Risks to gas consumers of declining gas demand

Key points

- Over 5 million households and thousands of businesses are connected to the gas network in Australia.
- As gas networks are a shared asset, some customers leaving the network can impact remaining customers.
- Decarbonisation is likely to drive customers to use less gas and eventually leave the network (usually by switching to electric alternatives). Government policies may accelerate this process but are not the only driver.
- While gas networks are trying to avoid this outcome by seeking to switch to renewable gases such as clean hydrogen and biogas, their success at scale is not guaranteed.
- As some customers leave the network, remaining customers will face progressively higher costs, and may eventually be at risk of having their gas supply withdrawn.
- Switching could be a money saver for many households, but this depends on many factors, including whether they have to pay an abolishment fee (average c. $900) and/or need to upgrade their electrical supply and related appliances.
- While many customers will be able to manage a switch away from gas at their own expense, others face barriers to doing so. These include renters, low income households, CALD customers, apartment dwellers and some businesses for whom alternative technologies are not yet viable.
- These groups of customers are at the greatest risk of spiralling gas costs and the risk of supply being withdrawn before they have been able to arrange alternative appliances/energy sources.
- While these risks are longer-term in nature, policymakers should begin thinking about how to address them now.

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Executive Summary

Reticulated natural gas - i.e. gas piped along distribution networks - is used to heat and cook in over five million homes and businesses around Australia. Natural gas produces carbon dioxide on combustion and so its use contributes to Australia's emissions. Part of realising a net zero emissions target will require that natural gas is phased out or replaced with cleaner substitutes.

On the one hand, gas networks are exploring options to maintain their commercial viability in a net zero future. This requires them to be able to transport renewable gases, a catch-all term for zero emissions gases such as renewable hydrogen or biomethane. Australian governments are providing a lot of support for the development of a hydrogen sector, but the pathway to viability and which use cases will achieve commercial viability is unclear at this stage. As a way to stimulate the supply side by creating demand for renewable hydrogen, gas networks are looking at blending hydrogen with natural gas. However, there is a limit to how much hydrogen can be blended in without affecting existing appliances and industrial processes – around 10-15 per cent by volume. Conversion to full hydrogen would require a complete changeover of appliances and may require significant upgrade of network infrastructure too. Biomethane by contrast requires no such changeover.

The alternative pathway to renewable gases is electrification of all the processes and services natural gas currently provides. While electricity supply in Australia is not yet zero emissions, the transition to net zero is well under way. For households there are no technical barriers to switch to electrical alternatives for heating cooking or hot water. Some businesses may find it harder to electricity their processes where these require much higher heat levels. The key difference is that this switch would make gas networks redundant. The increased reliance on the electricity system would need to be managed. It's not the purpose of this report to prosecute the case for or against any of these alternatives, but merely to note that there is no guarantee that a widespread switch to renewable gases will be achievable, and it's important to consider the implications of electrification as the primary option for decarbonisation.

The use of a shared network to deliver gas creates a particular set of issues associated with the transition to zero emission alternatives. As some customers switch to electric alternatives, for example, this will affect the cost of delivering gas to the remaining customers. This could in turn, prompt even more customers to switch, creating a self-reinforcing effect. If a critical mass of customers leaves the network in this way, then the option of switching to renewable gas supply that utilises the existing gas network may be foreclosed. Eventually, the network will be progressively decommissioned, and the remaining customers will have to make other arrangements whether they want to or not. By definition, these will be the customers least well placed to switch. This could be because they are vulnerable and low income consumers, renters or multi-unit dwellers with shared gas facilities. For business customers it could be because they depend on gas for key processes that are not easily electrified.

While, in some industries, prices may fall as demand falls, because suppliers want to retain as many customers as they can, gas network services work differently. Most gas distribution networks in Australia are regulated as natural monopolies. The costs they can recover are set for a five year period, which are then converted into a set of maximum prices (or tariffs). Gas network costs are largely fixed and do not vary significantly with demand. So a fall in the number of customers means that the same revenue has to be recovered from a smaller number of customers. Additionally, gas networks are very capital intensive with long-lived assets. These assets are included in a Regulatory Asset Base (RAB) which is recovered over several decades. But this is predicated on the continuing economic viability of the gas networks. If this viability is in question, then gas networks will seek permission from the regulator to accelerate the recovery of the RAB. This will increase the annual revenue they are allowed to recover and also lead to higher prices for customers.

