's business capital governance framework.

### Accuracy of supplied information

PB has no reason to doubt the accuracy of the information provided. JAM has willingly responded to PB requests for further information.

### Value and timing of project for inclusion in forecast capital expenditure

The answer to this question is as discussed above.

### PB opinion

Providing the issues raised by PB in this report are adequately addressed, PB is satisfied that the capital expenditure needed to upgrade the Tempe PRS meets the requirements of National Gas Rules 74 and 79(1)(a)&(b) and 79(2)(c)(i to iv).

# 7. Review of project cost-estimating process, out-turn costs and benchmarking key plant unit costs

## 7.1 Introduction

PB reviewed the methods used by JAM to estimate its projects and program of works for JGN to determine the prudence and efficiency of JGN's forecast capital expenditure. The identification and justification of defined work packages has been reviewed in Section 3 of this report. Our review considers the:

- Process used to develop budgets and identify assumptions, findings and any shortcomings.
- Consistency of the application of JGN's cost estimating methodology across projects and programs.
- Use of project contingency allowances or generic scoping factors.
- Dependence and use of third parties for estimating costs; and
- Procurement practices and processes adopted by Jemena, and the extent of outsourcing.

Fundamentally, PB's review will test the way JAM incorporates its actual project out-turn costs into its capital expenditure projections and determine whether, in PB's opinion, JAM's cost estimating processes comply with Rule 74.

## 7.2 Jemena Pricing Model

The Gate process JAM and JGN use to provide project governance requires development of cost estimates at each of the first three gates, with narrowing order of accuracy, as detailed in Section 3.4, reflecting the incremental development of the project.

These estimates are developed using the JPM, that has been developed to satisfy JAM's Company Pricing Policy which requires that the methods of establishing and calculating prices for all projects be standardised as far as possible throughout the company.'[30] The pricing model is an Excel workbook that allows estimates to be prepared through a standard network database system

The JPM contains default unit rates for labour, materials and other items, and has facilities for manual entry of rates, lump sum prices and quotations from contractors and suppliers. The unit rates are updated annually at minimum, to reflect changes in fixed term supply contracts, fixed term construction contracts, or when there are significant changes to the cost of line items.[31] Unit cost rates are based on actual costs of previous similar JAM projects and contracts, as well as rates obtained from the market.

Associated with the pricing model is a risk assessment tool which provides a standard network based system used in identifying project risks and mitigation measures and in determining contingency allowances.

[30] Business Rules for Jemena Pricing Model – Pricing Workbook Operating Notes, September 2008, V8.2, Jemena Asset Management Pty. Ltd.

[31] Email communication from V. Wieckowski (JGN) to L. Tung (PB) sent 10th March 2009, 12.30PM.

JAM advised that the same process and models are used for JGN and other parties (regulated and unregulated clients), including responding to competitive tenders.

### 7.2.1 PB's opinion of the pricing process and model

The pricing model is a well developed tool that should provide a standardised method of establishing and calculating reliable prices for projects. This is supported by an appropriate risk assessment tool.

A brief review of rates for pipe supply, pipeline construction and restoration works show these to be in line with current industry rates.

The pricing model relies on regular and rigorous updating of its unit cost data. We have concerns that the source of the unit rates in the database, any assumptions (e.g. discounts to account for economies of scale) that have been used to calculate the rates and the date of the last update are not noted.

This could affect the accuracy of the cost estimates, and introduce inconsistencies in the process. We recommend the basis of the rates in the database be clearly identified.

Apart from the concerns mentioned we are of the opinion that the JAM pricing process is generally sound and able to provide the best estimate in the circumstances at each stage of the project. The preparation of cost estimates with a narrowing order of accuracy at critical stages in the incremental development of the project is considered efficient.

## 7.3 Market expansion unit rates

JGN has provided an analysis of the actual costs associated with market expansion construction works to improve the forecast estimates for these works in the coming access arrangement period[32] and is considered part of the JPM. Trends within the component elements of market expansion work have been identified in order to forecast costs of future market expansion projects.

The actual expenditure will be a function of the market expansion work completed and the actual rates to complete the work. JGN's forecast expenditure is based on the forecast unit rates and the expected scale of market expansion work. The scale of work forecast is based on predicted development.

Over the current access arrangement period, improvements to the methodology for completion of some component elements of market expansion work have been offset by increases in other component areas. Specifically, savings have been achieved through:

- Ensuring competition between meter suppliers to maintain low meter costs.
- Increased use of common trenching lowering main installation unit costs for new estates.

These savings have been more than offset by:

- Higher than forecast construction costs due to clarification, in 2006 of the responsibilities within the OH&S Act.
- Higher than forecast construction costs due to the Construction CPI being higher than the normal CPI.
- Increased council restoration rates.

[32] AA10-SG-74101A JGN Distribution Market Expansion Unit Rates – FY05 to FY10.

- Increases arising from the Collaborative Delivery Agreement (CDA) implemented with contractors in 2008.

As a result, over the current access arrangement period, the unit cost of market expansion work was higher than forecast despite efficiency improvement.

PB's opinion is that the market expansion work has been delivered efficiently over the current period.

While the CDA and the relatively high Construction CPI are cited as factors exerting upward pressure on the market expansion unit rates, details of the CDA have not been reviewed.

A report undertaken by Competition Economists Group for JGN identified a number of escalation factors which are likely to impact on capital expenditure for market expansion work.

PB's opinion is that the basis of estimate for forecast unit rates for market expansion is reasonable.

### 7.3.1 PB Opinion of the market expansion unit rates

PB's opinion of the methodology for developing the market expansion unit rates is that it is sound, based on actual historic costs with an allowance for future trends. The report by CEG provides the best possible basis for forecasting unit rates for the completion of market expansion work, and therefore complies with Rule 74. The extent of market expansion work required during the access arrangement period is based on reasonable forecasts, and PB therefore accepts that the forecast expenditure on market expansion is reasonable.

