APA Group

Effectiveness of the Western Outer Ring Main (WORM) Project on Security of Supply of the Victorian Transmission System (VTS)

March 2012

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APPENDICES

Summary

R2A Due Diligence Engineers has completed a review of the security of supply of the Victorian Transmission System (VTS) with particular regard to the economic benefits to existing and long term customers of the proposed Western Outer Ring Main (WORM) Project.

This report is based on the information provided by the APA Group entitled, *Western Outer Risk Main Modelling Assumptions* attached as Appendix B. These input assumptions are used in the R2A *Cost of Risk Model* attached as Appendix A and summarised in this report.

This report concludes that in the event of a supply failure from the east such as occurred at Longford in 1998, the WORM Project:

* Provides major benefits in the shoulder seasons (spring and autumn) to all existing customers, and
* Substantially reduces a winter disruption particularly to domestic customers and essential services, if industrial and commercial loads are dropped off.

Additionally, the WORM Project is a vital element to support an augmentation of the supply transmission capacity to the Victorian gas market, facilitating long term market expansion benefits.

For a 5, 10 and 15 day duration interruption over a 60 year pipeline life, this amounts to a potential avoidance of $46.0m, $77.7m and $105.8m respectively. Longer events such as that experienced in the last Longford explosion would result in significantly higher benefits.

For a WORM net project capital value of $39.4 m, this suggests the WORM Project achieves a payback over the 60 year pipeline life for any one event exceeding about 5 days.

1. Objective

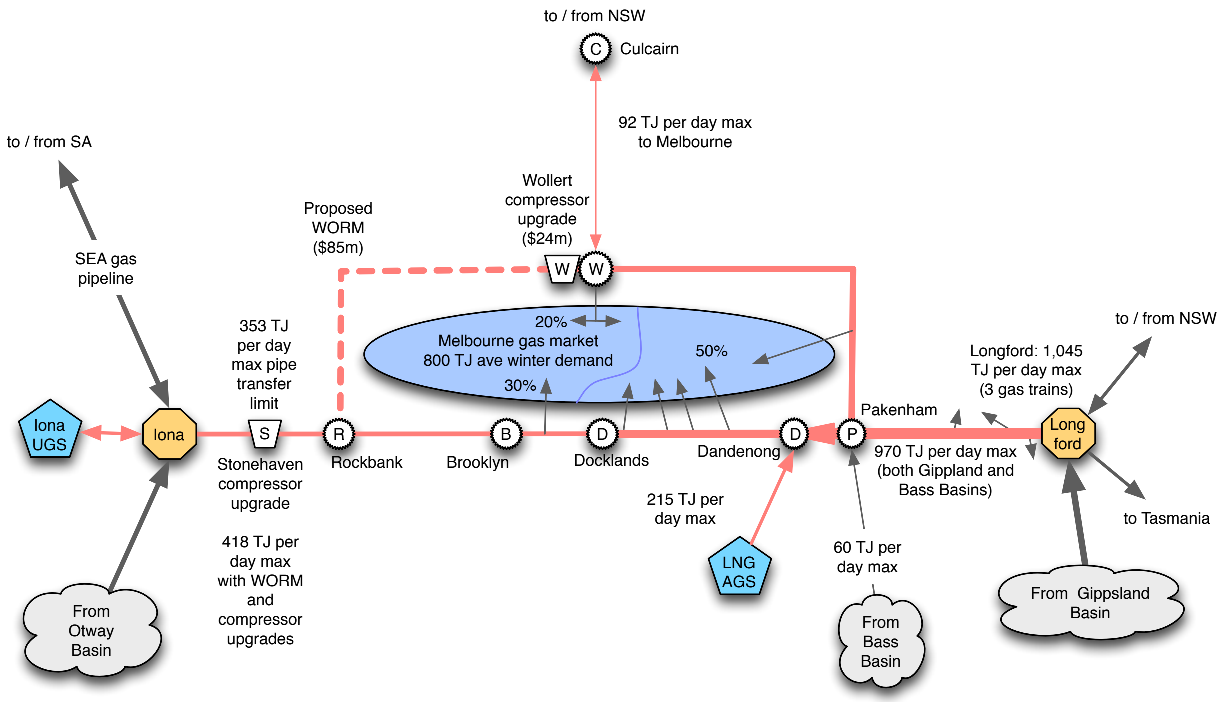
The objective of this report is to review the security of supply of the VTS with particular regard to the proposed WORM Project.

2. Victorian Transmission System & WORM

The VTS is bounded by Longford in the east, Culcairn to the north and Iona in the west. The VTS has three seasonal demands, namely, summer, shoulder and winter with current average demands of around 331TJ, 633TJ and 995TJ respectively. The VTS is designed primarily for gas flow from the east (mostly Longford).

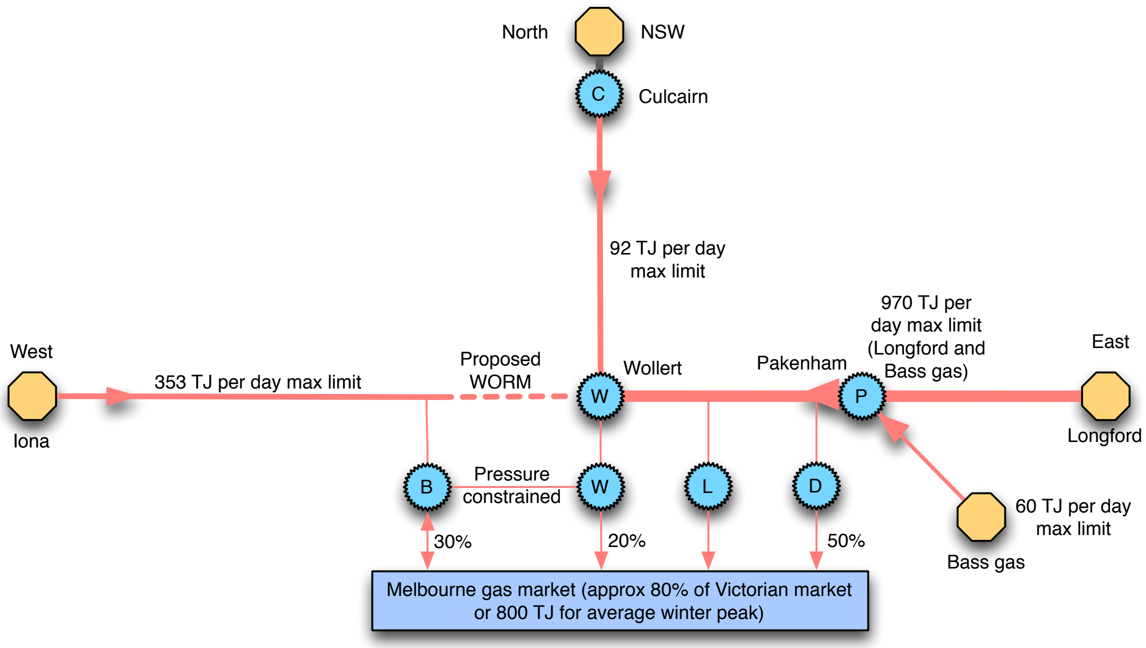
The WORM Project consists of a pipeline between Wollert and Rockbank and compressor upgrades at Wollert and Stonehaven at a net project capital cost of $39.4 m (see Appendix B). The WORM Project allows gas to flow between the north and west supply points as well as flowing gas to the east. A high level appreciation of the system and proposed WORM Project is shown in the diagrams below.

These high level models show the functional impact of the WORM proposal. It enables Wollert to become a transmission hub to move gas from any direction around Melbourne.



Middle Level Model

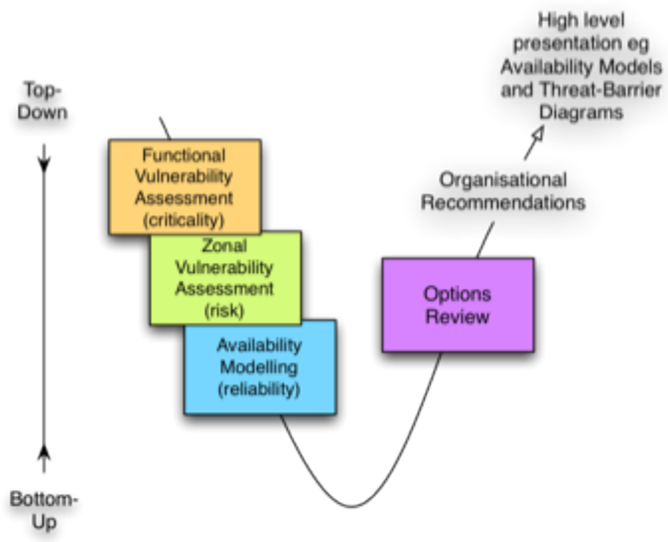
The middle level model shown above describes the basic system and was used as a basis to develop the higher, functional system diagram which is the basis for the payback model, shown below.



High Level Functional Model

3. Method

The review method adopted was top-down supported by bottom-up techniques (as required) as depicted in the diagram below. The R2A proposal is attached as Appendix D *Terms of Reference*.



Top down approach to required depth

As the WORM Project is about bulk gas transmission, the first task was to create a high level functional model of the VTS. This was developed generatively with APA and resulted in the models shown in Section 2 above.

From a security of supply perspective, this model was tested by applying credible worst case scenarios of stopping the supply of gas from each of the VTS gas supply directions, east, north and west. This understanding was established in a model in Excel™. Such an electronic model enables various assumptions to be tested, especially investment payback for different gas prices, gas supply interruption duration and return period. A printout of the model is attached as Appendix A.

The functional information contained in the Excel™ model was represented in both reliability block diagrams and market impact threat-barrier diagrams.

4. Effect of WORM on Security of Supply

4.1 Criticality

Appendix A is a printed copy of the Excel™ security of supply model developed for this review. The model tests the impact of credible worst case scenarios resulting from total loss of gas supplies from either of the three feed directions to the VTS, namely, East, North and West. As shown in the table below, from a security of supply viewpoint, loss of supply from the East (Longford) in the shoulder and winter seasons is the critical determinant.

Season	Victorian market average demand (TJ per day)	Surplus/deficit with total East failure - (TJ per day)	Surplus/deficit with total East failure plus WORM - (TJ per day)	Extra gas available to market due to WORM (TJ per day)
Summer	331	216	296	-
Shoulder	633	-84	-6	78
Winter	995	-443	-368	75

Supply Consequence of East Supply Interruption

The WORM Project provides substantial benefits to existing customers, notably sustaining the shoulder seasons (6 months of the year) and reduces losses if such an interruption event occurred in winter. For example, looking at the numbers above for winter, the major industrial and commercial customers representing up to 400 TJ per day may be expected to be dropped off first, meaning domestic and essential service customers would mostly be sustained through the WORM Project.

In financial terms, the impacts if gas is valued at $81.46 per GJ ($81,460 per TJ) are shown in the table below on a per day basis. The $81.46 per GJ is understood to be a typical market value that should be sustained if the WORM Project were in place based on the scenarios described above, and the gas is contractually available from the alternate supply directions.