Additionally, gas networks are signalling a change in approach to customer requests to disconnect from the gas network. While previously, they often treated such requests as temporary and were able to effect disconnection at low cost by removing their meter, this was predicated on an expectation that the customer might change their mind in the future (or might move and the new customer would want gas again) and so they wanted to make it easy for customers to return to the network. But, in a future where disconnection is more likely to be permanent, gas networks consider that their safety case requires them to remove the service pipe. This work is significantly more expensive (an average of almost $900 versus $90 for meter removal) and materially increases the cost to switch.

Government policies have begun to be oriented towards phasing out natural gas, but governments are reluctant to be definitive about the future (or lack of) for gas networks. Accordingly they have not yet given full consideration to the range of issues that will arise for customers left on the gas network. The default position is that customers are free to choose whether to stay on the gas network or not. But current indications are that they will mostly choose to stay. Survey data indicates low levels of interest in switching away from gas and network demand at the national level is holding up. Customer attitudes may change, of course, for financial and non-financial reasons. The economics of switching depend on a range of factors, but are tending towards electrification being the better financial option. Even where this is the case, it requires access to up front capital.

As governments introduce policies to drive switching, they will also need to consider the ongoing implications of declining use of gas networks, such as rising costs for those remaining on the networks and the need to make alternative arrangements where an area of mains is decommissioned. This will require careful co-ordination with economic and safety regulators, gas networks themselves and consumer representative groups. It will be useful to monitor developments overseas noting that international jurisdictions are facing the same challenges as Australia.

Introduction

All Australian governments have committed to a net zero target by 2050 or earlier. Natural gas is a fuel used to heat and cook in homes and small businesses and its use contributes to Australia's emissions. This means part of realising a net zero emissions target will require that natural gas is phased out or replaced with cleaner substitutes.

To date two jurisdictions have taken steps towards this phase out: the ACT as part of its Climate action plan and Victoria which has recently published its Gas Substitution Roadmap. In neither case is there yet an explicit trajectory for the phase out, and the "door is being left open" for the possibility of a reticulated hydrogen network in the future, which has its own set of challenges.

Consumer groups have highlighted that there are risks to consumers inherent in a gas phase-out. To date these have largely focused on the risks of rising gas prices (due to higher network charges) for those who remain on the network longer, and identification of consumer groups most likely to be in that situation: vulnerable and low income consumers, renters and multi-unit dwellers with shared gas facilities. Small businesses will be impacted too, especially where there is a greater reliance on gas appliances such as restaurants and cafes.

However, the risks and costs go beyond higher gas prices, significant as these may be. They potentially include:

- Loss of supply/lower reliability due to operational challenges of demand reduction affecting gas pressure levels;
- Loss of supply/lower reliability due to gas network financial distress;
- Loss of supply as retailers exit the market;
- Additional exit costs due to abolishment fees for leaving the network;
- Additional conversion costs beyond purchase of new appliances;
- Delays or additional costs of conversion due to supply chain issues as demand for appliances and installers/electricians increases beyond historic norms, and;
- Lack of awareness of need to convert, potentially concentrated in culturally and linguistically diverse (CALD) communities.

These risks require careful consideration by policymakers in consultation with consumers and other relevant stakeholders. This project will analyse these risks as well as others that emerge through the course of research and propose next steps. This could include more detailed research and analysis as well as high-level recommendations for regulatory reform and policy support. The analysis will look across Australian jurisdictions to identify where and how the risks are most likely to manifest, given the varying levels of penetration of gas appliances and gas usage by households in different states and territories as well as relevant regulatory differences.

The decarbonisation imperative

All Australian governments have committed to reaching net zero greenhouse emissions by 2050 (or earlier) and, in many cases have formally legislated it. The reticulated gas networks that transport natural gas from transmission pipelines to end users are directly responsible for relatively few emissions. But most gas consumers use gas to create heat, and this combustion results in carbon dioxide emissions.

Burning natural gas releases 55.82kg CO2 per GJ of energy. In 2020 Australian households used 147PJ [1](1PJ = 1m GJ), resulting in over 8m tonnes of CO2 emissions. This does not include any methane leakage or other upstream emissions. Businesses connected to the gas distribution network used 218PJ, equivalent to 12m tonnes CO2. Together, this accounts for around 4 per cent of Australia's greenhouse emissions[2].

These combustion processes will need to be decarbonised over the next 28 years. Energy efficiency measures could reduce emissions in the short term but will not eliminate

them. Possible avenues for full decarbonisation of domestic and commercial heat include biogas, clean hydrogen and electrification. The prospects and implications of each of these options are briefly set out below.