Since market expansion projects are customer initiated, any projects will therefore comply with Rule 79.

## 7.4 Non-distribution capex

PB undertook a high level review of the forecast methodology for the Non-Distribution expenditure forecasts provided by JGN.

The total 'non-system assets' forecast expenditure for the coming access arrangement is $128M, with this figure comprised of:

- Motor Vehicles ($21.8m)
- Leasehold improvements ($0.8m)
- IT and Communications ($102m)
- SCADA/Communications ($1.8m)
- Planned Fixed and Mobile Plant ($1.6m).

The forecast methodology document provides that the motor vehicle costs included were based on JGN's rolling replacement program, replaced on registration renewal date. Fleet Management is an ongoing cost, proportional to the size of operations of the company, with replacements a necessary cost for prudent and efficient operation. Assuming the processes employed by Fleet Management for forecasting vehicle costs are comparable to similar organisations, based on the information provided PB believes the methodology for forecasting vehicle replacement expenditure is prudent.

It is expected there will be some cost associated with the remaining categories of non system assets (Leasehold improvements, SCADA/Communications and Planned Fixed

and Mobile Plant). In the case of JGN's expenditure they comprised approximately 3% of the total forecast expenditure.

## 7.5 Procurement practices and processes

JAM has a documented Tender/Contract Award Process (Document No. AAM PR 0173) that describes the process of awarding a contract and includes determining contract requirements, developing tender strategy, preparing and evaluating tenders, preparing contract documentation and contract award.

### 7.5.1 Strategy

JAM's stated aim is to obtain and continue with 'Best Price' contracts. 'Best Price' is defined as the lowest cost to obtain outputs to pre-determined and specified technical and safety standards quality.

JAM has adopted a strategy to formulate contracts that embodies:

- Contestable Market – Using market forces to drive in the lowest price for the specified outputs.
- Output Forces – Specifying the absolute minimum requirements particularly with respect to regulatory requirements, standards of workmanship and materials, and safety.
- Turnkey Contracts – Giving the contractor as much freedom as possible to develop smart methods to reduce costs and improve quality and productivity.
- Efficient Utilisation of Resources – Packaging contracts to enable cross-utilisation of resources allowing the contractor to maximise efficiency.
- Reduce In-house Expenditure – formulating contracts that minimise total cost of the contract price and in-house costs by determining which party can do the various components most efficiently and avoid duplication.
- Win-win – this approach gives the owner the desired output at the lowest market price and the contractor is free to use his talents, skills and resources to maximise profitability.
- Relationship of Trust – the whole procurement process must be ethical and open.

### 7.5.2 Contracting methods

The normal contracting methods used by JAM are:

- Registration of Interest (followed by selective tendering)
- Tendering (Selective or Public)
- Preferred Supplier – fixed term contract (Usually awarded through Selective. Tendering)
- Turnkey Works Quotation.

Selective tenders are obtained through a two stage process that includes initial registration of interest or from a small number of contractors/suppliers known to have the ability to undertake the project or from a register of suitably qualified Preferred Suppliers.

### 7.5.3 Procedure and responsibilities

JAM has documented procedures illustrated with flow charts for letting contracts covering all steps from initial request for a new contract or replacement of term contract through to

contract award. Responsibilities for managing contracts development and implementing the standard procedures are also documented.

### 7.5.4 PB Opinion of the procurement practices and processes

We consider the procurement practices and processes adopted by JAM to be:

- Efficient and prudent
- Able to achieve the lowest cost; and
- In line with good industry practice.

We are of the opinion that the extent of subcontracting by JAM is appropriate.

# 8. Declaration

PB declares that all members of the review team, as introduced in Section 1.7 of this report, have read the Federal Court Guidelines 'Guidelines for Expert Witnesses in Proceedings in the Federal Court of Australia' attached to the Terms of Reference and have made all the inquiries that PB believes are desirable and appropriate and that no matters of significance that PB regards as relevant have, to the best of PB's knowledge, been withheld from the Court.

# Appendix A

Data Sources, References

## Sources of Information and References


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## Table A1: Jemena Asset Management Technical Policies for Jemena Gas Networks assets

| | | | |
|---|---|---|---|
| **General information on Technical Policies** | | | |
| TPG.ADM.000 | Technical Policy Manual Contents List | Rev. 40 | 03/01/2009 |
| TPG.ADM.010 | Technical Policy Review Committee Operating Charter | Rev. 7 | 31/12/2008 |
| TPG.ADM.030 | Technical Policy Documentation Control | Rev. 4 | 31/12/2008 |
| **Policies relating to Network Planning** | | | |
| TPG.DES.010 | Distribution Network Operating and Metering Pressures | Rev. 2 | 29/07/2008 |
| TPG.DES.020 | Network Supply Performance Validation and Long Term Capacity Planning | Rev. 2 | 29/07/2008 |
| TPG.DES.040 | Distribution Network Capacity Planning Criteria | Rev. 2 | 29/07/2008 |

## Table A2: Schedule of Meetings with Jemena Asset Management staff

| Time | Meeting attendees | | Purpose of meeting |
|---|---|---|---|
| | **PB staff** | **Jemena staff** | |
| ***16th February 2009*** | | | |
| 0930 to 1030 | Uldis Clarson; Ian Sharp; Li-Anne Tung | Veronica Wieckowski – *Lead Engineer Capacity Planning, Gas Distribution Asset Management* | Project inception meeting |
| ***23rd February 2009*** | | | |
| 0930 to 1300 | Uldis Clarson; Li-Anne Tung | Veronica Wieckowski – *Lead Engineer Capacity Planning, Gas Distribution Asset Management*<br>Jasmin Wu – *Senior Asset Performance Engineer*<br>Graham Thomas | Capital planning framework;<br>Presentation of asset management plan |
| ***25th February 2009*** | | | |
| 0900 to 1000 | Li-Anne Tung | Veronica Wieckowski – *Lead Engineer Capacity Planning, Gas Distribution Asset Management*<br>Andy Carr – *Manager Network Capital and Projects, Capital Construction and Engineering* | Gate process<br>Tendering and procurement processes |
| 1000 to 1100 | | Veronica Wieckowski – *Lead Engineer Capacity Planning, Gas Distribution Asset Management*<br>Stan Brulinski – *Asset Manager, Metering* | Meter refurbishment and replacement policy |
| 1115 to 1200 | | Veronica Wieckowski – *Lead Engineer Capacity Planning, Gas Distribution Asset Management*<br>Keith Masters | Engineering assessment process for Mascot and Tempe PRS – Regulator / Instrumentation upgrade projects |

