REPORT

Malabar Biomethane Project – Options Analysis

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AUTHORISATION

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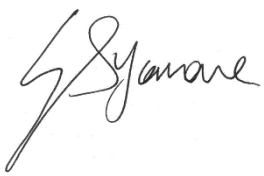
Gabrielle Sycamore	General Manager – Strategy & Commercial		20/12/2019

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DOCUMENT HISTORY

Revision	Date	Author	Description of Changes
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1 EXECUTIVE SUMMARY

Jemena Gas Distribution Network's (JGN) has recently undertaken extensive engagement with customers as part of JGN's Access Arrangement for 2020-25. Many of JGN's customers have advised they are seeking to decarbonise their existing energy supply to meet their sustainability targets or to meet future sustainability accreditation requirements. Specifically, Interface Carpets, City of Sydney and Dexus have advised they are seeking access renewable gas or will discontinue their gas use and invest in alternatives (such as electrification or offshoring). In additional the next version of the Green Star energy rating tool to be released in 2020 incentivises the removal of Natural Gas Appliances (Green Building Council of Australia, 2018). Hence, significant demand destruction is forecast if these customers are not provided with a decarbonised gas option.

Losing these customers identified above will result in an existing revenue loss of $2.1 million pa of by 2050, not including the potential future connections and increase in throughput from these customers. Unless averted, this reduction in network utilisation and the resultant revenue loss will result in higher network charges for remaining customers.

The Sydney Water Malabar Sewage Treatment plant currently produces approximately 1500 Nm3/h of Biogas that is burnt in generators to create electricity and flared. Sydney Water intends to upgrade its facility so that it can convert this Biogas to Renewable Gas. This facility would have the capacity to inject up to 268 TJ/yr of methane into our network.

Augmenting our network by building a secondary main to the Malabar Sewage Treatment plant will allow Renewable Gas to be injected into our network. The customers that want to decarbonise would be able to procure this Renewable Gas from Sydney Water through an accreditation and certification scheme instead of electrifying or relocating their operations.

In addition to avoiding revenue loss, this investment would provide a pathway for additional Renewable Gas to be injected into our network by providing a proof of concept (lowering technical risk for future projects), enabling development of certification and creating a market for Renewable Gas.

JGN have considered three options:

1. Maintain the status quo and do not augment the network to connect the Malabar Sewage Treatment plant to our network. This option avoids any network augmentation costs but results in revenue loss, and higher bills for our customers.
2. Providing a connection direct to our secondary network. This option would provide enough capacity for the Malabar Sewage Treatment plan to inject all the Renewable Gas it can produce at a cost of $2.5M.
3. Providing a connection to our local distribution network. This option provides a lower capital cost connection option ($2.0M) however it will limit how much Renewable Gas can be supplied into our network and so the number of customers that can be retained on the network.

Evaluation of these options indicates that the secondary main provides the most benefits to our customers with an NPV of $20.2M relative to the status quo.

1.1 KEY DRIVERS

Several key customers are exploring decarbonisation options, including disconnection from the gas network and electrification of their gas load. The key driver of this project is to retain these customers on the network for the benefit of all customers. Furthermore, this project will provide additional benefits to further Renewable Gas projects that could provide value to any other customers that want to decarbonise:

1. Develops Renewable Gas certification system to allow customers to be credited with Renewable Gas injected.
2. Establishes a decarbonisation pathway for the gas network.
3. Establish technical processes for Renewable Gas injection.
4. Derisk and encourage investment in Renewable Gas facilities to enable more Renewable Gas to be supplied to customers.
5. Ensure the Federal Government BioEnergy roadmap can be fulfilled.
6. Ensure Federal and NSW government targets for Renewable Gas can be fulfilled.

These items contribute to the reduction in the risk of demand destruction discussed in Attachment 7.10 - Proposed changes to asset lives for new investments.