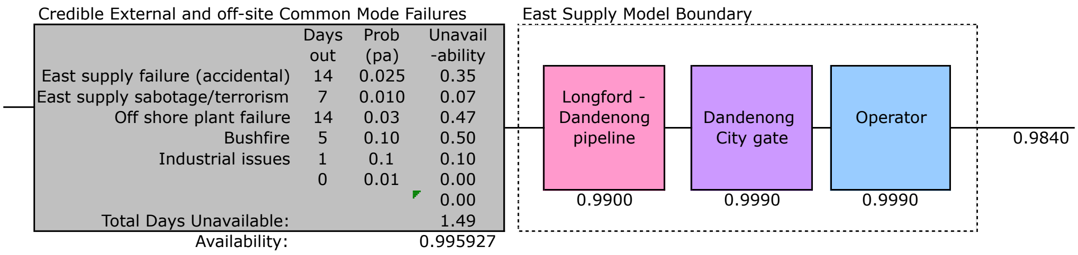
Season	$ per TJ	Surplus/deficit with total East failure - ($ per day)	Surplus/deficit with total East failure plus WORM - ($ per day)	Extra gas available to market due to WORM ($ per day)
Summer	$81,460	0	0	0
Shoulder	$81,460	-6,842,640	-488,760	6,353,880
Winter	$81,460	-36,086,780	-29,977,280	6,109,500

Financial Consequence of East Supply Interruption

4.2 Interruption Event Likelihood

Such total supply interruptions are considered to be credible in view of the Longford incident of 1998 and the Moomba gas supply interruption event of 2004. Both these events occurred with plant having been in service of around 40 years.

The first Longford gas production plant was constructed in 1969. The explosion occurred on Friday 25 September 1998. Gas supplies were resumed on 14 October, meaning a supply interruption of around 20 days.[1] Full production was achieved by mid-1999, some 6 months after the incident. The first Moomba pipeline (to Adelaide) was commissioned in 1969. The major Moomba fire occurred on 1 January 2004. 40% production resumed on 5th January. Full production took a further 2 months.[2]



East Supply Availability Model

In fact there are a number of other credible mechanisms that may create such an interruption shown in the simple availability model above.

4.3 Interruption Event Duration and WORM Payback

The Excel™ model has been set up to test the value of different event durations, based around incidents of 5, 10 or 15 days duration. The available savings due to the WORM Project are similar for both the shoulder and winter interruptions as the extra gas supplies potentially available with the WORM are essentially the same although the value of gas is higher for short term events. The main difference is that during the shoulder season, the market demand can be met meaning there should be no reason to suspend the market and the value of gas should remain at market values.

The numbers for the Winter season interruption from the Excel™ workbook are shown below.

East supply failure duration (days)	$ per TJ	Without WORM	with WORM	Difference
5	$106,300	-$235,454,500	-$195,592,000	$39,862,500
10	$89,750	-$397,592,500	-$330,280,000	$67,312,500
15	$81,460	-$541,301,700	-$449,659,200	$91,642,500

Winter season interruption cost implications

These numbers are based on current gas market values, even though interruption events occur in the future. This value described is on the basis of the value of lost gas sales. Emergency Management Australia's *EMA Disaster Database* suggests that the actual cost of the 1998 Longford interruption was around $1.3 billion[3].

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1 Esso Longford gas explosion. As viewed at http://en.wikipedia.org/wiki/Esso_Longford_gas_explosion on 22 January 2012.
2 Gas back on at Moomba. As viewed at http://www.smh.com.au/articles/2004/01/04/1073151209381.html?from=storyrhs 22 January 2012 plus other references.
3 Emergency Management Australia. *EMA Disaster Database.* http://www.ema.gov.au/ema/emadisasters.nsf

An annualised cost-of-risk value from the model for a 10 day duration interruption is shown below.

Years between events:	40
Event duration (days):	10

Annualised cost of risk at: $89,750 per TJ

Season	Event freq (pa)	Season Exposure	Likelihood (pa)	WORM Saving (pa)
Summer	0.025	0.25	0.00625	$0
Shoulder	0.025	0.50	0.0125	$875,063
Winter	0.025	0.25	0.00625	$420,703
		1		$1,295,766

Annualised cost of risk for 10 day east supply interruption

For a 5, 10 and 15 day duration interruption over a 60 year pipeline life, this amounts to a potential avoidance of $46.0m, $77.7m and $105.8m respectively, using the gas values shown for the different duration events in the table entitled *Winter season interruption cost implications* shown above. Longer events such as that experienced in the last Longford explosion would result in significantly higher benefits.

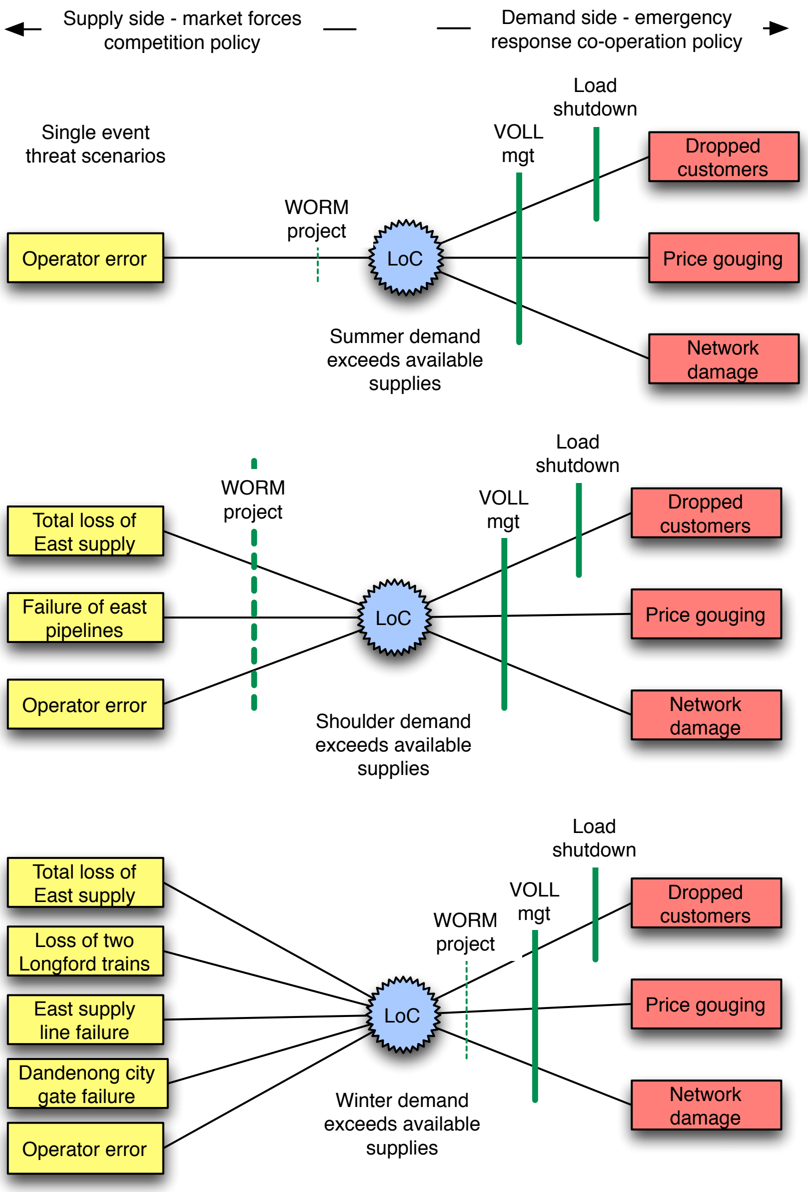
For a WORM net Project capital value of $39.4 m, this suggests the WORM Project achieves a payback over the 60 year pipeline life for any one event exceeding about 5 days.

Note that this payback does not consider increases in market size or price escalations. It also assumes that the gas will be commercially available from the north and west model boundaries, that is, it has not been contractually committed elsewhere.

4.4 Market Threat Barrier Modelling

The following threat barrier models were created to show the impact of the WORM Project for the different seasons.

In summer the demand is low so that the loss of supply from any direction should be manageable (meaning the market can be sustained). This means that security of supply in summer is not a driver for the WORM Project.



Seasonal Market Threat Barrier Models

In the shoulder seasons (spring and autumn) the WORM Project acts before the loss of control point to enable the market to be sustained in the event of a total failure of the east supply which means that gas sold could remain at higher market values for the short term (until the opportunity to re-bid gas injections and withdrawals).

In winter, the WORM project is incapable of sustaining the market, but it does minimise the impact as described in section 4.1.

5. Findings

5.1 From a security of supply viewpoint, the WORM Project:

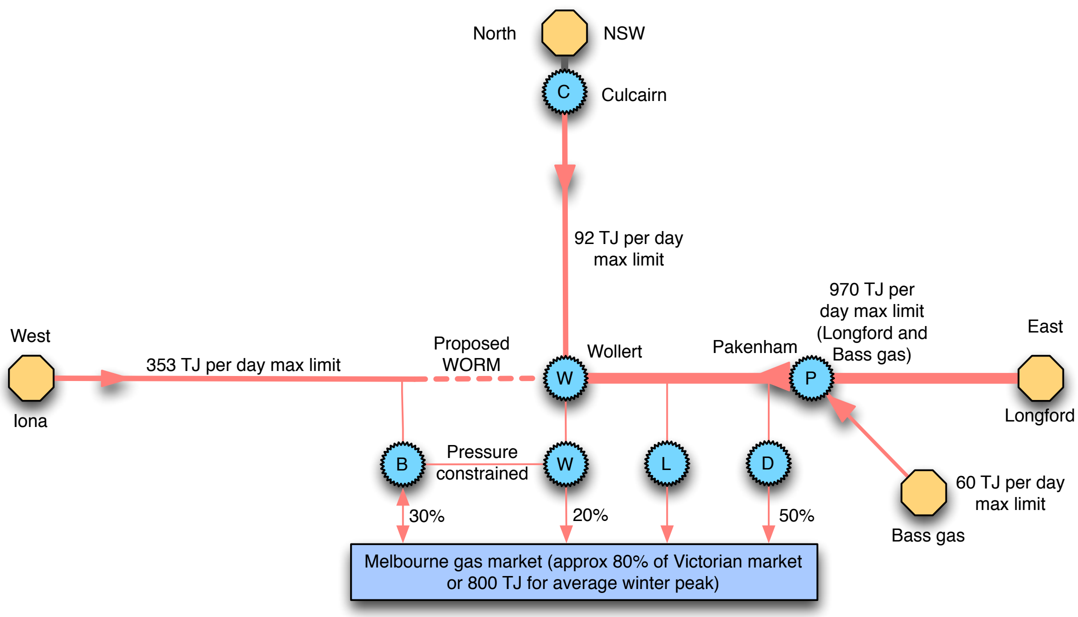
* has minimal benefits in summer,
* provides major benefits in the shoulder seasons (spring and autumn) to all existing customers, and
* substantially reduces a winter disruption particularly to domestic customers and essential services, if industrial and commercial loads are dropped off.

5.2 In the immediate term, the WORM Project is economically viable to existing customers on the basis of the reduced cost of risk in the shoulder and winter seasonal markets.