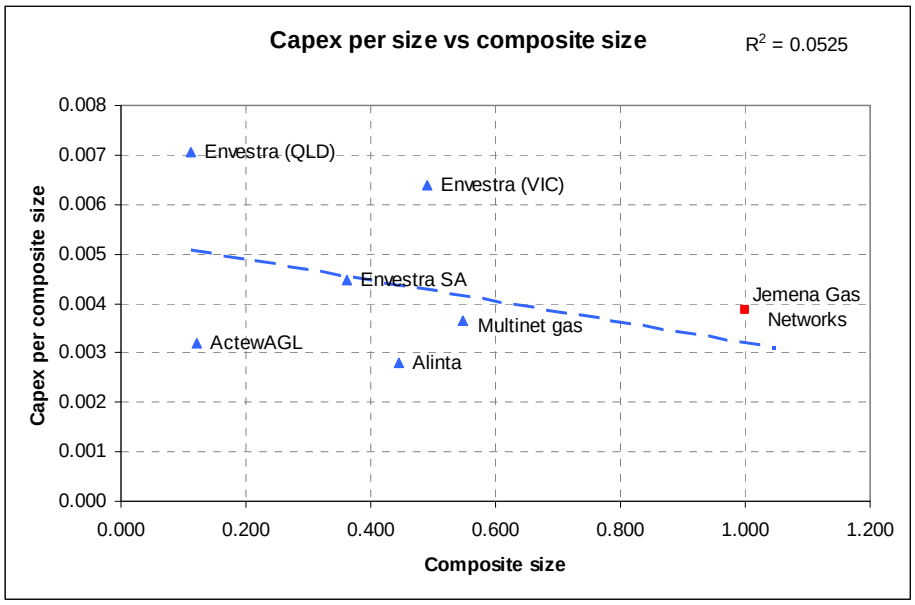
| Time | Meeting attendees | | Purpose of meeting |
|---|---|---|---|
| | PB staff | Jemena staff | |
| 1200 to 1300 | | Veronica Wieckowski – *Lead Engineer Capacity Planning, Gas Distribution Asset Management*<br>Boris Kirigin – *Acting Lead Engineer Capacity Planning, Gas Distribution Asset Management* | Capacity planning process<br>Wakehurst Parkway Secondary Main project |
| ***4th March 2009*** | | | |
| 0930 to 1020 | Uldis Clarson; Li-Anne Tung | Veronica Wieckowski – *Lead Engineer Capacity Planning, Gas Distribution Asset Management*<br>Richard Chawa | Sydney storage / peak shaving / peak security of supply concept project |
| 1020 to 1110 | | Veronica Wieckowski – *Lead Engineer Capacity Planning, Gas Distribution Asset Management*<br>Jasmin Wu – *Senior Asset Performance Engineer*<br>James Angelo | Mains and services renewal projects |
| 1115 to 1215 | | Veronica Wieckowski – *Lead Engineer Capacity Planning, Gas Distribution Asset Management*<br>George Christodoulou | Gate process – project design and delivery |

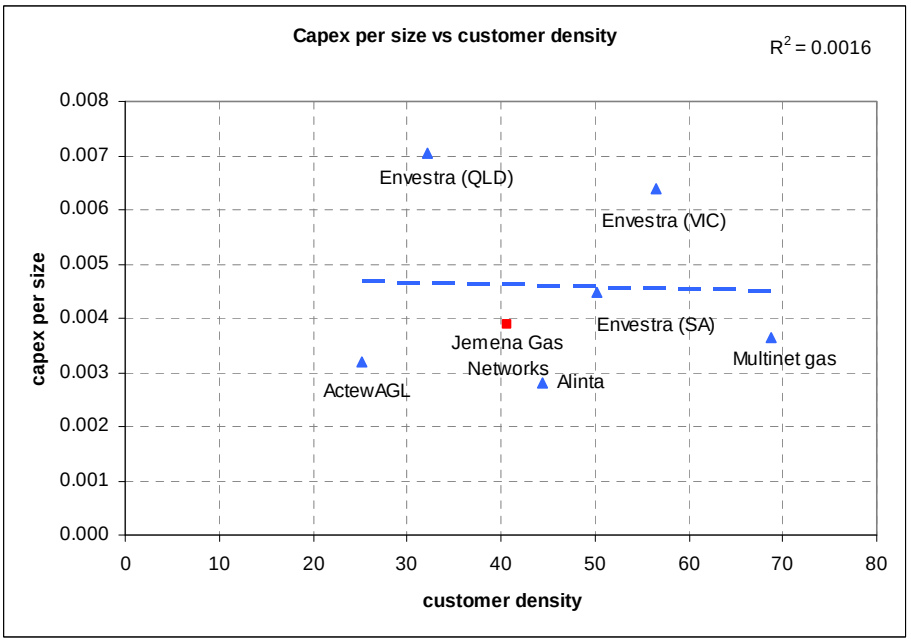
# Appendix B

Benchmarking charts – Composite size variable

The composite size variable which incorporates, customer numbers, total length of main and units of energy delivered, was used for high-level benchmarking of JGN with its peers as described in Section 4.

The appropriateness of using composite size variable for benchmarking and comparisons between networks of different size densities can be assessed by consideration of any correlation between the composite size variable and customer densities (as described in Wilson Cook & Co, 2008). Two plots have been prepared comparing these variables with no correlations observed. This supports the use of the composite size variable for benchmarking.