1.2 CREDIBLE OPTIONS

Several options were considered based on the customer demand:

1. **Maintain Status Quo** - Do not connect Renewable Gas project. Loose customers from the network.
2. **Connection to Secondary Main** - Connect injection project to the secondary main that will enable all named customers to remain on the network.
3. **Connection to local distribution network** - Connect to the local distribution network, however this will not enable sufficient flow to retain all customers on the network.

Option	Annual revenue lost by 2050	Capex	NPV	Incremental NPV
1	$2.1 M	$0.0 M	-$22.7 M	$0.0 M
2	$0.0 M	$2.5 M	-$2.5 M	$20.2 M
3	$1.9 M	$2.0 M	-$21.3 M	$1.4 M

1.3 RECOMMENDATION

Option 2: A connection to the secondary main is the recommended solution. This solution provides the highest NPV as the additional capex costs are more than offset by the benefit of avoiding the lost revenue. This option will result in the lowest customer bills.

This option also provides a pathway to further Renewable Gas injection into our network.

1.4 CONSUMER ENGAGEMENT

Our engagement for the 2020-25 Access Arrangement review included comprehensive engagement on our customers current and future preferences. In this engagement, our customers told us that they expect us, and other parts of the energy industry, to innovate and plan for the future so that they can continue to use gas in the longer term as we move to a zero-carbon future

1.5 NATIONAL GAS RULES

Under Rule 79 of the National Gas Rules, capital expenditure can be rolled into JGN's capital base if it is conforming capital expenditure.

Conforming capital expenditure must be such as would be incurred by a prudent service provider acting efficiently, in accordance with accept good industry practice, to achieve the lowest sustainable cost of providing services.

Facilitating access to Renewable Gas is consistent with good industry practice. This is demonstrated by gas networks around the world who are actively working to facilitate and encourage the injection of Renewable Gas into the networks to ensure that the network has a role in a decarbonised future. Facilitating the injection of Renewable Gas will also help lower bills, than they otherwise have been, helping achieve the lowest sustainable cost to consumers.

Conforming capital expenditure must also be justified under Rule 79(2).

Augmenting our network to facilitate the injection of Renewable Gas will lead revenue which exceeds the cost of the capital expenditure and as a result this expenditure is justified under Rule 79(2)(b).

The expenditure is also justified under Rule 79(2)(a) as the overall economic value is positive – as the value to our customers (which must exceed our network charges and revenue we will collect) exceeds the cost of the augmentation.

2 PROJECT KEY DRIVERS

The key driver to the project is to provide Renewable Gas to key customers to prevent the loss in revenue being spread across remaining customers, increasing their bills. Additionally, further drivers include:

1. Ready network to meet NSW and Federal government drive for Renewable Gas
2. Develop a decarbonisation pathway for the gas network to prevent further demand destruction beyond these initial key customers

2.1 BACKGROUND

In December 2015, 195 countries, including Australia, agreed on the United Nations' Paris Agreement on climate change. This agreement commits countries to reducing the amount of carbon dioxide they emit into the atmosphere. In line with the Paris Agreement, Australia has committed to a low carbon future, and the Federal Government has set a target to reduce carbon emissions to 26-28% below 2005 levels by 2030. The NSW Government has endorsed the Paris Agreement and stated it will take action consistent with the level of effort required to achieve Australia's commitments to the Paris Agreement. It has also made a commitment to a net zero carbon future by 2050.

While natural gas has historically been promoted as the low-carbon energy option, the change in the energy market means that the future of natural gas beyond 2050 is no longer assured, because it contains carbon.

Internationally, a number of cities and countries have already committed to banning natural gas by 2050. While no such ban exists in Australia at this time, there have been efforts to ban natural gas infrastructure from some new developments. While the industry is currently putting significant effort into identifying a credible pathway to a net-zero carbon future, success is not assured either technically or from a cost competitiveness perspective. Although we have recently seen significant growth in customers connecting to our network—driven by the NSW housing boom—it is possible that

Government policy changes to meet the net-zero carbon target could make the gas network too expensive to be competitive in the long-term, or make continued operation of the network infeasible.