Appendix A – Printout of model in Excel™

APA Group
Criticality Model for VTS User Guide & Notes
This guide has been prepared to assist third parties use this Excel™ model

1. The model is based on the diagram shown below .The numbers shown are typical and are more accurately represented in the following spreadsheets.
2. Blue coloured cells are input cells in the following spreadsheets. The numbers should be changed in these.
3. The model is driven by total loss of gas supply from one of the three feed directions. Partial loss (for example, two gas trains at Longford) has not been considered. Practically it only deals with the East as the other two supplies are so small in VTS market share terms.
4. Three seasons are considered. Summer (3 months), shoulder (spring and autumn, 6 months) and winter (3 months).
5. LNG storage at Dandenong has been ignored as this is for perturbation management, not supply.
6. Bass gas is presumed to be available even if the rest of the East supply (Longford) is unavailable.
7. The model assumes that gas would be contractually available from the north (NSW) even in winter.
8. The summary generally takes values from the supporting summer, shoulder and winter sheets.
9. Likelihood, that is, total loss of supply return period is based around Longford (1988) incident, around 1 in 40 years. This is similar to the Moomba (2004) incident experience.
10. Consequence (severity) is based on a 5, 10 or 15 day interruption in the seasonal spreadsheets. In the summary spreadsheet the duration can be changed as well as the dollar cost of the lost gas sales.
11. All dollar values are today's values, as though an interruption occurred tomorrow even though incidents occur in the future.



APA Group
VTS Cost of Risk Model Notes
R2A Due Diligence Engineers
R2A Ref: 456-01
5 March 2012

Summary

Consequence of east supply interruption (TJ per day) from supporting spreadsheets

Season	Victorian market average demand (TJ per day)	Surplus/deficit with total East failure - (TJ per day)	Surplus/deficit with total East failure plus WORM - (TJ per day)	Extra gas available to market due to WORM (TJ per day)
Summer	331	216	296	-
Shoulder	633	-84	-6	78
Winter	995	-443	-368	75

Consequence of east supply interruption (dollars per day)

Season	$ per TJ	Surplus/deficit with total East failure - ($ per day)	Surplus/deficit with total East failure plus WORM - ($ per day)	Extra gas available to market due to WORM ($ per day)
Summer	$89,750	0	0	0
Shoulder	$89,750	-7,539,000	-538,500	7,000,500
Winter	$89,750	-39,759,250	-33,028,000	6,731,250

East supply failure risk characterisation (based on Longford & Moomba experience)

Years between events:	40
Event duration (days):	10

Annualised cost of risk at: $89,750 per TJ

Season	Event freq (pa)	Season Exposure	Likelihood (pa)	WORM Saving (pa)
Summer	0.025	0.25	0.00625	$0
Shoulder	0.025	0.50	0.0125	$875,063
Winter	0.025	0.25	0.00625	$420,703
		1		$1,295,766

Annualised cost of risk = consequence x likelihood pa.
Likelihood pa = event frequency pa x season exposure.

Summer

	Max existing available supply to Victorian market (TJ per day) [A]	Max supply availability (normal conditions) with WORM (TJ per day) [B]	Max available supply with total East failure - emergency conditions (TJ per day) [C]	Max available supply with total East failure plus WORM - emergency conditions (TJ per day) [D]	Extra available due to WORM with total east failure (TJ per day) [D-C]	
North	55	55	108	113	5	
West	121	310	374	449	75	Note iii)
East	970	970	65	65	0	
	1,146	1,335	547	627	80	

Summer ave (TJ)		Surplus/deficit	Surplus/deficit	
331		216	296	
$ per GJ	$ per TJ	Sales loss (pd)	Sales loss (pd)	Sales saved (pd)
$50	$50,000	$0	$0	$0
$100	$100,000	$0	$0	$0
$200	$200,000	$0	$0	$0
$400	$400,000	$0	$0	$0
$600	$600,000	$0	$0	$0
$800	$800,000	$0	$0	$0
$1,000	$1,000,000	$0	$0	$0

East supply failure duration (days)	$ per TJ	Without WORM	with WORM	Difference
5	$106,300	$0	$0	$0
10	$89,750	$0	$0	$0
15	$81,460	$0	$0	$0

Notes:

i) Summer exposure is 3 out of 12 months or 0.25

ii) Loss of east supply does not appear to create gas availability demand deficits in summer.

iii) By dropping pressures up to 105 TJ may be transferred. Refer AEMO VAPR 2011 AppC fig C-7

Shoulder

	Max existing available supply to Victorian market (TJ per day) [A]	Max supply availability (normal conditions) with WORM (TJ per day) [B]	Max available supply with total East failure - emergency conditions (TJ per day) [C]	Max available supply with total East failure plus WORM - emergency conditions (TJ per day) [D]	Extra available due to WORM with total east failure (TJ per day) [D-C]	
North	55	55	110	113	3	
West	230	418	374	449	75	Note i)
East	970	970	65	65	0	
	1,255	1,443	549	627	78	Note ii)

Shoulder Ave (TJ)		Surplus/deficit	Surplus/deficit	
633		-84	-6	
$ per GJ	$ per TJ	Sales loss (pd)	Sales loss (pd)	Sales saved (pd)
$50	$50,000	-$4,200,000	-$300,000	$3,900,000
$100	$100,000	-$8,400,000	-$600,000	$7,800,000
$200	$200,000	-$16,800,000	-$1,200,000	$15,600,000
$400	$400,000	-$33,600,000	-$2,400,000	$31,200,000
$600	$600,000	-$50,400,000	-$3,600,000	$46,800,000
$800	$800,000	-$67,200,000	-$4,800,000	$62,400,000
$1,000	$1,000,000	-$84,000,000	-$6,000,000	$78,000,000

East supply failure duration (days)	$ per TJ	Without WORM	with WORM	Difference
5	$106,300	-$44,646,000	-$3,189,000	$41,457,000
10	$89,750	-$75,390,000	-$5,385,000	$70,005,000
15	$81,460	-$102,639,600	-$7,331,400	$95,308,200

Notes:

i) By dropping pressures up to 205 TJ may be transferred. Refer AEMO VAPR 2011 AppC fig C-7

ii) Under normal operating conditions, the WORM enables 203 TJ per day to be available from the west.

iii) Shoulder exposures are 2 x 3 months out of 12 months or 0.5

Winter

Supply	Max existing available supply to Victorian market (TJ per day) [A]	Max supply availability (normal conditions) with WORM (TJ per day) [B]	Max available supply with total East failure - emergency conditions (TJ per day) [C]	Max available supply with total East failure plus WORM - emergency conditions (TJ per day) [D]	Extra available due to WORM with total east failure (TJ per day) [D-C]	
North	55	55	113	113	0	Note i)
West	374	449	374	449	75	Note ii)
East	970	970	65	65	0	Note iii)
	1,399	1,474	552	627	75	Note iv)

Winter ave (TJ)		Surplus/deficit	Surplus/deficit		
995		-443	-368		Note v)
$ per GJ	$ per TJ	Sales loss (pd)	Sales loss (pd)	Sales saved (pd)	
$50	$50,000	-$22,150,000	-$18,400,000	$3,750,000	
$100	$100,000	-$44,300,000	-$36,800,000	$7,500,000	
$200	$200,000	-$88,600,000	-$73,600,000	$15,000,000	
$400	$400,000	-$177,200,000	-$147,200,000	$30,000,000	
$600	$600,000	-$265,800,000	-$220,800,000	$45,000,000	
$800	$800,000	-$354,400,000	-$294,400,000	$60,000,000	
$1,000	$1,000,000	-$443,000,000	-$368,000,000	$75,000,000	

East supply failure duration (days)	$ per TJ	Without WORM	with WORM	Difference
5	$106,300	-$235,454,500	-$195,592,000	$39,862,500
10	$89,750	-$397,592,500	-$330,280,000	$67,312,500
15	$81,460	-$541,301,700	-$449,659,200	$91,642,500

Notes:

i) Current demands and configuration may mean that no gas is curently available from the north in winter.
ii) By dropping pressures up to 374 TJ may be transferred. Refer AEMO VAPR 2011 AppC fig C-7
iii) Bass gas provides 60 TJ to Pakenham independent of Longford supplies.
iv) Under normal operating conditions, the WORM enables 65 TJ per day to be transferred from the west.
v) Victorian industrial load (which would be shed first) is presently around 360 TJ per day.
vi) Each Longford gas train provides about one third of the plant capacity or around: 323 TJ
vii) Winter exposure is 3 out of 12 months or 0.25

B. APA Group. Western Outer Ring Main Modelling Assumptions

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Western Outer Ring Main

Modelling Assumptions

1 Introduction

This paper provides basis of data, information and assumptions used in the Criticality study undertaken by R2A Due Diligence Engineers in respect of the Western Outer Ring Main (WORM) Project.

APA GasNet has in all cases applied the most conservative estimate available in determining the value of security of supply and the benefits of the WORM Project.

2 Input Assumptions

2.1 Victorian Market Demand

The seasonal demand for gas for a typical year (1:2 planning criteria) has been determined based on 2010 data available from the Market Information Bulletin Board. This data allows analysis of injections by location, withdrawals by withdrawal zone and withdrawals by tariff V (domestic) and D (Industrial and Commercial). The demand data can be presented as a load duration curve (the 365 days of demand sorted highest to lowest), as shown in Figure 1 below. For the purposes of this study, “Winter” is defined as the average of highest 91 days, “Shoulder” is defined as the next 183 days, and “Summer” as the last 91 days.

Injection and withdrawal capacity by season are shown in Table 1 below.

Figure 1 – Victorian Market Load Duration Curve

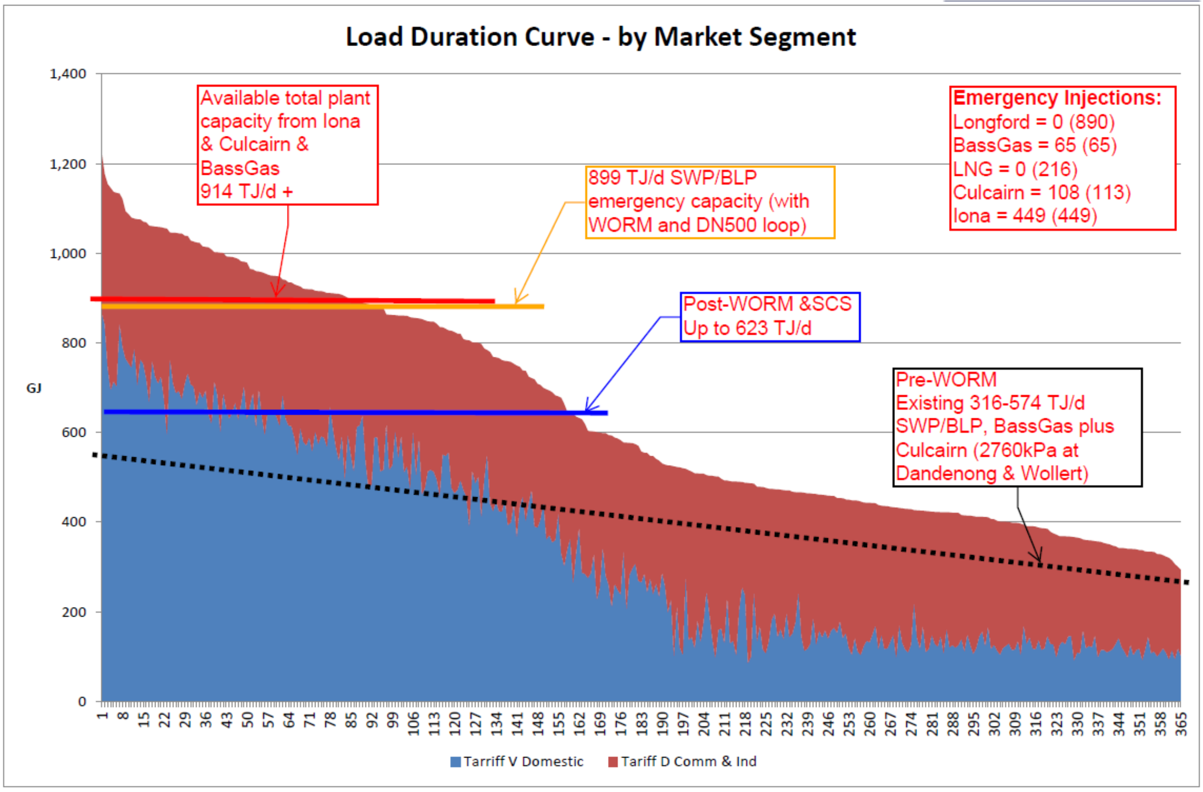


Table 1 – Injection and withdrawal capacity by season

Injection Point	Winter	Shoulder	Summer
East (Longford – Melb) *1	891	537	205
West (Iona – Melb)	97	92	56
North (Culcairn – Melb)	6	5	3
TOTAL	994	633	328

Withdrawal	Winter	Shoulder	Summer
Domestic (Tariff V)	659	299	109
Ind & Comm (Tariff D) *2	336	335	222
TOTAL	995	633	331

*1 Includes LNG

*2 Includes WUGS refill and exports to NSW and SA

2.2 Interruption Event Duration

Several severe incidents have been recorded affecting supply from the Bass Strait, including Marlin well major gas leak (12 hours, winter 1980), hydrate formation in gas plant slug catchers causing severe, but not total, supply failure for about 4 days in June 1998, and the Longford explosion and fire of 25-Sep-1998 which had partial supply restored on 14-Oct-1998 (about 20 days) and full production in mid-1999 (about 6 months).