# Appendix C

IPART determination table

In its 2005 to 2010 Final Decision for JGN Access Arrangement, IPART allowed the capital costs shown in Table B-1.

**Table B-1 IPART 2005 Determination – capital expenditure 2005/06 to 2009/10**

| Real 2005$'000 | 2005/06 | 2006/07 | 2007/08 | 2008/09 | 2009/10 | Total |
|---|---|---|---|---|---|---|
| **Market Expansion** | 54,800 | 53,800 | 52,700 | 53,000 | 53,400 | 267,700 |
| **Non – System Assets** | 8,000 | 8,000 | 9,200 | 9,700 | 42,900 | 42,900 |
| **System Upgrade** | | | | | | |
| Growth capacity development | 16,368 | 8,576 | 3,451 | 4,096 | 4,316 | 36,807 |
| Security of supply | 14,048 | 13,873 | 17,829 | 4,655 | - | 50,405 |
| Mines subsidence | 1,056 | - | - | - | - | 1,056 |
| Mains & services renewal | 10,042 | 4,483 | 4,402 | 250 | 259 | 19,436 |
| Facilities renewal & upgrade | 6,508 | 2,243 | 2,718 | 2,818 | 2,129 | 16,416 |
| Meter renewal & upgrade | 7,072 | 9,929 | 7,463 | 9,803 | 8,863 | 43,130 |
| Government Authority Work | 4,806 | 1,095 | 1,536 | 1,580 | 1,533 | 10,550 |
| **Sub-total (with Sydney Primary Loop project)** | **59,900** | **40,199** | **37,399** | **23,202** | **17,100** | **177,800** |
| **Sub-total (without Sydney Primary Loop project)** | **45,852** | **26,326** | **19,570** | **18,547** | **17,100** | **127,395** |

Source: JGN 2005-10 Historic Capital expenditure 25March09.xls, supplied by JGN 25 March 2009.

Note: Figures may not add up to sub-total and total due to rounding

# Appendix D

Curricula Vitae

# ULDIS CLARSON
## Project Manager

### Years of Experience
10

### Education
Masters of Engineering Management, University of Technology, Sydney; Bachelor of Chemical Engineering (Hons), Sydney University

### Professional Affiliations
Member Institute of Chemical Engineers (MIChemE)

### Key Qualifications
Uldis Clarson is a project manager with 10 years' experience in the delivery of infrastructure design and industrial engineering projects. With experience gained in Australia and the United Kingdom, he has developed a strong understanding of the different requirements and market drivers in the two countries.

He seeks to ensure that the project needs are identified at the outset, and retains a particular focus on ensuring that projects are delivered that meet those needs and objectives. Throughout, Uldis ensures good client relations and communications are maintained to ensure successful delivery.

Uldis is currently undertaking a Masters in Business Administration and has also developed particular skills in identifying new opportunities to deliver services to new and existing clients in the water industry and other sectors.

## Experience

### Project Development
- Appin Servicing strategy, Sydney Water Corporation, Sydney, Developed the delivery methodology adopted for a site selection process for ranking potential sites of a new sewage treatment plant to serve unsewered towns in Sydney. The methodology was based on Simple Multi Attribute Ranking Techniques, which enable the client to clearly identify the important factors for selecting a site and objectively rank the available sites against those criteria. Costs of alternative options were also developed in order to quantify the benefit offered by alternatives.
- Keston Dog Training Centre Sustainable Wastewater Solution, London UK, Metropolitan Police. Developed bid and won $20,000 feasibility study for new government client. Feasibility assessment involved application of Simple Multi Attribute Ranking Techniques (SMART) to identify most sustainable option for replacement of existing wastewater treatment package plant. Recommended retention of existing package plant with modified operations and maintenance (O&M) procedure to reduce overall costs.

### Business Efficiency and Risk Management
- Chichester Sludge Processing Plant, Chichester UK, 4Delivery. Initiated net present value (NPV) comparison of alternative sludge dewatering process identifying 6% savings on whole life cost with reduced exposure to rising power prices. Identified inconsistent levels of financial and technical risks within 4Delivery's project approval process and proposed remediation strategy.
- Corporate Responsibility Strategy, UK, 4Delivery. Devised 4Delivery's corporate responsibility strategy to realise measurable financial gains through improving environmental and social impacts of project delivery.

### Project Management and Delivery

- Cannock Liquid Waste Cementation Plant, Cannock UK, Augean PLC. Managed development of new best available technology for liquid hazardous waste processing plant. Identified client needs and managed preparation of project program and capital cost estimates for process.
- Trident South Alliance Costs, London, Black & Veatch. Quantified impact of scope changes within alliance projects and communicated results to management. Through understanding the causes of cost increases within alliance projects, identified strategies for reducing cost increases and delivering projects on time and budget.
- Ford Sewage Treatment Centre (STC), Ford UK, 4Delivery. Assessed project brief and led development of detailed scope and design for $1 million maintenance and upgrade works. Developed project program and planned procurement strategy to enable delivery within the agreed timescale and budget. Calculated OPEX estimates for upgraded works to enable modelling of whole life costs. Developed technical specifications and negotiated with suppliers to develop accurate cost estimates for package plant items used directly in CAPEX estimates
- Eastry Wastewater Treatment Works, Kent, UK, 4Delivery. Led design team to deliver $3 million wastewater works upgrade outperforming project target costs by 8%. Presented project design solutions at commercial and technical reviews and provided design input during operability studies and value engineering workshops. Delivered design of projects using remote teams due to local resource limitations. Prepared monthly progress reports for design deliverables to enable accurate monitoring and earned value calculations. Monitored subcontractors to ensure delivery of equipment to agreed schedule. Provided construction and commissioning support.
- Green St Green Nitrate Removal, Kent UK, Thames Water Trident South Alliance. Led development of design options for integration of Green St Green into existing Lane End water treatment works. Developed solution to de-nitrify 4 megalitres per day for less than $2.5 million.
- Chertsey Digester refurbishment, Chertsey UK, Thames Water Trident South Alliance. Successfully designed, specified and managed the delivery of control system upgrade for digesters refurbishment to increase biogas production. Technically and financially evaluated tender responses and negotiated detailed scope of works with preferred bidders. Identified and managed project risks during digester refurbishment and Cambi thermal hydrolysis plant (THP) recommissioning project to increase biogas production and improve viability of combined heat and power (CHP). Developed and maintained good client relationships and ensured stakeholder engagement in project development. Managed risks of re-integrating Cambi THP process into sludge processing plant.
- Land End Water Treatment Works, Kent UK, Thames Water Trident South Alliance. Developed detailed design for process control system for nitrate removal and chlorination plant worth $35 million. Planned procurement strategy of process control system for a $35 million water treatment works and adapted strategy to suit project teams. Developed technical specifications for both fixed price and target cost contracts and reviewed tender responses. Secured a 50% cost saving on delivery of the sampling control system by challenging and improving the standard procurement strategy. Undertook key role during HAZOPs to ensure risks to operators the public and the environment were identified and eliminated or reduced. Controlled factory acceptance tests to ensure performance criteria were met. Provided construction and commissioning support to ensure plant performance requirements were met within project constraints.