Independently other customers (as outlined in Section 2.3) and stakeholders are encouraging the move away from gas. Recent examples include:

- Article in Domain on 17 December 2019 – Discussed the move away from gas by Moreland Council whose "design excellence scorecard encourages gas-free electrified homes" and a developer who "where possible it would no longer be including gas in residential projects" and that they are "sure [electrification] will become more common." (Malo, 2019)
- Inner West Climate Strategy – in which key area 2 is to "phase out natural gas" (Inner West Council, 2019) and this was enhanced in the council meeting on 10 December 2019 carried a modification to include that "natural gas is not renewable and should be phased out" (Inner West Council, 2019)
- Mirvac plans to be net positive carbon by 2030 – this includes that "eliminating natural gas from.. new developments" and are planning to "investigate electrification options when replacing natural gas plant equipment" from 2020 " and eliminating all gas from existing developments by 2030 (Mirvac, 2019)
- AGL are encouraging their customers to switch from gas to electricity – as "choosing to go all-electric can not only be cheaper but can also help reduce your CO2 emissions" (AGL, 2019) and are based on a study that states "emissions from the electricity generation network in the NEM will decrease in the coming years, while emissions from the natural gas industry are unlikely to do so" (Anderson, 2019)

Any reduction in average loads (demand destruction) will continue to put upward pressure on the network costs borne by each of our current and future customers. Should demand destruction occur, we are likely to see customers disconnect from our network in greater numbers, meaning that there will be fewer customers over which to spread our largely fixed costs. The customers remaining on the network at that future time are likely to be those who are constrained in their ability to switch technologies. This may be due to cost constraints or for practical reasons. This raises an issue of fairness, as those customers who are less able to afford price increases would have price increases imposed on them with little capacity to respond.

2.2 RENEWABLE GAS

Renewable Gas is a general term for low carbon Natural Gas and currently includes Hydrogen produced by Renewable energy and Biogas produced from organic material. Currently the lowest cost option to produce Renewable Gas is through Biogas as it is already being produced from waste and sewage for electricity and flaring.

Biogas is produced through Anaerobic (without oxygen) Digestion of organic material. It is mostly a mix of methane and carbon dioxide. This mixture can be 'upgraded' to produce a high purity stream of methane and another of carbon dioxide. The methane can be injected into the gas network and the carbon dioxide stream can potentially be utilised for other purposes.

This process is well established in Europe with other 1000 sites upgrading and injecting Renewable Gas from Biogas. However, no such projects exist in Australia.

2.3 IDENTIFIED NEED

Jemena has been approached and made aware of a number of customers they were looking to decarbonise their gas supply through electrification or similar, resulting in gas demand destruction. These customers are outlined below.

2.3.1 INTERFACE CARPETS

Interface carpets are a leader in sustainability and have a decarbonisation target by 2020. At the point they made contact with Jemena these were evaluating the potential of electric boilers for their manufacturing to electrify their gas load. They have provided a letter of support for this project which can be found in Appendix D.

2.3.2 CITY OF SYDNEY

The City of Sydney have a decarbonisation target for their own energy by 2030 (City of Sydney, 2019) and the City of Sydney itself by 2050, this would result in the early reduction in their reliance on natural gas for their buildings in the short term and reducing the use of gas across their region following this. They have provided a letter of support for this project which can be found in Appendix E.

2.3.3 DEXUS

Dexus has a net zero emissions target by 2030 and such “proposes to steadily phase out onsite natural gas and diesel and replacing gas appliances with electric equivalents” (Dexus, 2018). They made contact with Jemena after they were made aware of the potential of Renewable Gas after discussing electrification options with an energy consultant Jemena had previously engaged with. They have provided a letter of support (see Appendix F) for the potential to utilise Renewable Gas as an alternative to replacing gas appliances if it is made available, otherwise they will proceed with their public commitment.