The Moomba gas fire on 1-Jan-2004 led to total gas supply interruption with 40% production resumed on 5-Jan-2004. Full production took a further 2 months.

Impact on short duration events (<2 to 3 days) is limited due to the availability of Liquified Natural Gas (LNG) (up to 215 TJ/d for 2 days). Western Underground Storage (WUGS) capacity is assumed to be sufficient for the scenario event timelines proposed – typically 100 days of storage capacity at rated plant capacity is assumed, well above that required for this analysis. Stored gas is also available from Moomba to Sydney Pipeline (MSP) for short duration events <5 days.

Interruption event duration for supply from the east has been conservatively set at 5, 10 and 15 days, as set out in Table 2 below

Table 2 – Event Durations modelled in criticality study

Event Duration	5 days	10 days	15 days

2.3 Value of Lost Load Customer Reliability for Gas

The following documents have been relied upon to derive a value of lost load.

a. "The Value of customer reliability for gas" 20-Sep-2005 McLennan Magasanik Associates Pty Ltd

b. "General Procedure; Gas load curtailment and gas rationing and recovery guidelines" 13-May-2010; AEMO

c. "Wholesale Market Administered Pricing Procedures (Victoria)"; June-2010; AEMO

The following costs are material to an event such as loss of supply from the Longford plant:

- Losses incurred by Customers who are interrupted.
- Losses incurred by Retailers due to lost sales.
- Losses incurred by Market Participants who have to source gas from Iona or Culcairn at spot market prices. (ie do not have supply contracts underpinning the injections).
- Losses incurred by Distributors due to isolation and relight and DUoS
- Losses incurred by APA (Transmission) for loss of TUoS are not considered material to this study

Each of these is discussed below.

Losses incurred by customers who are interrupted

Value of Customer reliability (VCR) in Victoria has been assessed by MMA in 2005 and shown to reduce over time for short to medium term interruption for participants on Curtailment Tables 2 to 5. (refer also ref b). Values are noted as "higher" if Curtailment Tables 7, 9 and 11 are not available (small commercial and critical services). The conservative estimate of $80/GJ, $60/GJ and $40/GJ (for 5d, 10d and 15d interruption of supply) has been assumed. This does not apply CPI escalation to the above data, nor allow for higher value of Tables 7 to 11 customers.

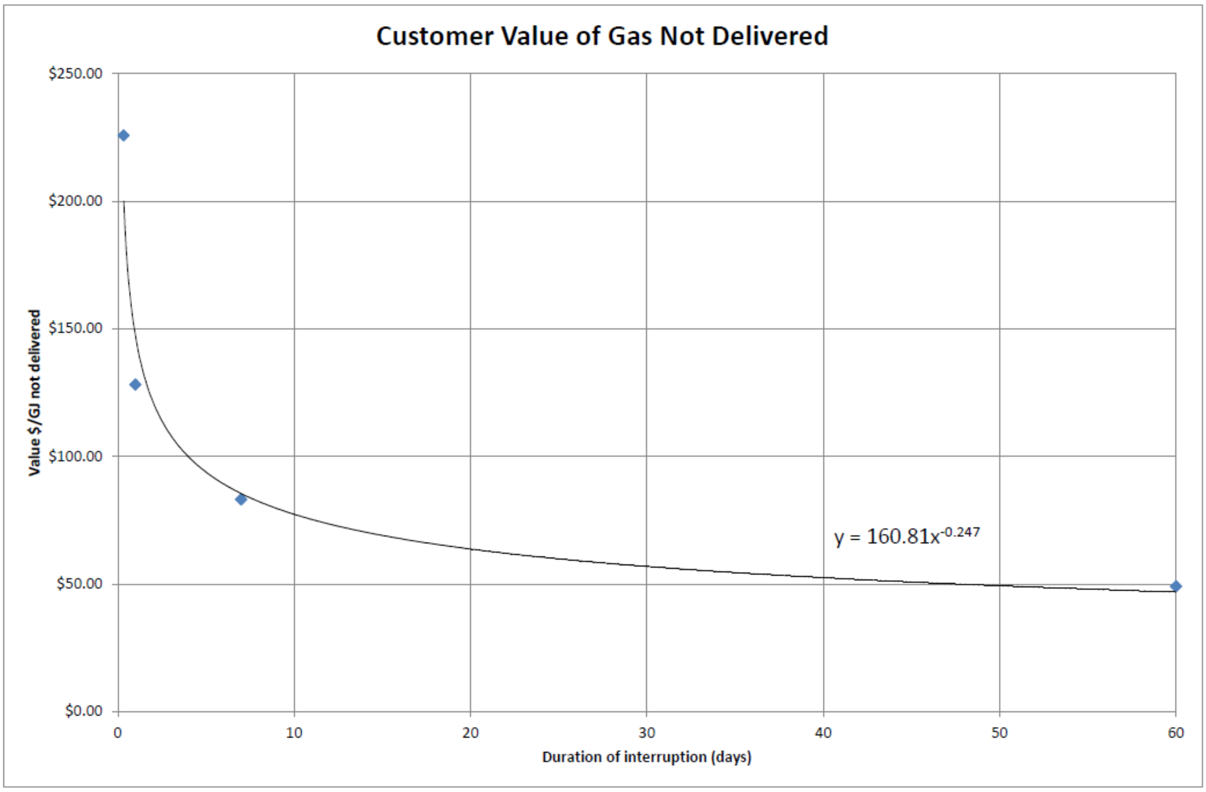
The number participants in each of the relevant Curtailment tables is set out in Table 3 below.

Table 3a – Companies in each segment

Duration of interruption	Sample	Total costs incurred ($)	Total gas not delivered (GJ)	VCR for Curtailment Tables 2 to 5 ($/GJ not delivered)
8 hours	n=41	$6,412,100	34,810	$184.21
24 hours	n=41	$14,643,075	140,075	$104.54
7 days	n=41	$86,194,674	1,270,990	$67.82

The costs incurred by Industrial and Generation customers are shown in Figure 2 below after correction for CPI since 2005. Refer Appendix E for calculation basis.

Figure 2 – Customer cost function for Industrial curtailment ($2012)



Values determined for the interruption intervals of interest to this study are presented in Appendix E.

Table 3b – Customer cost function for Industrial curtailment ($2012)

Event Duration	5 days	10 days	15 days
VCR (MMA study, ($2012))	$93.80/GJ	$77.25/GJ	$68.96/GJ

Losses incurred by Retailers due to lost sales

For the purposes of this study, a mean retail value of gas to the market segments potentially interrupted by a Longford event (a mix of Industrial, Commercial and Domestic customers), is taken to be 1.25 c/MJ **($12.50/GJ)** (refer Appendix D: TRUEnergy Standing Tariffs 2011).

Losses incurred by Market Participants who have to source gas from Iona or Culcairn

AEMO have set the Victorian gas market Value of Lost Load (VoLL) maximum to $800/GJ. (NGR Rule 200 definition). During normal operation of the market, the gas price acts as a de-facto wholesale value of gas to the Retailer for each trading interval. Analysis of typical bid stack for injections at Iona suggest the initial market price for gas above the prevailing system demand is about $3.50/GJ rapidly rising to $786/GJ for gas above the normal scheduled rates.

The “Administered Price Cap” (APC) is set by AEMO at $40/GJ (ref c). However, this represents an artificial valuing of gas on the wholesale gas market and would undervalue the gas to the customer. The APC may be set if the gas market “Cumulative Price Threshold” (CPT) of $3700 over 35 successive trading intervals (7 days) is reached at any time. (ref c). This can be achieved within one day if the market price reaches VoLL for 5 successive intervals (24 hours). A 7-day average cost of spot gas (cost to retailers in sourcing uncontracted gas from Iona) is therefore about $105/GJ. It may be anticipated that Market Participants seeking to avoid an APC will schedule bids at about $100/GJ. This cost is borne by Retailers on gas delivered but procured on the spot market and is therefore the highest exposure of Market Participants to the spot market. For sensitivity purposes, market exposure was considered on the basis of 10% of gas being traded on the spot market on the basis that Market Participants would reduce their medium to long term exposure to the spot market. Spot market trading is typically below this level.

However, it may be anticipated that Market Participants will have established risk strategies to avoid the market exposure to unscheduled potential gas flows from Iona, either using financial instruments (hedges etc) or wholesale contracts with producers to match capacity of the pipeline. This is implied to be the case in the declaration in AEMO GSOO 2011 (see Appendix) that gas from Iona is “available”. Therefore for the purposes of this study, it is considered more likely that *no material losses due to imbalance* will occur due to a long term Longford event, noting that Market Participants will have incurred costs in achieving this position, but these costs are difficult to quantify and therefore not included in this study.

Losses incurred by Distributors due to isolation and relight and loss of DUoS

Advice from APA Networks indicates that approximately $2 million would be required to isolate and relight all customers primarily in the Melbourne area. The main exposure to this liability is domestic customer interruption in winter. As the extent of avoided domestic customer interruption is limited and a “one-off” event, this is not considered material to this study.

Losses incurred by APA due to loss of TUoS

Losses incurred by APA Group for loss of TUoS are not considered material to this study.

Conclusions on appropriate value of lost load scenarios and sensitivities

On the basis of the above discussion, the sensitivities to the Value of Customer Reliability set out in Table 4 have been used in the modelling of the value of the WORM to customers.

Table 4 – Sensitivities to the value of lost load

Value of Customer Reliability	**5 days**	**10 days**	**15 days**
VCR (MMA study, ($2012))	$93.80/GJ	$77.25/GJ	$68.96/GJ
Lost Sales	$12.50/GJ	$12.50/GJ	$12.50/GJ
Cost of Spot Gas	($0/GJ)	($0/GJ)	($0/GJ)
Total	$106.30/GJ	$89.75/GJ	$81.46/GJ

Above if Market Participants avoid uplift due to imbalance by underpinned wholesale contracts at Iona.