# Ian Sharp
## Principal

### Years of Experience
36

### Education
Bachelor of Engineering (Hons), University of New South Wales; Diploma, Civil Engineering, University of New South Wales

### Professional Affiliations
Institution of Engineers, Australia: Member; Institution of Civil Engineers, United Kingdom: Member; Australian Water Association: Member; American Water Works Association: Member

### Key Qualifications
Ian has more than 30 years of international experience covering all aspects of water, wastewater, solid waste and gas projects from inception through to commissioning and operations.

## Experience

### Gas Distribution
- NSW gas networks Productivity Review, NSW, AGLGN. Technical specialist for a productivity review of AGL gas networks covering operating expenditures to assess further productivity improvements while maintaining safety and service level requirements. The review recommended an appropriate level of efficiency to be submitted for the next IPART regulatory pricing decision.
- NSW gas networks Capital and Operating Expenditure Review, NSW, AGLGN. Conducted a study to assess whether proposed levels of capital and operating expenditure were reasonable and efficient given defined levels of security of supply and service standards, the prudency of past capital and operating expenditure and whether growth associated costs were reasonable. The study included a review of asset management practices to prompt further improvements where possible.
- ACT gas network Capital and Operating Expenditure Review, Canberra, ACT, ActewAGL. Conducted a study to assess whether proposed levels of capital and operating expenditure were reasonable and efficient given defined levels of security of supply and service standards, the prudency of past capital and operating expenditure and whether growth associated costs were reasonable. The study included a review of asset management practices to prompt further improvements where possible.
- Review of Gas Network Extension Proposal TXU (SPI Networks), Victoria, Essential Services Commission. Technical specialist for the review of customer demand forecasts, network design, and forecast capital and operating expenditure for proposed gas network extensions to Macedon Ranges, Creswick, Camperdown, Barwon Heads, Port Fairy and Maiden Gulley.
- Review of Gas Network Extension Proposal Multinet, Victoria, Essential Services Commission. Technical specialist for the review of customer demand forecasts, network design, and forecast capital and operating expenditure for proposed gas network extensions to Seville East, Woori Yallock, Launching Place, Yarra Junction, Wesburn, Milgrove, Warburton, Wandin, Seville and Yarra Glen.
- NSW Gas Networks Due Diligence Independent Engineer's Assessment, NSW, Australian Gas Light Company. Assessed AGL gas assets in NSW, including pipelines and network compliance, network performance, quality of service and level of network utilisation and capacity. Reviewed forecast capital costs for replacement, capacity growth and geographic growth. Assessed asset condition and impact on efficiency and delivery risk. Reviewed

operation and maintenance practices and forecast costs. Assessed safety and environmental management practices and business risk exposure.

- Tasmanian gas distribution, Aurora Energy. Reviewed design and forecast capital and operation costs for proposed Tasmanian natural gas distribution system.
- Audit of Gas Pricing Models, NSW, Independent Pricing and Regulatory Tribunal. Reviewed and assessed Stoner Workstation Services Gas Model used as input to gas undertaking pricing model to ensure reasonable, equitable and defendable distribution of costs for supply by third party suppliers to customers.
- Canberra Gas Distribution Optimisation Study, ACT, AGL Networks. Conducted independent assessment of the potential for optimisation of mains in the ACT and Queanbeyan. Work involved the use of fluid distribution and secondary (high pressure distribution and secondary (high pressure) networks capital cost savings were then assessed using optimised models.
- Canberra Gas Distribution, ACT, Depreciated Optimised Cost (DORC), AGL Gas Networks. Conducted independent assessment of the DORC in AGLGN networks for the ACT and Queanbeyan using stoner optimised models. A comprehensive review of unit roles and asset lives that were used to develop the DORC was undertaken.
- NSW Gas Networks, Depreciated Optimised Replacement Cost (DORC), NSW, AGL Gas Networks. Conducted independent assessment of the DORC in AGLGN NSW networks as of 1st of July 1996 as part of the AGLGN Access arrangement. Work involved the use of fluid distribution system modelling using STONER software. Prepared optimised designs using STONER for all trunks primary and secondary networks. A sample of 17 optimised medium pressure systems were evaluated representing 16% of all NSW medium pressure networks. A comprehensive review of the unit rates and asset lives was undertaken that were used to develop the DORC.