2.3.4 GREEN BUILDING COUNCIL OF AUSTRALIA

The Green Building Council of Australia managed the Green Star Certification scheme that assesses the sustainable design, construction and operation of buildings, fit outs and communities. They issue tools that are utilised to determine the calculation of a star rating. Previously their tools encourage the use of gas as a low carbon fuel, however their new tool (to be released in 2020) disincentivises the installation of gas appliances and actively encourages the removal of gas appliances from existing buildings, as outlined in their Carbon Positive Roadmap (Green Building Council of Australia, 2018). While their roadmap relates to new registrations, if a new fit out occurs in the building it will need to comply with this new roadmap. Therefore, it has been assumed that a new building fit out is required every 15 years and so at 15 years passed the buildings initial registration date it will need to meet the new standard. It has been assumed that the buildings will maintain their current rating level and so transition as per the roadmap with 4, 5 and 6 star rated buildings transitioning after 2028, 2026 and 2023 respectively.

2.4 STAKEHOLDERS DRIVING RENEWABLE GAS

In addition to stakeholders that are currently moving against Natural Gas there are a number of stakeholders that are pushing for Gas Networks to allow for the injection of Renewable Gas as part of decarbonation policy objectives.

Minister for Energy and Emission Reduction Angus Taylor has requested ARENA to invest in the development of a roadmap for the bioenergy sector in Australia (ARENA, 2019). One of the key issues the roadmap will include is to look at opportunities to decarbonise the gas network. The development of this project will help meet federal government policy.

The National Hydrogen Strategy sets out a vision for a the development of the Renewable Gas industry in Australia (COAG Energy Council, 2019). One of the key measures of success is the

development of a certification scheme and also outlines the technical developments required. This project assists in the development of a certification scheme at a lower cost than current hydrogen production and so will enable the policy to be achieved at lowest cost.

2.5 DECARBONISATION PATHWAY

Currently, there is no Renewable Gas injection into Gas Networks in Australia. The injection and crediting of Renewable Gas in the proposed project will be undertaken in a bespoke manner, the pathway to enabling Renewable Gas to be made widely available to customers will require the following, which will be enabled by this project:

- Established Certification system for Renewable Gas
- Encourage investment in Renewable Gas projects
- Establish incentives
- Technical standards and processes

How these aspects are being addressed and how this project will assist and the long term aim is addressed below. The development of this pathway will ultimately reduce the cost to supply Renewable Gas to customers and so ensure that more customers select Renewable Gas as a decarbonisation option rather than electrification thus reducing bills for all remaining customers.

2.5.1 CERTIFICATION OF RENEWABLE GAS

Certification of Renewable Gas works similar to the GreenPower scheme for electricity. When gas is injected Jemena measures the amount and a certificate is issued, this certificate can be then claimed by any customer on the network to decarbonise their gas supply which is also measured by Jemena.

For this project this will be a manual process of crediting the certificates to customers and working with their reporting requirements which will test the system and establish principles.

The manual process will be in the interim until the system is owned by an recognised body that will manage the crediting and ‘retirement’ of certificates. This will enable Renewable Gas to be injected, withdrawn and credited at any point on a connected network. It will be widely recognised as a zero emission fuel and have an established ecosystem of traders and Renewable Gas purchase agreements. This will provide customers with an alternative to Renewable Power Purchase Agreements (PPAs) utilising existing infrastructure.

2.5.2 ESTABLISH INCENTIVES

The injection of Renewable Gas into the gas network is not recognised as a destruction mechanism under the Energy Reduction Fund (ERF), in comparison to flaring onsite which is, therefore cannot be credited for its carbon reduction value through the issuance of Australian Carbon Credit Units (ACCUs). Therefore, this project does not benefit from any external incentives, this project will enable the development of existing incentives to include Renewable Gas and potentially establish additional incentives based on the value to the energy system.