Value of Customer Reliability	**5 days**	**10 days**	**15 days**
VCR (MMA study)	$93.80/GJ	$77.25/GJ	$68.96/GJ
Lost Sales	$12.50/GJ	$12.50/GJ	$12.50/GJ
Cost of Spot Gas	($4/GJ)	($4/GJ)	($4/GJ)
Total	$102.30/GJ	$85.75/GJ	$77.46/GJ

Above if Administered Pricing Cap of $40 is placed on market and 10% gas is traded on spot market

Value of Customer Reliability	**5 days**	**10 days**	**15 days**
VCR (MMA study)	$93.80/GJ	$77.25/GJ	$68.96/GJ
Lost Sales	$12.50/GJ	$12.50/GJ	$12.50/GJ
Cost of Spot Gas	($10/GJ)	($10/GJ)	($10/GJ)
Total	$96.30/GJ	$79.75/GJ	$71.46/GJ

Above if Market Participants set gas price to avoid APC and 10% gas is traded on spot market

2.4 Injection Capacity

The 2011 Victorian Annual Planning Report prepared by AEMO has been relied upon to determine injection capacities. Refer to AEMO VAPR 2011, App C (attached) and AEMO Gas Statement of Opportunities (GSOO) 2011.

West

South West Pipeline (SWP)/Brooklyn Lara Pipeline (BLP) winter capacity (injections at Iona) is 353 TJ/d to Melbourne plus 21 TJ/d to the Western Transmission System (WTS): Total **374 TJ/d** prior to installation of the WORM and Stonehaven CS.

AEMO note in their VAPR 2011, App C that the existing SWP/BLP capacity (pre-WORM) is reduced on low system demand days due to pressure constraints at Wollert and Dandenong. In winter, there could be some potential loss of supply to domestic customers, although this is less likely in the event load shedding of industrial customers is implemented. Post WORM, this constraint is removed and full pipeline capacity is achievable all year.

Based on APA GasNet modelling post installation of the WORM and Stonehaven Compressor Station, the total emergency capacity is **449 TJ/d**. These capacities are summarised in Table 5 below.

Table 5 – Western Import Capacities

Western Imports (Iona); (TJ/d)	**Winter**	**Shoulder**	**Summer**
Pre-WORM: 5, 10, 15d **	374	230	121
Pre-WORM: 5, 10, 15d emerg	374	374	374

Post-WORM: 5, 10, 15d emerg	449	449	449

** Assumes 2760 kPag at Dandenong and Wollert - see AEMO VAPR AppC (Appendix C)

AEMO VAPR App C, Fig C-8 also shows that an additional 20 TJ/d capacity is achievable if Iona pressure maximum is allowed to reach MAOP (10,000 kPag).

East

Longford and VicHub injection capacity is assumed to be 0 for a total loss of the Longford gas plants.

BassGas capacity is 87 TJ/d.

LNG capacity is assumed to be 0 from events greater than 2 days. LNG may be scheduled for short term balancing of supply and demand within the day during an emergency. Plant capacity (non-firm) is 180 t/h or 216 TJ/d. (There has been one day in recent years where this has been achieved). These capacities are summarised in Table 6 below.

Table 6 – Eastern Import Capacities

Eastern Imports (Longford/BassGas/LNG) (TJ/d)	Winter	Shoulder	Summer
Pre-WORM: 5, 10, 15d	65	65	65
Post-WORM: 5, 10, 15d	65	65	65

North

Imports available from Culcairn during emergency are constrained to 117 TJ/d due to capacity of the Young to Culcairn pipeline. Based on the assumption that a Longford loss of supply will trigger emergency load shedding of large industrial consumers, and noting that this also triggers a similar NSW emergency for supply to their Industrial and commercial customers normally fed via the Eastern Gas Pipeline (EGP), the MSP has sufficient capacity to deliver 117 TJ/d all year in the event of emergency.

However, the VTS is constrained by the seasonal capacity of the DN300 pipeline from Barnawartha to Melbourne. AEMO VAPR App C Fig C-10 shows the capacity of the VTS to receive available gas seasonally prior to the Young to Wagga loop (complete). The VTS is capable of delivering an additional 28 TJ/d with Wagga Loop, Springhurst Compressor Station and Euroa Compressor Station delivering into the Wollert to Pakenham pipeline. These capacities are summarised in Table 7 below.

Table 7 – Northern Import Capacities

Northern Imports (Culcairn) (TJ/d)	Winter	Shoulder	Summer
Pre-WORM: 5, 10, 15d normal	55	55	55
Pre-WORM: 5, 10, 15d emerg	113	110	108
Post-WORM: 5, 10, 15d emerg	113	113	113

Further prospective augmentation of the Northern system between Young and Wollert will potentially increase import capacity, but may be constrained by availability of gas from NSW via the MSP.

Total

Total injection capacities derived from the above analysis is shown in Table 8 below.

Table 8 – Total VTS injection capacities

Total (TJ/d)	**Winter**	**Shoulder**	**Summer**
Pre-WORM: 5, 10, 15d norm	494	405	241
Pre-WORM: 5, 10, 15d emerg	552	549	547
Post-WORM: 5, 10, 15d	627	627	627

Net benefit of WORM & Stonehaven Compressor Station

Net Benefit (TJ/d)	**Winter**	**Shoulder**	**Summer**
Demand	995	633	331
Post-WORM: 5, 10, 15d	75	78	0 **

** Existing cap > demand

2.5 Net Cost of the Wollert Outer Ring Main project

The purpose of this study is to determine the appropriate allocation of the WORM project that can be attributed to security of supply. This is important as the WORM projects also addresses a number of stay-in-business issues that would need to proceed should the WORM project not proceed. The following therefore determines the net cost of the WORM project, taking account of required stay-in-business expenditure.

This analysis takes into account capital and operating expenditure over the life of the WORM (69 years) compared to capital and operating expenditure for 'non-WORM' alternatives otherwise required under stay-in-business expenditure over the same term.

It is assumed that the following projects are approved and completed under separate justifications:

- Stonehaven Compressor Station (proposed for 2014) Euroa Compressor Station (committed 2012).

Relevant projects required under the WORM project are set out in Table 9 below.

Table 9 – Components of the WORM project

	CAPEX ($'000)	Life (yrs)	CAPEX ($'000 pa)	OPEX ($'000 pa)
WORM Stg 1	13,500	60	225	Low
WORM Stg 2 & 3	71,580	60	1,193	Low
WCS6	20,680	30	689	High
WORM Wollert PRS	4,270	30	142	Med
Rockbank PRS	2,117	30	71	Med
BCS GEA Replace	550	30	18	Low
TOTAL	112,697		2,339	

Projects not required if WORM is completed (avoided stay-in-business and growth expenditure) is set out in Table 10.

Table 10 - Projects avoided by completing the WORM project as forecast

	CAPEX ($'000)	Life (yrs)	CAPEX ($'000 pa)	OPEX ($'000 pa)
Sunbury Loop	8,750	60	146	Low
Kalkallo Lateral	6,170	60	103	Low
BCS 11, 13, 14	55,000	30	1,833	High x 3
BCS GEA Upgrade	880	30	29	Low
BCS Station Isolation Valves	910	30	30	Low
BCS Ballarat Filter	400	30	13	Med
Wollert CS A Unit Instrumentation	500	10	50	Low
Iona CS Aftercooler Upgrade	706	30	24	
TOTAL	73,316		2,229	TBA

	CAPEX ($'000)		**CAPEX ($'000 pa)**	**OPEX ($'000 pa)**
Net Project Cost	**39,381**		**110**	

Operating expenditure for compressors is materially higher than for pipelines, particularly if high compression hours are experienced. The avoided project Operating expenditure will therefore be higher than the proposed WORM projects.

2.6 Emergency Management

AEMO Gas Winter Operations Strategy 2011 (5.2.1) states that AEMO can declare an emergency when NGR Rule 333 is satisfied. (refer Appendix A). On this basis, it is expected that it is most probable that an emergency would be declared.

Under these conditions, it would be expected that NSW would also declare an emergency, as most of the industrial and commercial load transported from Longford to Sydney via the EGP would be curtailed. Injections into the EGP from the Orbost (68 TJ/d) are likely to continue. Gas is likely to be scheduled for import at Culcairn where this is required, up to available pipeline capacity or required volumes, whichever is the lowest. In summer, it is possible that exports will be reduced or cease but no imports scheduled, with the required injections being scheduled from Iona (subject to market bid stack pricing).

Similarly, Tasmania's gas supply is supplied via the TGP from Longford and would likely declare an emergency. It may be assumed that injections into EGP at Orbost may partially satisfy essential Tasmanian demand. (ie demand for exports from VicHub at Longford are unlikely.

APPENDIX A

Reference: AEMO Gas Winter Operations Strategy 2011, ENDOCS #327357 v3.0, 26-May-2011

5 Emergency Management

AEMO has the power to declare a threat to system security if it reasonably believes some level of operational response can address the issue, otherwise an "emergency" will be declared.

5.1 Threats to System Security

A threat to system security can occur at any level (i.e. it does not specifically align with one of the gas market emergency levels, such as a "level 4 emergency"), and may impact the DTS partially or as a whole. AEMO has procedures to operate the DTS in a manner that averts or minimises threats to system security.

Only AEMO can declare a threat to system security. Generally if time permits, there will be consultation with ESV prior to any declaration[2], and industry will be advised accordingly through the market notice system.

[2] Note: AEMO would not consult with ESV for the purpose of declaring a threat to system security if the reason for declaring is to perform an ad-hoc schedule to inject peak shaving LNG.

5.1.1 Triggers to declare a threat to system security

As per NGR rule 341, a threat to system security can be indicated by:

- The annual planning reviews prepared by AEMO;
- An operating schedule; or
- any other fact or circumstance which AEMO becomes aware of.

If AEMO believes that declaring a threat to system security is necessary then a notice will be issued. Once the threat to system security has subsided, AEMO will inform registered participants through another notice.

5.2 Emergencies

AEMO has a number of responsibilities related to managing emergencies, one of which is to maintain the gas emergency protocol. This protocol consists of the following:

- Gas Load Curtailment and Gas Rationing and Recovery Guidelines
- Wholesale Market System Security Procedures
- Emergency Procedures (Gas)

The Gas Load Curtailment and Gas Rationing and Recovery Guidelines define classes of gas customers within curtailment tables, which are used to construct curtailment lists. These guidelines are based on system security criteria and can be modified by Government direction.

The Wholesale Market System Security Procedures set the thresholds of operation for the DTS in a way that averts or minimises threats to system security, however, the procedures do not provide information concerning the management of gas quality, scheduling or emergencies. These processes and requirements are covered in the Gas Quality Guidelines, Wholesale Market Gas Scheduling Procedures and Gas Emergency Protocol respectively

The Emergency Procedures (Gas) provides guidance in the management, preparation, response and recovery for gas emergences in Victoria. The procedures are underpinned by the principles of maintaining the reliability of gas, maintaining security of the gas transmission system, and minimising the risk to public safety.

5.2.1 Triggers to declare an emergency

AEMO can declare an emergency when NGR rule 333 is satisfied. Refer to Figure 9 below for an extract of rule 333.

(1) An emergency occurs when:

(a) AEMO reasonably believes there to be a situation which may threaten:

(i) reliability of gas supply; or

(ii) system security or the security of a declared distribution system; or

(iii) public safety,

and AEMO in its absolute discretion considers that the situation is an emergency and declares there to be an emergency; or

(b) AEMO declares there to be an emergency at the direction of a government authority authorised to give such directions.