### Water Supply

- Sydney Canberra Corridor Northern and Central Sectors Water Options Study, NSW, NSW Department of Planning. Project managed a study of water supply options in response to the worst drought since the 1930s and the resultant shortage of water supplies in Goulburn, Wingecarribee, Upper Lachlan and Wollondilly local government areas. Environmental concerns, especially the importance of river health were also addressed in the study. The outcome of this study was a list of water supply options recommended for further consideration designed to secure water supply for people, industry and the environment over the next 25 years.
- Wetalla to Millmerran Pipeline, Queensland, Millmerran Power Partners (InterGen). Provided front end strategic input and peer review for feasibility study, preliminary design and detailed design of 100 km-long pipeline conducting 1000 ML per year of secondary-treated sewage effluent from Toowoomba to Millmerran for water supply to new power station.
- Warragamba Pipeline Contingency Plan, Western Sydney, NSW, Sydney Catchment Authority. Provided specialist input into the development of a contingency plan in the event that the Warragamba 2000mm and 3000mm pipelines are damaged as a result of terrorist attack, other malicious damage, accidental events or natural disaster. This plan details the risks associated with a terrorist event, the extent of damage that could realistically be caused to the pipeline, the time required to reinstate the pipeline, materials and equipment required and the staging and methods that can be adopted in reinstating the pipelines.
- Benchmark Study of Demand Management and Security of Supply, Sydney, NSW, Sydney Catchment Authority. Reviewed current initiatives of water authorities in Europe, USA, Africa and Australia to manage demand for water and assessment of measures being used to ensure security of supply in drought. Identified and assessed appropriate measures to be adopted for Sydney.

# Victor Petrovski
## Consultant

### Education
Bachelor of Engineering (Electrical), Royal Melbourne Institute of Technology, Melbourne Australia, 1995

Ongoing studies, primarily concerning power systems analysis:
- Integration of Wind Farms, 2003
- Optimal Power Flow, 2001
- Reliability Analysis, 2000
- Power System Dynamics, 1999
- Economic Analysis and Project Evaluation, 1998
- Voltage Stability and Reactive Power Planning, 1997

### Key Qualifications
Victor Petrovski is an electricity transmission network expert who has been heavily involved in planning in the regulated National Electricity Market (NEM) environment of Australia.

Victor is based in Melbourne and has been responsible for reviewing and defining the capability of the integrated electricity transmission network, identifying network constraints, developing methodologies for the assessment of constraints and augmentation options, and project justification and development in accordance with the National Electricity Rules and the Regulatory Test.

In addition to his transmission planning background, Victor has experience in the specification and procurement of bulk transmission services through competitive tender processes, and the project management of network augmentation projects.

Victor has also assessed and facilitated a number of connections to the transmission network for customers and generators, as well as providing advice on technical access standards to distribution businesses regarding embedded generation developments.

Through his involvement in the Victorian energy industry, Victor has gained a thorough understanding of the operation and design of the NEM, including experience in modelling and analysis of the wholesale energy market, as well as a comprehensive understanding of the day to day operation of the integrated power system.

## Experience

### Regulatory Compliance and Pricing Reviews
- Responsible for the assessment of the adequacy, efficiency and appropriateness of Powerlink Queensland's $2.5billion capital expenditure program as part of its transmission network revenue proposal for the period 2007-2012 for the Australian Energy Regulator (AER). The review examined the probabilistic based allowance under the ex-ante regime, including a detailed review of drivers for both network and non-network driven investment and contingent based projects. (August 2006)
- Auditor for regulatory compliance of a Victorian electricity distributor. Reviewed relevant distribution codes, guidelines and licenses in conjunction with Essential Services Commission of Victoria (ESCV) requirements. (July 2006)
- Responsible for the independent audit review of an electricity distribution business' reliability measurement and reporting systems for the Queensland Department of Energy. The review involved establishing the accuracy of published SAIDI and SAIFI statistics across a range of feeder categories and advising of the potential for improving their accuracy. (February 2006)

- Through a consultation process, Victor was responsible for implementing changes to the Information Specification (Service Performance) for Victorian Electricity Distributors as a consequence of the Essential Services Commission Electricity Distribution Price Review 2006-10. (January 2006)

### Transmission Planning

- Engaged to provide and independent review of technically, environmentally and economically feasible alternatives for transmission network developments for the Adelaide central business district for the Electricity Supply Industry Planning Council. (Project Manager, May 2006)
- Responsible for the successful analysis, justification and public consultation of various large and small network augmentations in Victoria, in accordance with the National Electricity Rules and the Regulatory Test. In particular, Victor was the principal engineer responsible for the development of a second 500/220kV, 1000MVA transformer and associated switching facilities at Rowville Terminal Station. The capitalised cost estimate of this augmentation was $37M and it is due for completion in September 2007.
- Over an extended period, Victor undertook technical and economic analysis of transmission network constraints and their augmentation options as part of a TNSP's Annual Planning Report. The Annual Planning Report presents a ten year outlook of transmission network capability and investment and is the key reference in support of the TNSP's electricity revenue cap application to the AER. Victor has both chaired and made various presentations during the TNSP's public forums covering the outcomes of its Annual Planning Report.

### Project and Commercial Management

- In an environment where the ongoing provision of transmission network services has been uniquely contestable, Victor has been responsible for identifying and defining contestable components of augmentation projects and developing the necessary Project Agreements, long term (30-year plus) Network Service Agreements and Interface Agreements that allow for competition in the provision of transmission services in Victoria.
- Development of technical, commercial and risk related specifications for transmission plant up to 500kV for inclusion in invitations to tender. He has subsequently participated in tender evaluations, assessing the capability of service providers and providing specialist advice on a range of matters, leading to the award of build, own and operate contracts for transmission plant in excess of $45M. (October 2005)

### Industry Involvement

- TNSP representative on various national working groups, including the Dispatch and Pricing Working Group, the Forward Looking Loss Factor Working Group, and the Reliability Augmentation Working Group.
- In addition to designing the scenario, Victor was a key participant in an industry wide hypothetical Electricity Industry Emergency Exercise prior to Summer 2003/04 - aimed at testing the emergency response of all Victorian participants. This half day exercise included the involvement of generation, retail, distribution and transmission businesses, as well as representatives from the State Government, NEMMCO, Victoria Police and the Office of the Chief Electrical Inspector. (September 2003)