2.5.3 TECHNICAL STANDARDS AND PROCESSES

Jemena has specifically technically evaluated this project for its ability to inject into the gas network as this is the first injection project in Australia. Through this project it is intended that technical standards will be developed that can be applied to all future projects. Furthermore, through testing and evaluation of this project the technical standards should be able to be optimised such that the cost to process and inject Renewable Gas is reduced to enable more customers to access it.

2.5.4 ENCOURAGE INVESTMENT

Biogas upgrading to decarbonise the gas network has been identified as a key issue as part of ARENA's $100m Bioenergy Roadmap. Whilst biogas upgrading for grid injection is a proven technology and an established industry across Europe and North America, the Australian industry is still emerging. The proposed Malabar Biomethane Project has received ARENA panel approval as part of their Bioenergy Road Map investment.

The initial investment and support and demonstration of the grid injection is seen as a critical enabler to supply the market with renewable gas and to encourage future larger scale investment to further meet customer demand for renewable gases.

2.5.5 REDUCTION IN COST TO SUPPLY RENEWABLE GAS

Without the pathway described above Renewable Gas is only available to customers that have an immediate need to decarbonise, but the cost to decarbonise through electricity is also high, so they have a high willingness to pay. As the push to decarbonise increases, as discussed in Section 2.4, customers with lower cost alternatives (such as residential customers) will start to decarbonise, this will increase the bills of all remaining customers. Therefore, it is imperative that the cost to decarbonise through Renewable gas is driven down to prevent the loss of these customers. These knock on benefits of this project are not included in the justification, but would be many multiples of the current customer benefit.

2.5.6 AWARENESS

The current Gas Network customers who were going to disconnect from the gas network and increase costs for remaining customers because there was no access to Renewable Gas were identified through direct engagement. However, it is probable that there are currently a large amount of customers that are looking to decarbonise and disconnect that have not been identified. This project will enable these customers to be identified and potentially served.

2.6 IDENTIFICATION OF SPECIFIC PROJECT

Jemena has been exploring potential projects to meet the immediate customer demand. This project could be delivered in the timeframe required to retain the customers on the network and had sufficient supply to meet their demand.

2.6.1 PROJECT OUTLINE

The Sydney Water Malabar Sewage Treatment plant currently produces approximately 1500 Nm3/h of Biogas that is burnt in generators to create electricity and flared. A project is in advanced planning to upgrade all of this Biogas to Renewable Gas which could produce up to 268 TJ/yr of methane into the network.

There are further plans to upgrade the plant to process other organic material that could expand the capacity of the plant significantly. This would allow other customers to be supplied and prevent them disconnecting from the gas network to the benefit of all customers.

2.7 CURRENT STATUS OF ASSET

There is currently no Renewable Gas injection in Australia, including the Jemena Gas Network.

There is no existing connection to the site. The nearby assets were analysed for injection potential and capacity. The 7kPa local distribution network was excluded as it did not meet the technical requirements for injection. The remaining two assets as shown in Figure 1 can be seen below.