Figure 9 – NGR version 7, rule 333

AEMO will declare an emergency if it reasonably believes an operational response can not address the issue. The declaration will be implemented by issuing an Emergency Declaration Notice, to the Emergency Manager, Duty Manager or General Manager of each registered participant.

The declaration can be issued by AEMO, Energy Safe Victoria (ESV), or Governor in Council under Part 9 of the Gas Industry Act 2001. AEMO will consult with ESV and/or the Department of Primary Industries (DPI), prior to declaring the emergency (time permitting).

5.2.2 AEMO's powers during an emergency

AEMO can invoke the powers given to it under 91BC of the NGL for managing:

- The operation or use of any equipment or installation
- The control of the flow of natural gas
- Any other matter that may affect the safety, security or reliability of the DTS or a declared distribution system

While AEMO's powers under 91BC can be invoked without the declaration of an emergency or threat to system security, it is unlikely AEMO would invoke these powers without declaring one or both of these.

APPENDIX B

Reference AEMO GSOO 2011

Iona injection point

Iona gas processing and storage facilities are described in Chapter 4.

As shown in Table A1-14, participants have advised that winter peak day available supply from Iona is 492 TJ/d in 2012, potentially increasing to 550 TJ/d by 2016.

Participants have furthermore advised that Iona has a winter peak day plant processing and injection capacity of approximately 520 TJ/d for 2012, however not all of this capacity is classified as available and participants have not indicated that there is any prospective supply.

Iona plant processing and injection capacity could potentially be increased to 600 TJ/d from 2014 onwards depending on augmentation of the SWP.[24]

Mortlake injection point

A new Mortlake injection point was installed in 2010 and will allow gas from the pipeline supplying the Mortlake Power Station to be injected into the DTS via the SEA Gas connection point. However, no available or prospective supply capacity has been advised for this injection point.

Otway injection point

The Otway gas plant is described in Chapter 4. Gas from the Otway plant can be injected into the DTS through the Otway, SEA Gas or Iona injection points.

Participants have advised that winter peak day available supply at the Otway injection point is 188 TJ/d for 2012. No prospective supply has been advised.

[24] This is the updated plant capacity provided by the participant in September 2011. It differs from the plant capacity that was used in Chapter 4 and used in the modelling described in Chapter 7.

BassGas injection point

The BassGas injection point is located at the Lang Lang gas plant in West Gippsland. It is the DTS injection point that allows gas produced from the offshore Yolla gas field and processed at the Lang Lang gas plant to flow into the LMP. Participants have advised that the winter peak day available supply from BassGas is 65 TJ/d for the outlook period. The participants have indicated no prospective supply.

SEA Gas injection point

The SEA Gas injection point is the DTS injection point for gas from the offshore Minerva gas field, the Otway gas plant, and the Mortlake pipeline. From this injection point, gas can be injected into the DTS, the SEA Gas pipeline (for export to South Australia), or into the underground gas storage facility at Iona.

Participants have advised that the winter peak day available supply from the SEA Gas injection point is 87 TJ/d for 2012 (see Table A1-14). Additional supply from SEA Gas could be available to the DTS depending on market conditions, however the participants have not advised any prospective supply.

Northern SWZ – Culcairn injection point

The Culcairn injection point in New South Wales is located in the Northern SWZ on the New South Wales – Victoria Interconnect pipeline. Participants have advised that supplies of 60 TJ/d will be available in 2012, and an additional 1.5 TJ/d should be classed as prospective. For 2013 onwards, the prospective quantity of supply to Victoria increases to 5 TJ/d.

However, given that the Interconnect pipeline can flow in either direction, some participants indicate that gas might, at times, be exported to New South Wales.

Table A1-14 also includes last year's peak day gas supply forecasts for 2012. Compared with that forecast, available supply for 2012 has decreased by 23 TJ/d and total available plus prospective supply has decreased by 92 TJ/d. This data has been provided by participants.

Table A1-14 — Winter peak day supply forecast by SWZ and injection point (TJ/d)

System Withdrawal Zone	Injection Point	2012 (2010 VAPRU)	2012	2013	2014	2015	2016
Gippsland	Longford available	789.6	854.3	854.3	855.8	841.5	834.6
	Longford prospective	189.5	120.5	126.0	148.0	142.0	166.0
	VicHub available	35.0	85.0	69.0	69.0	69.0	20.0
	VicHub prospective	0.0	0.0	0.0	0.0	0.0	0.0
	BassGas available	65.0	65.0	65.0	65.0	65.0	65.0
	BassGas prospective	0.0	0.0	0.0	0.0	0.0	0.0
	Gippsland available	889.6	1004.3	988.3	989.8	975.5	919.6
	Gippsland available plus prospective	**1079.1**	**1124.8**	**1114.3**	**1137.8**	**1117.5**	**1085.6**
Geelong	Iona available	500.0	492.0	480.0	560.0	550.0	550.0
	Iona prospective	0.0	0.0	0.0	0.0	0.0	0.0
	Otway available	312.7	188.2	182.7	199.7	195.2	192.7
	Otway prospective	0.0	0.0	0.0	0.0	0.0	0.0
	SEA Gas available	102.0	86.8	78.8	97.8	89.3	82.3
	SEA Gas prospective	0.0	0.0	0.0	0.0	0.0	0.0
	Geelong available plus prospective[a]	**914.7**	**767.0**	**741.5**	**857.5**	**834.5**	**825.0**
Northern	Culcairn available	50.0	60.0	60.0	60.0	60.0	50.0
	Culcairn prospective	1.5	1.5	5.0	5.0	5.0	5.0
	Northern available plus prospective	**51.5**	**61.5**	**65.0**	**65.0**	**65.0**	**55.0**
Melbourne	LNG available	87.0	87.0	87.0	87.0	87.0	87.0
Total available		1941.3	1918.3	1876.8	1994.3	1957.0	1881.6
Total prospective		191.0	122.0	131.0	153.0	147.0	171.0
Total available plus prospective		**2132.3**	**2040.3**	**2007.8**	**2147.3**	**2104.0**	**2052.6**

a. Participants indicate that the total for Iona and SEA Gas is available to both South Australia and Victoria. The quantity available to Victoria will depend on the market

Table 4-1 — Gas processing facilities in Eastern and South Eastern Australia

Basin	Facility	State	Type of gas processed onsite	Processing capacity (TJ/d)
Bass	Lang Lang	VIC	conventional	70
Gippsland	Longford	VIC	conventional	1,145
	Orbost (Longtom)	VIC	conventional	100
	Gippsland subtotal			**1,245**
Otway	Iona	VIC	conventional	570
	Minerva	VIC	conventional	73
	Otway	VIC	conventional	203
	Otway subtotal			**846**

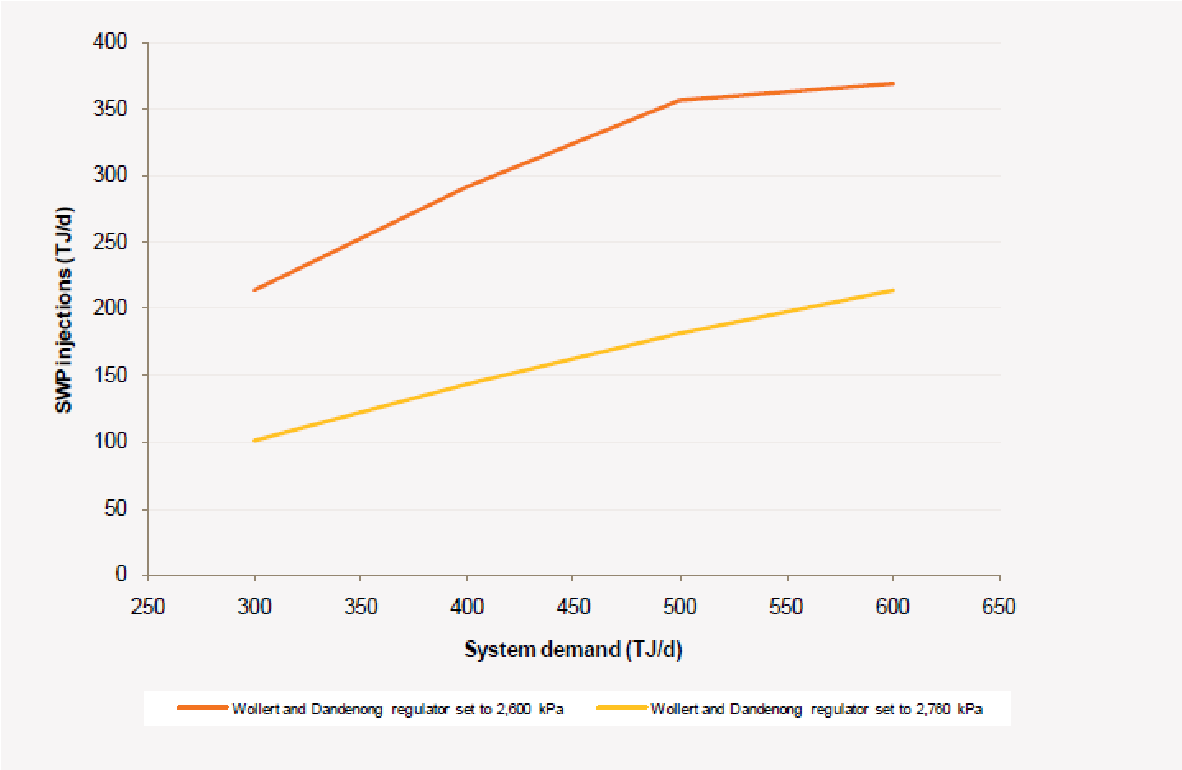
Table 5-2 — 2010 annual gas demand by market segment and demand group

Market segment	Demand Group 1 (SA)		Demand Group 2 (VIC)		Demand Group 3 (TAS)		Demand Group 4 (NSW / ACT)		Demand Group 5 (QLD)		Total	
	PJ	%	PJ	%	PJ	%	PJ	%	PJ	%	PJ	%
Mass Market	11.2	11.0	121.4	56.9	0.5	4.8	44.1	34.0	6.1	3.0	183.2	28.0
Large Industrial [7]	26.4	26.0	84.1	39.4	3.6	35.5	69.0	53.2	104.8	52.2	287.9	43.9
GPG	64.1	63.0	7.9	3.7	6.0	59.7	16.7	12.9	90.0	44.8	184.4	28.1
Total	**101.7**	**100.0**	**213.4**	**100.0**	**10.0**	**100.0**	**129.8**	**100.0**	**200.8**	**100.0**	**655.5**	**100.0**

APPENDIX C

Reference: VAPR 2011 App C

Figure C-7 — Iona injection capability on low system demand days



Connection Agreements require gas in the Dandenong area to be 2700 kPag minimum. This limits capacity of the existing DN750 pipeline from Brooklyn to service demand in the Dandenong area.

Post-WORM, gas is able to be transported via the WORM and Pakenham to supply eastern Victoria and eastern Melbourne via Dandenong and maintain 2700 kPag minimum requirement.

APPENDIX D: TRUEnergy Residential and Standing Offer Tariffs 2011

TRUEnergy Residential and Standing Offer Tariffs 2011

Residential & Small Business Gas Standing Offer Tariffs Valid From 23 January 2011

Pursuant to sections 42, 44 and 46 of the Gas Industry Act 2001 the following variations to gas tariffs for the deemed and standing offer domestic (residential) and small business customers of TRUenergy Pty Ltd (ABN 99 086 014 968) (formerly known as CLP Australia Retail Pty Ltd, SPI Retail Pty Ltd and TXU Pty Ltd) ("TRUenergy") will take effect on and from 23 January 2011 until such time as the tariffs are further varied. Customers can obtain a full list of tariffs by telephoning TRUenergy on 133 466.