### Power Systems Analysis and Technical/Economic Advice

- Engaged by a NSW distribution network service provider to provide an independent assessment of two network investment models. The substation investment model considered life cycle costs comparing outdoor versus indoor design, using either conventional AIS or modern GIS plant. The transformer replacement model considered spend limits based on life cycle costs, accounting for transformer failure risk profiles using Weibull based failure rates. (June 2006)

# Li-Anne Tung
## Water and Process Engineer

### Years of Experience
6

### Education
Bachelor of Engineering (Chem) (Hons 1), University of New South Wales

### Professional Affiliations
Institution of Chemical Engineers: Associate; Institution of Engineers, Australia: Member

### Key Qualifications
Li-Anne is a chemical engineer with experience in gas and water and wastewater engineering related projects. Her water and wastewater engineering experience includes concept and detailed design of sewage and water pumping stations and pipelines, wastewater management strategies, population and loadings projection studies, process audits and water hammer analysis. She also has experience in capital and operating expenditure, and productivity reviews for gas distributors in NSW and ACT.

Li-Anne's recent project experience includes project management of the Taste and Odour Management Plans for Sydney's Water Filtration Plants and for the Assessment and Evaluation – Sewerage to unsewered towns and villages; tender design co-ordination for the Replacement Flows project; and the concept and detailed design of Junction Hill Sewage Transfer Scheme that includes the design of pumping stations and rising mains and decommissioning of existing sewage treatment plants.

## PB Experience

### Gas Distribution
- Review of AGL Gas Networks Capital and Operating Expenditure, NSW, AGL Gas Network. Assisted in the review of actual and forecasted capital and operating expenditure for submission to IPART, NSW. This review will be used for the development of the next Access Arrangement.
- AGL Gas Network Productivity Review, NSW, AGL Gas Network. Assisted in the operational productivity review of AGL gas network and comparing with the performance of other Australian gas distributors in order to explore the efficiency requirements for AGLGN for the following regulatory period. This review will be used for the development of the next Access Arrangement.
- Review of ActewAGL Gas Network Capital and Operating Expenditure, ACT, ActewAGL. Assisted in the review of actual and forecasted capital and operating expenditure for submission to ICRC, ACT. This review will be used for the development of the next Access Arrangement.

### Water and Wastewater Engineering
- Potable Water Filtration Plants – Taste and Odour Management Plans, NSW, Sydney Water Corporation. Project manager assisting the technical co-ordinator for the development of short-term and medium-to-long term management plans for the control of aesthetic water quality affected by algal and other taste and odour compounds. Management plans also considered algal toxicity associated aspects, and involved 'soft options,' such as communication procedures, and technical (or engineering) aspects. The project considered all SWC water filtration plants and their associated catchments, reservoirs and raw water transfer systems.
- Prospect Water Filtration Plant Powdered Activated Carbon (PAC) contact time verification, NSW, Sydney Water Corporation. Project manager and engineer for verification of contact times available within the channels and structures of Prospect Water

Filtration Plant (WTP) for PAC dosing. This required detailed review of the hydraulic arrangement within the channels and structures, consideration of hydraulic flow conditions, and process calculations to determine hydraulic residence time within the WFP at various flowrates.

- Assessment and Evaluation – Sewerage to unsewered towns and villages within the catchment, NSW, Sydney Catchment Authority (SCA). Project manager for a study to assist the SCA to set future priorities for the SCA sewage strategy by addressing sewage management for the currently unsewered towns and villages within the SCA catchments. The broad analysis involved identification of the unsewered towns and villages; establishment of sewage loads through population and dwelling estimates; identification of the benefit to water quality, if any, through the provision of reticulated sewerage; and preparation of budget estimates for sewering of the identified towns and villages.
- Mt Arthur Coal Mine Water Management Plan, NSW, BHP Billiton. Developed recommendations for the preparation of a water management plan at Mt Arthur Coal Mine, with particular emphasis on maintaining the health and safety of the non-potable water used on site. Recommended water quality guideline values as well as risk mitigations and water treatment measures. As there had been reports of an odour from the water, identified possible causes of the odour and control measures.
- Hydrotesting Water Sourcing and Disposal Options Investigation, Sydney Primary Loop Project, NSW, Alinta. Large volumes of water are required for the hydrotesting of the Sydney Primary Loop (SPL) natural gas pipeline. The required filling and discharge flowrate is fairly high, at between 100 to 250 kL/hour. High quality water (similar to potable water quality) is required to minimise the risk of corrosion to steel systems. Identified possible large sources of high quality water available at high flowrates; and water bodies or land capable of receiving large volumes of water at high flowrates. Investigations included treatment options for ensuring the water is of suitable quality for hydrotesting and for disposal.
- Western Sydney Water Recycling Initiative – Replacement Flows Project Tender Design, NSW, Leighton Contractors. Project engineer and design co-ordinator for the tender design of a 50 ML/day water recycling scheme. Tertiary effluent is transferred from Penrith, St Marys and Quakers Hill Sewage Treatment Plants to an Advanced Water Treatment Plant at St Marys Sewerage Treatment Plant (STP). Recycled water is then returned to Penrith STP to discharge into the Nepean River. Brine is discharged into the Northern Sydney Ocean Outfall Sewer at Dundas via Quakers Hill STP. The project involved the design of tertiary effluent intake and storage structures, pumping stations, brine storage pond, 20 km of parallel pipeline, 20 km of pipeline through highly-developed areas, and brine discharge arrangement. Two arrangements for the brine discharge arrangement were developed; namely, discharge directly into the NSOOS and connection to an existing rising main discharging to the NSOOS. Waterhammer analysis of the transfer pipelines were undertaken as part of the design.
- Dora Creek Wastewater Treatment Plant (WWTW) Stage 2 Upgrade, NSW, Hunter Water Corporation. Project engineer for the concept and detail design and tender documentation of the Stage 2 upgrade of Dora Creek WWTW. Upgrade works involve a new septage receival facility; flow balance tank; inlet works; diversion of existing rising mains; conversion of the existing IDAL process to MLE process; secondary clarifiers; aerobic digesters and sludge handling building. The upgrade will increase process capacity from 16,000 EP (3.8 ML/day) to 48,000 EP (10.6 ML/day).
- Edgeworth WWTW Inlet Works Upgrade, NSW, Hunter Water Corporation. Project engineer for the concept and detail design and tender documentation of a new inlet works at Edgeworth WWTW with capacity to screen a Peak Instantaneous Flow of 3,500 L/s and degrit 3xADWF (819 L/s). The project includes developing a construction and commissioning sequence/methodology as the existing rising mains to the existing inlet works runs through the intended location of the new inlet works.