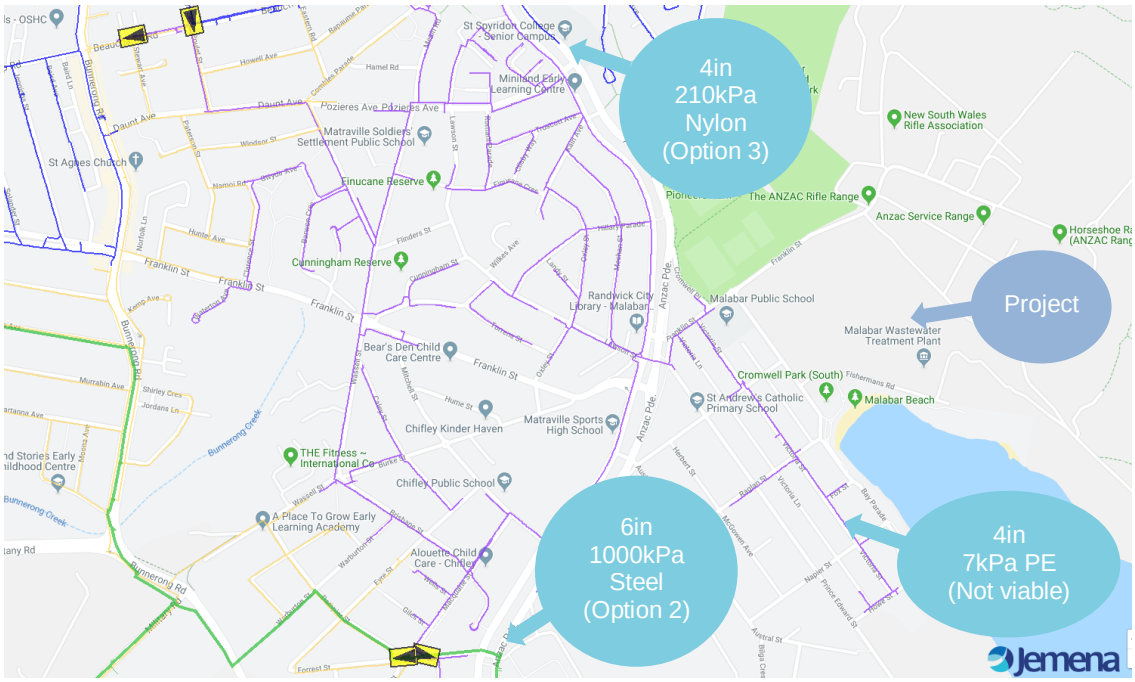

Figure 1 - Nearby assets

3 DEMAND DESTRUCTION MITIGATION OPTIONS

The following options were identified:

1. Option 1 – Maintain status quo – Loose customer revenue to electrification
2. Option 2 – Connect project to the secondary network
3. Option 3 – Connect project to the local distribution network

Further detail of the NPV calculations can be found in Appendix A.

3.1 OPTION 1 – MAINTAIN STATUS QUO - LOOSE GAS SUPPLY TO CUSTOMER ELECTRIFICATION OF LOAD

This option involves not connecting the project and thus not providing Renewable Gas to customers.

3.1.1 COST

The cost of this option is determined by the rate of customer demand destruction. Table 1 below summaries the calculation of the NPV of lost revenue. The demand destruction is estimated based on their decarbonisation policies and letters of support. It is estimated to reduce in line with the customer decarbonisation goals without Renewable Gas available, but as the demand destruction will not occur instantaneously it is gradually increased from the start ramp year to the end ramp year when all gas demand has been destroyed. The ramping rates are conservative compared to the targets and drivers discussed in Section 2.3, as outlined below:

1. Interface Carpets – have a decarbonisation target by 2020 but they are modelled to eliminate gas demand by 2028.

2. City of Sydney – have a city wide decarbonisation target by 2050 and so are expected to eliminate their internal gas demand much earlier, however the demand destruction is modelled to occur by 2050.
3. Dexus – have a decarbonisation target by 2030, but their complete demand destruction is projected to occur in 2035.
4. GreenStar – is modelled based only on demand destruction from currently certified buildings, however the number of GreenStar certified buildings is growing by 17% per annum and so the number of buildings that are incentivised to remove gas is expected to increase significantly in the future.

Table 1 – Electrification of customers

Loss of Customer	Start ramp year	Start revenue Lost ($000)	End Ramp year	End ramp amount revenue Lost ($000)	Lost Gas demand	Avg Rev / GJ	NPV of Revenue Lost ($000)
Interface Carpets	2023	55	2028	61	13,372	4.56	1,079
City of Sydney	2025	52	2035	217	47,862	4.53	2,808
Dexus	2025		2035	282	45,447	6.21	3,362
GreenStar Buildings	See Appendix C				161,844		15,428
				560	268,525		22,677

The NPV of this option is -$22.7M.

3.1.2 BENEFITS & DRAWBACKS

The benefit of this option are that no capital investment is required.

The drawback is that not only will we lose revenue that will ultimately need to be recovered from other customers – increasing their bills.