TRUenergy Gas Zone 1^* - Residential Tariffs	Unit	Ex GST	Inc GST
Tariff 01 - Multiple Residential (meter/regulator capacity up to 50m^3/hr)			
Supply charge	$ per 2 months	35.83	39.413
Commodity charge (peak)	¢/MJ	1.21	1.331
Commodity charge (off-peak)	¢/MJ	1.21	1.331
Tariff 02 - Multiple Residential (meter/regulator capacity over 50m^3/hr)			
Supply charge	$ per 2 months	109.14	120.054
Commodity charge (peak)	¢/MJ	1.09	1.199
Commodity charge (off-peak)	¢/MJ	1.09	1.199
Tariff 03 - General Residential			
Supply charge	$ per 2 months	27.68	30.448
First 3200 MJ/per 2 months (peak)	¢/MJ	1.7900	1.96900
Balance MJ (peak)	¢/MJ	1.4300	1.57300
First 3200 MJ/per 2 months (off-peak)	¢/MJ	1.5200	1.67200
Balance MJ (off-peak)	¢/MJ	1.3400	1.47400
Tariff 04 - Residential Bulk Hot Water Master Meter (meter/regulator capacity up to 50m^3/hr)			
Supply charge	$ per 2 months	37.17	40.887
Commodity charge (peak)	¢/MJ	1.49	1.639
Commodity charge (off-peak)	¢/MJ	1.49	1.639
Tariff 05 - Residential Bulk Hot Water Master Meter (meter/regulator capacity over 50m^3/hr)			
Supply charge	$ per 2 months	130.79	143.869
Commodity charge (peak)	¢/MJ	1.42	1.562
Commodity charge (off-peak)	¢/MJ	1.42	1.562
Tariff 09 - Unmetered Gas Lights (closed to new entrants)			
Standard two mantle light	$ per 2 months	53.17	58.487
Additional mantle	$ per 2 months	26.58	29.238
Tariff 10 - Bulk Supply to Flats for Storage Water Heating (meter/regulator capacity up to 50m^3/hr)			
Gas commodity charge	¢/MJ	1.5329	1.68619
Hot water charge	¢/litre	0.7622	0.83842
Conversion factor	MJ/litre		0.49724

Tariff 11 - Bulk Supply to Flats for Storage Water Heating (meter/regulator capacity over $50m^3/hr$)

Gas commodity charge	¢/MJ	1.5329	1.68619
Hot water charge	¢/litre	0.7622	0.83842
Conversion factor	MJ/litre		0.49724

TRUenergy Gas Zone 1^* - Small Business Tariffs		Ex GST	Inc GST

Tariff 13/21 - General Business (meter/regulator capacity up to $100m^3/hr$)

Supply charge	$ per 2 months	34.80	38.280
First 100000 MJ/per 2 months (peak)	¢/MJ	1.3100	1.44100
Next 450000 MJ/per 2 months (peak)	¢/MJ	0.9500	1.04500
Balance MJ (peak)	¢/MJ	0.9200	1.01200
First 100000 MJ/per 2 months (off-peak)	¢/MJ	1.2200	1.34200
Next 450000 MJ/per 2 months (off-peak)	¢/MJ	0.8700	0.95700
Balance MJ (off-peak)	¢/MJ	0.8500	0.93500

Tariff 14/22 - General Business (meter/regulator capacity from $100.1m^3/hr$ to $850m^3/hr$)

Supply charge	$ per 2 months	34.80	38.280
First 100000 MJ/per 2 months (peak)	¢/MJ	1.3100	1.44100
Next 450000 MJ/per 2 months (peak)	¢/MJ	0.9500	1.04500
Balance MJ (peak)	¢/MJ	0.9200	1.01200
First 100000 MJ/per 2 months (off-peak)	¢/MJ	1.2200	1.34200
Next 450000 MJ/per 2 months (off-peak)	¢/MJ	0.8700	0.95700
Balance MJ (off-peak)	¢/MJ	0.8500	0.93500

Tariff 08 - Standby Power Generation Tariff

Supply charge	$ per 2 months	748.55	823.405

Commodity charge as specified in tariffs 13, 14, 21 or 22 as appropriate.

^ Includes the following postcodes:
3024, 3029, 3030, 3211, 3212, 3214, 3215, 3216, 3217, 3218, 3219, 3220, 3221, 3222, 3223, 3224, 3225, 3226, 3227, 3228, 3335, 3337, 3338, 3427, 3429, 3430

(Excludes customers in the SP AusNet Central new towns distribution extension zone)

* Rates subject to confirmation of distribution zone at your supply address

Additional Notes:

- Seasonal usage:
  - Peak - usage between 1 June and 30 September inclusive
  - Off-Peak - all other times
- Tariffs are based on a 2-month billing cycle

There are several other tariff regions with similar tariff schedules.

For the purposes of this study, a mean retail value of gas to the market segments potentially interrupted by a Longford event (a mix of Industrial, Commercial and Domestic customers), is taken to be 1.25 c/MJ **($12.50/GJ)**

APPENDIX E: Value of Lost Load

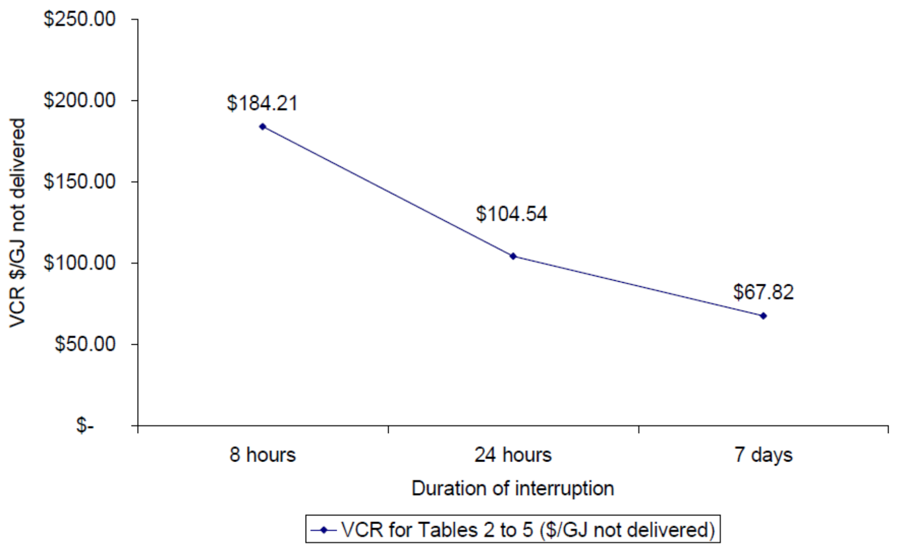
Refer: "The value of customer reliability for gas", McLennan Magasanik Associates Pty Ltd, 20 September 2005

The following extracts from the MMA report establish the value of customer reliability for gas in 2005 dollars:

Table 1 – VCR for Curtailment Tables 2 to 5

Duration of interruption	Sample	Total costs incurred ($)	Total gas not delivered (GJ)	VCR for Curtailment Tables 2 to 5 ($/GJ not delivered)
8 hours	n=41	$6,412,100	34,810	$184.21
24 hours	n=41	$14,643,075	140,075	$104.54
7 days	n=41	$86,194,674	1,270,990	$67.82

Figure 1 – Customer cost function for Curtailment Tables 2 to 5

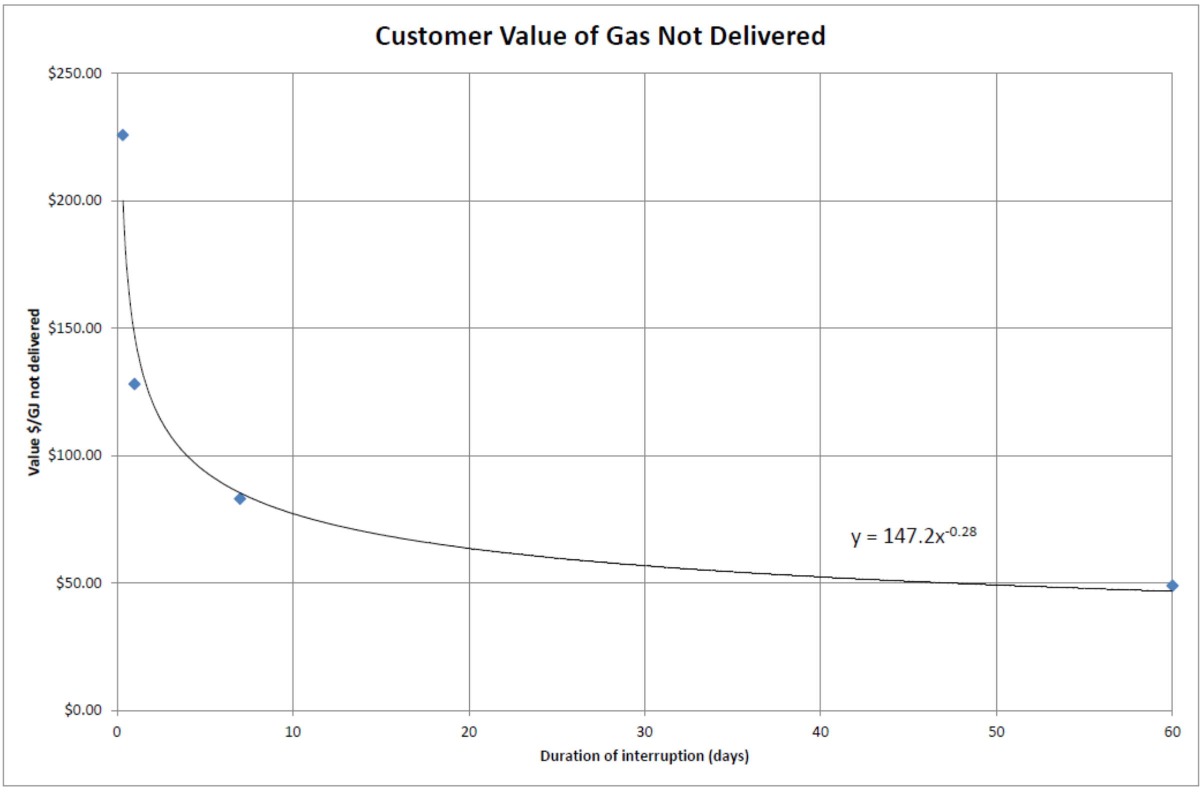


	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
	Historical	Historical	Historical	Historical	Historical	Historical	Historical	Historical	Forecast	Forecast
CPI p.a.	2.37%	2.59%	2.80%	3.25%	2.96%	3.69%	2.11%	2.65%	3.00%	3.00%
Escalator : Nominal $ to Real $ 2012	1.293	1.260	1.226	1.187	1.153	1.112	1.089	1.061	1.030	1.000

Using the above escalating table, the values from the 2005 MMA report have been escalated to 2012 dollars:

	Customer	Customer
days	2005	2012
0.333	$184.21	$225.79
1	$104.54	$128.14
7	$67.82	$83.13
60	$40.00	$49.03

The data produced has then been fitted to establish a best fit curve:



The resultant table of Cost of Gas is then derived by interpolation from the above relationship.