# Malcolm Young
## Consultant Engineer, Energy Sector

### Professional Associations
Member, Institution of Engineers Australia

## Experience

### 1997-2008 Consultant/Project Manager, Energy Sector
Business Focus: Provision of business management services incorporating:

- Engineering due diligence assessments
- Gas distribution total cost reviews
- Technical regulatory advice
- Technical Audits
- Gas Distribution Management Consulting
- Technical project management

Clients cover the Utilities and Government sector and related engineering and customer services.

| Key Clients | Sector |
|---|---|
| Gas Transmission and Distribution (Confidential Due Diligence and Expert Opinion) | Gas |
| Essential Services Commission | Gas/Regulatory |
| Independent Competition and Regulatory Commission | Gas/Regulatory |
| Independent Pricing and Regulatory Tribunal | Gas/Regulatory |
| Energy Safe Victoria (Office of Gas Safety) | Gas |
| AGL Gas Networks | Regional Gas Infrastructure |
| Regional Development Victoria (RDV) | Gas |
| GPA Engineering Pty Ltd (Envestra Ltd) | Power Industry |
| PB Associates (Parsons Brinckerhoff) | Utility Services |
| PPK Environment and Infrastructure Pty Ltd | Local Government |
| Cardinia Shire Council | Local Government |
| East Gippsland Shire Council | Electricity |
| PacifiCorp (Powercor Australia Ltd) | Gas Meter/Regulator Manufacturing |
| Schlumberger Measurement and Systems | Gas |
| GPUGasNet | Gas |
| Origin Energy Asset Management (now APA O&M Services Pty Ltd) | Water, Gas, Electricity |
| Fieldforce Services Pty Ltd | Utility, Government, Commercial |
| Customer Service Benchmarking Aust. | Power/Gas/Telecommunications Industries |
| National Power Services Pty Ltd | Gas Appliance/Regulator Manufacturers |
| Rinnai Australia Pty Ltd | Gas Appliance Manufacturers |
| Heatcraft Australia Pty Ltd | Property Group |
| Department of Treasury and Finance | |

### Key Activities/Achievements
- Advise on and assist in the preparation of engineering due diligence assessments of large natural gas transmission and distribution networks in Victoria and NSW, focussing on capital and operating expenditures.
- Advise on and assist in the preparation of engineering due diligence assessments of proposed natural gas distribution networks in Tasmania.
- Provide advice on capital and operating expenditures as part of the five-yearly review of ACT, NSW and Victorian gas distributors' Access Arrangements.
- Provide strategic advice to RDV relating to the Victorian Government's Natural Gas Extension Program.
- Carry out Regulatory Audits for the Essential Services Commission related to a Victorian gas distributor's Licence obligations.

- Carry out operational and compliance regulatory audits related to Victorian gas distribution assets for compliance with Licences, Distribution Code and Retail Market Rules' requirements.
- Carry out technical audits related to gas transmission and distribution assets in Victoria, NSW, Queensland, Northern Territory and South Australia for compliance with Licences and Safety & Operating Plans.
- Prepare and present to executive management a strategic report on the natural gas business in Victoria and the new Government owned distribution and retail companies, which replaced Gas & Fuel.
- Provide strategic advice to help establish sale value of the new gas companies, including analyses of the Government's Information Memoranda and subsequent due diligence information issued to prospective bidders, focussing on capital and operating expenditures.
- Conduct a review of gas safety administration for the Office of Gas Safety in association with Risk and Reliability Associates Pty Ltd.
- Provide expert opinion on aspects of the ActewAGL gas infrastructure system following the bushfires that occurred in Canberra in January 2003.
- Develop transmission pipeline operations and maintenance policies and procedures to meet new safety regulatory requirements (Safety Case) in accord with Gas Industry Reforms.
- Advise on, and project manage two national product safety recall programs for natural gas meter pressure regulators and LPG regulators to satisfy Trade Practices Act (Consumer Affairs) and State/Territory gas technical regulatory bodies.
- Establish and manage a risk based maintenance regime for a potentially faulty gas fired central heating furnace to satisfy State/Territory gas technical regulatory bodies.

### 1991-1997 Gas and Fuel

Group Manager Distribution, reporting to the Deputy Chief Executive
Regional Business Manager reporting to Deputy Chief Executive
Regional Operations Manager

Responsibilities

- Gas distribution asset management – design, construction, operation and maintenance
- Managing capital and operating expenditure programs
- Gas marketing, meter reading, appliance sales, installation and maintenance
- Contracting/outsourcing management
- 24 hour emergency service management
- Driving change related to Gas Industry Reforms in preparation for gas-on-gas competition and privatisation
- Driving continuous improvement

Dimensions:

- Up to 900 staff
- Up to 160 contractors
- Up to 700,000 customers
- Up to $35m annual capital expenditure
- Up to $75m annual operations and maintenance expenditure
- Fixed assets – up to $600m
- Multi site operations (metro and country)

# Appendix E

Terms of Reference

Confidential terms of reference removed