Further, no Renewable Gas pathway will be created which will increase the risk that we lose additional customers (and result in higher bills).

Lastly, this approach does not align with the customer feedback who told us to do more to work towards a renewable future.

3.2 OPTION 2 – CONNECT PROJECT TO SECONDARY NETWORK

This option involves the connection of the Renewable Gas injection project to the secondary network. This allows for the full Renewable Gas potential of the project to be injected into the Jemena Gas Network (See Figure 1). A drawing of the connection can be found in Appendix B.

3.2.1 COST

The connection of the project to the Secondary network has been subject to a detailed FEED cost forecast. See Appendix C.

The NPV of this option is -$2.5M.

3.2.2 BENEFITS & DRAWBACKS

The benefits of this option is that all key customers identified can be supplied with Renewable Gas.

This option enables potential expansion of the project capacity in the future to enable more customers to be supplied with Renewable Gas to prevent them leaving the network and enable the additional benefits as described in Section 2.5.

The drawback of this option is that it requires the higher capital cost.

3.3 OPTION 3 – CONNECT PROJECT TO THE LOCAL DISTRIBUTION NETWORK

This option aims to reduce the connection cost, however it only allows for a limited amount of Renewable Gas to be injected into the gas network and so will not maintain the revenue of all customers.

3.3.1 COST

This option requires the same length of main to be constructed as Option 2 but as it is at a lower pressure it can be constructed out of PE reducing the capital cost to 80% of Option 1. Furthermore, it will only be able to supply 47 TJ/a of Renewable Gas (see below), therefore there is no lost gas demand for Interface Carpets and only partial demand destruction for City of Sydney.

Table 2 below summaries the calculation of the NPV of lost revenue. Interface Carpets have identified the immediate desire (by 2020) to decarbonise therefore are modelled to be supplied first (no demand destruction) out of the customers in Option 1. The rate of demand destruction for customers not supplied by Renewable Gas is estimated based on the decarbonisation policies and letters of support, as described in Section 3.1.1.

Table 2 – Rate and consequence of demand destruction

Loss of Customer	Start ramp year	Start revenue Lost ($000)	End Ramp year	End ramp amount revenue Lost ($000)	Demand Destruction (GJ/a)	NPV of Revenue Lost ($000)
Interface Carpets	2023	-	2028	-	-	-
City of Sydney	2025	-	2050	61	13,474	439
Dexus	2025	-	2035	282	45,447	3,362
GreenStar Buildings	See Appendix C				161,844	15,428
				343	220,765	19,229

The NPV of this option with CAPEX is -$21.3M

3.3.2 BENEFITS & DRAWBACKS

The main drawback of this option is the capacity of this section of the network is low and so has a capacity of 300 Nm3/h in winter and almost 0 Nm3/h during some periods in summer. Therefore, it should be able to supply 150 Nm3/h on average or 47 TJ/a. This will only prevent some of the customers disconnecting from the network.

4 RECOMMENDATION

Option 2 – the connection to the secondary main – is the recommended solution as it has the lowest NPV (See Table 3) as it allows currently identified customers to be retained on the network and

enables further expansion of the project to potentially allow more customers to be retained in the future.

Table 3 – NPV of options

Option	Final annual revenue lost	Capex	NPV	Incremental NPV
1	$2.1 M	$0.0 M	-$22.7 M	$0.0 M
2	$0.0 M	$2.5 M	-$2.5 M	$20.2 M
3	$1.9 M	$2.0 M	-$21.3 M	$1.4 M

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6 APPENDICES

APPENDIX A OPTIONS ANALYSIS CALCULATIONS

APPENDIX B OPTION 2 DRAWING

APPENDIX C OPTION 2 COSTING

APPENDIX D INTERFACE CARPETS – LETTER OF SUPPORT

APPENDIX E CITY OF SYDNEY – LETTER OF SUPPORT

APPENDIX F DEXUS – LETTER OF SUPPORT