	Customer
days	2012
5	$93.80
10	$77.25
15	$68.96
60	$46.78

C. CV's for Richard Robinson and Gaye Francis

RICHARD ROBINSON

BE BA FIEAust

Richard Robinson is a career risk and due diligence engineer with over 30 years experience in the industry.

Richard's primary focus for the past 15 years as a Director of R2A has been -

- technical due diligence and organisational risk control
- construction of risk and reliability based models for common law and for investment payback criteria
- short course presentations and liability briefings
- facilitating workshops
- appearing as expert witness
- principal author of Risk & Reliability: Engineering Due Diligence (now in its eighth edition).

Education

BE, Mechanical Engineering, Monash University, 1974
BA, Philosophy, University of Melbourne, 1981

Memberships

Member, Society of Fire Protection Engineers, USA, 1983
Chairman, Masters of Systems Engineering Course Advisory Committee, RMIT, 1987-1988
Fellow, Engineers Australia, 1992
Chairman, Victoria Division, Engineers Australia, 1993
Chairman, Course Advisory Committee, RMIT Pilot Centre, Point Cook, 1994-1998
Director, Engineers Media (Engineers Australia Pty Ltd), the wholly owned publishing subsidiary of the Institution of Engineers, Australia, 1984-2004
Chairman, Engineers Media, 2001- 2004.

Training

On behalf of Engineering Education Australia, Richard presents a two-day public short course on Risk & Liability Management.

Experience

Richard has been responsible for implementing major risk and reliability studies and technical due diligence reviews for large organisations such as –

- Office of Airspace Regulation
- Civil Aviation Safety Authority
- Air Services Australia
- South Port NZ
- Silverfern Shipping NZ
- Tasports
- V/Line Passenger Services
- Rail Corporation NSW
- performance review of the Office of Gas Safety.

Recent undertakings include –

- the development of alternate airspace collision risk models for the Civil Aviation Authority New Zealand, and for the Office of Airspace Regulation Australia
- strategic risk reviews for the Marina Coastal Expressway Singapore and for the Tugun bypass Gold Coast
- due diligence reviews for rockfalls in cuttings Railcorp NSW
- hazardous atmospheres in laboratories (CSIRO)
- many SIL (Safety Integrity Levels) allocation studies and enterprise availability studies for Melbourne Water
- member of the ministerial peer review panel for the Eildon Dam Alliance Project
- member of the Independent Blasting Audit Team, Department of Minerals & Energy, WA (Western Mining Corporation Nickel & Gold), 1999.

Richard is currently –

- a risk advisor to the Training and Education board of the Australian Marine Pilots Association
- the expert risk management member on the Victorian Powerline Bushfire Safety Taskforce
- presenting the postgraduate due diligence unit at Swinburne University of Technology.

DUE DILIGENCE ENGINEERS

GAYE FRANCIS

BE MIEAust

Gaye is an experienced risk and due diligence engineer and highly effective project manager, with a diverse range of project experience collected over 13 years of consulting activities with R2A. Gaye has worked with both private and government clients across a wide range of industries including road, rail, marine, mining, aviation and water.

As a R2A Director, Gaye is involved in all aspects of the practice and oversees the consulting stream. In-house tasks include contribution to and development of the R2A text, Risk & Reliability: Engineering Due Diligence (now in its eigth edition), preparation of conference papers and training courses, and on-going development of the R2A method of work.

Education

Bachelor of Engineering (Chemical), University of Melbourne, 1997

Memberships

Member, Engineers Australia 2003
Committee member Victorian Women in Engineering (June 2009 - 2011)
Victorian representative National Women in Engineering Committee 2010 - 2011
Organising Committee 15th International Conference for Women Engineers & Scientists 2011 (ICWES15)
Co-chair Women in Engineering Victoria Committee, Feb 2007 - June 2008
Emerging Leaders pilot program, Engineers Australia, 2008
Committee member for the revision of the Safety Case Guidelines, Engineers Australia 2007
Chairperson Drafting Committee Safety Case Guidelines Engineers Australia, 2002

Experience

Port Hedland Pilotage Review & Safety Management System Development – Port Hedland Pilots
In July 2010, R2A completed a due diligence safety review for the provision of pilotage services at Port Hedland, Australia's largest port in terms of tonnage. The outcomes were included in the Pilotage Operations Safety Management System (POSMS) for the port.
A generalised common law safety case approach was used to document that all statutory, regulatory and common-law requirements have been met. It consisted of a number of arguments that demonstrate that all reasonable practicable precautions are in place for all credible critical issues including grounding, collision and allision. Issues were identified on a zonal basis.
During the review on-site, a number of tasks were completed including a due diligence briefing to stakeholders and legal counsel, documentation review, observation of pilotage services, generative interviews and a final sign-off briefing and presentation.

Taupo Aerodrome Airspace Collision Risk Model Application – Civil Aviation Authority, New Zealand
As part of a larger aeronautical study by the Civil Aviation Authority, Gaye provided risk advice and modelling expertise into the safety implications of the different risk mitigation options for the Taupo aerodrome airspace.
The primary approach used was generative interviews. Generative interviews were completed with Taupo airport stakeholders including representatives from the commercial airlines, Airways, pilot training organisations, sky diving operators, helicopter operators, the Float Plane operator, charter service operators, the Taupo District Council as the airport owner, the Airport Operational and Safety Committee and the Airline Pilots Association.

Tram Procurement Project – Department of Transport, Victoria
Gaye was the nominated project manager for various risks, reliability and due diligence studies relating to the Tram Procurement & Support Infrastructure Project. The project was responsible for the procurement of fifty new, low floor trams as well as associated depot, power supply and infrastructure upgrade works.
Studies have involved a variety of stakeholders including the Government as the owner, the Franchisee operator and the safety regulator.

Options Review – Gladstone Area Water Board
Gaye was part of the R2A team engaged to assess the options being considered to address the critical infrastructure issues identified in R2A's original Critical Asset Due Diligence Review report and subsequent maintenance issues identified by GHD.
The options were reviewed against project critical success factors including fit for purpose, design life, capital cost, whole of life cost, timing, operational and maintenance issues, safety, environment and social considerations during a workshop of key stakeholders.

DUE DILIGENCE ENGINEERS

D. Terms of Reference (R2A Proposal dated 16 December 2011)

DUE DILIGENCE ENGINEERS
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16 December 2011

Mr Alan Burt
Chief Engineer Process
APA Group
Po Box 4204
Dandenong South 3164

Alan.Burt@apa.com.au

Dear Alan

Re: **Due Diligence Review for Security of Supply of VTS**
R2A Ref: 110-00

Further to our meeting last Thursday, R2A is pleased to provide the following proposal to assist APA Group with a due diligence review regarding security of supply of the Victorian Transmission System (VTS). Based on our conversation it is understood that the review will consider Reliability, Availability, Maintainability and Safety (RAMS) implications and will form the basis of APA's access arrangement submission to the Australian Energy (economic) Regulator (AER) for the provision of increased transmission capacity to ensure security of supply to the Victoria gas market, based on financial investment guidelines.

R2A propose to undertake the review in a common law due diligence context consistent with the provisions of the model Work Health and Safety (WHS) Act expected to be introduced in Victoria during 2012. This act has already been passed by the Commonwealth, NSW, QLD, ACT and NT parliaments for commencement on 1 January 2012. It specifically applies to the storage and handling of dangerous goods including Major Hazard Facilities. The act requires a positive demonstration of due diligence by responsible *officers* for safety outcomes of the business to all parties affected by the business, including the public.

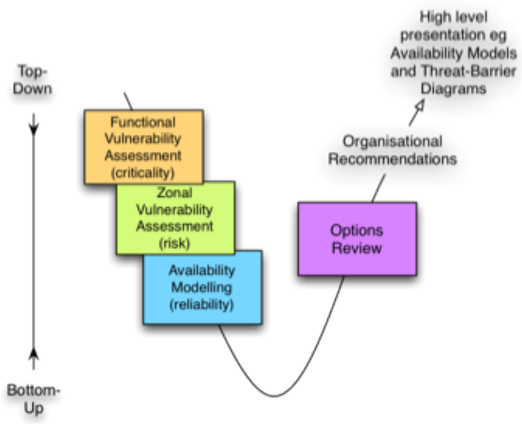
The act adopts a precaution rather than a hazard based approach to risk consistent with the modus operandi preferred by Energy Safe Victoria. This approach ensures that all sensible practical precautions are in place to maintain security of supply for Victoria based on the balance of the significance of the risk verses the effort required to reduce it (the High Court decision making point). This subject is described in more detail in Section 4.4 *Due Diligence* of the 8th edition of the R2A Text, a copy of which was left with you at our meeting.

DUE DILIGENCE ENGINEERS
ABN 66 115 818 338

1.0 METHOD

Chapter 22 of the R2A text outlines the process in detail and is summarised below.

The review method is top-down supported by bottom-up techniques (as required) as depicted in the diagram below.



Top down approach to required depth

Referred to as high level availability profiling, four separate tasks are completed, with an initial task to define the limits to the system under consideration:

- o) Define the boundary of the system being analysed
- i) Functional (context or boundary) vulnerability assessment
- ii) Zonal / geographic (common mode) vulnerability assessment
- iii) Availability modelling of all current and proposed operating modes
- iv) Investment payback analysis of existing and proposed operating modes

1.1 Functional vulnerability assessment. This is a high-level context (boundary) vulnerability analysis establishing the risk context for the remainder of the analysis. It examines the credible boundary threats to the critical success factors of the system. This is an established process derived from the security/military intelligence community. It is conducted through a combination of generative interviews and workshops with experts and management, and produces a straightforward and easy to understand threat-vulnerability matrix showing critical external network (often organisational) vulnerabilities.

1.2 Zonal Vulnerability Assessment. This assessment is usually performed based on the geographic layout, high-level system functionality, and incident history. It identifies critical common mode and common cause failures such as fires/explosions, pipe failures and the like. These are typical common mode failures for which organisations purchase insurance. This process is long established in underwriting and HPR (Highly Protected Risk) industries. It is the approach encouraged by AS 2885.1 – 2007 Section 2 *Safety* and Appendix B of the same standard. Where possible, it is based on historic data.

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1.3 **Availability modelling.** Modelling initially focuses on the identified critical elements for each operating mode, consistent with standard reliability modelling techniques. Two models are suggested, with the current and the proposed pipeline configurations. Subject to further discussion, 3 seasonal operating times/modes are proposed (peak / winter, shoulder and low demand / summer). The analysis will be based on historical data and known maintenance activities. This work will be prepared in Excel in the first instance.

1.4 **Options review and recommendations.** Based on the different availability models developed in 1.3 above, financial payback assessments for each can be prepared and compared.

2.0 TASKS

The follow section outlines the proposed tasks for the review.

2.1 **Generative interviews** with key APA personnel to collect information regarding the system and key infrastructure components relevant to the delivery of gas, asset condition and precautionary information. This will assist R2A to develop a first cut of the availability model for discussion.

2.2 **Model development**. A first cut of the high level availability model for the different operating modes relating to season will be developed as a desktop exercise based on the information collected during the generative interviews.

2.3 **Test model and define failure modes** (external and common mode) with key APA personnel. Options to be tested will also be developed during this step of the process.

2.4 **Stakeholder workshop and sign-off** to test the developed model, failure modes and characterisation. This will be tested in relation to security of supply of the VTS with particular regard to the new western ring main and the investment payback of same.

2.5 **Report**. R2A will produce and deliver a draft report for review within a week of the stakeholder workshop being completed for review and comment.