Biogas

Biogas is the simplest option from an end user perspective. It entails replacing natural gas with gas produced as a side effect or waste stream from agricultural or waste management activities. Enteric fermentation by farm animals or degrading biomass produces hydrocarbon gases, primarily methane, which with some processing can provide an almost pure stream of methane, making it chemically equivalent to natural gas. While this means that its combustion still produces carbon dioxide, that CO2 is the end stage of a relatively short term carbon cycle, so it is considered carbon neutral. The great advantage is that because it is chemically equivalent to natural gas, household appliances and business processes do not need to change. The reason that this option is not expected fully replace natural gas use is that there is unlikely to be sufficient feedstock to do so.

Australia's Bioenergy roadmap, released last year, projects that up to 150PJ of biogas could be injected into the gas pipeline system by 2050, representing up to a third of pipeline gas consumption. This is the most optimistic scenario and still leaves 2/3 of pipeline gas consumption to be replaced by other zero emissions alternatives. Small gas consumers will be competing with hard-to-abate sectors such as aviation and industrial heat for limited bioenergy stocks. Multiple technical and commercial hurdles need to be cleared to realise this vision in any case.

Clean hydrogen

There is a big effort globally, with significant funding from governments, to develop a low/zero emissions hydrogen industry. In Australia, the main types of prospective hydrogen production are blue and green hydrogen.

[1], EnergyConsult, 2021
[2] Sources for this section include: EnergyConsult, Residential Baseline Study 2021 update, 2021; AEC, Electricity Gas Australia 2021; Commonwealth, National Greenhouse Gas Inventory Quarterly Update: December 2021

Blue hydrogen is where hydrogen is split from methane (natural gas) most commonly using steam methane reforming, and the carbon dioxide produced is captured and sequestered. This requires access to cost effective carbon sequestration, which remains challenging.

Green hydrogen is hydrogen made from the electrolysis of water, powered by clean energy sources. It is technically possible to make green hydrogen today, but the cost remains commercially prohibitive. Most research is focussed on reducing this cost to a target cost of around $2/kg.

Hydrogen technology development is well resourced, but challenging. Hydrogen is the smallest molecule and difficult to store and move without leakage. So, while pipeline transmission of hydrogen is possible, it is dependent on the material used for the pipelines. This means it needs to be contained by polymer pipes rather than steel, which are more resistant to the evasive nature of hydrogen atoms and their corrosive impacts on metals. Australian gas networks are a patchwork of different material types and so a definitive understanding of the scale and cost entailed in refitting them to safely and securely transport hydrogen is yet to be determined. Most Australian gas network and pipeline businesses are actively researching these issues. Many are also involved in pilot projects to blend some hydrogen into the existing network. However, these blends are limited by the need to keep the hydrogen proportion low enough that existing gas appliances and processes still function. A switch to pure hydrogen would require a complete refit of end user appliances and processes. Hydrogen-compatible appliances are not yet on the market although the UK is targeting hydrogen-ready boilers (for heating/hot water) for new installations from 2025.

Appliance conversion would entail many of the costs of electrification and need to be carefully co-ordinated. Similar conversions have happened before - in the changeover from town gas to natural gas for example. So, the issue with a large-scale changeover to hydrogen is not that it is impossible, but that it is uncertain and is predicated on technological development. But unlike electrification, it ensures a future for gas network businesses, and so they are highly motivated to make the transition if they can.

Even if it is technically possible, the success of the clean hydrogen industry relies on a greater range of use cases than just supplying homes and small businesses. Industrial heat, transport, electricity generation/storage and export markets are all being targeted as well. It's beyond the scope of this report to evaluate the prospects of each of these or all of them in aggregate, but it does mean that several of these markets need to come to fruition for hydrogen to achieve the scale necessary to be cost-competitive.

Electrification

For households this may be the most prospective route to decarbonising heat. Efficient electricity to heat technologies already exist. In some cases, such as heat pumps, the energy efficiency is such that running costs are likely to be materially cheaper than the gas equivalent. There are several reports analysing the costs of conversion that argue that even accounting for the upfront capital costs, households can save money. These claims are considered in greater detail later in the report. Despite these efficiency gains, to date there has been little sign of rapid large-scale defection from the gas networks by consumers. This reflects factors such as:

- Lack of access to the upfront capital needed to secure future cost benefits
- Consumer preferences for gas appliances
- Consumer inertia – effort is required to convert especially if needing to co-ordinate the changeover of multiple appliances.

It remains to be seen if government policies such as subsidies for electric alternatives stimulate a more rapid rate of defection.

There does not need to be a "winner takes all" scenario in which one of these three decarbonisation options wins out for all use cases. It's plausible that the result is a patchwork of outcomes, with some retention of gas networks for biomethane distribution in areas close to reliable biogas feedstock, separate networks for hydrogen distribution – most likely to business users who have processes that are not easily electrified – and the remainder of the networks decommissioned as their former customers have electrified.

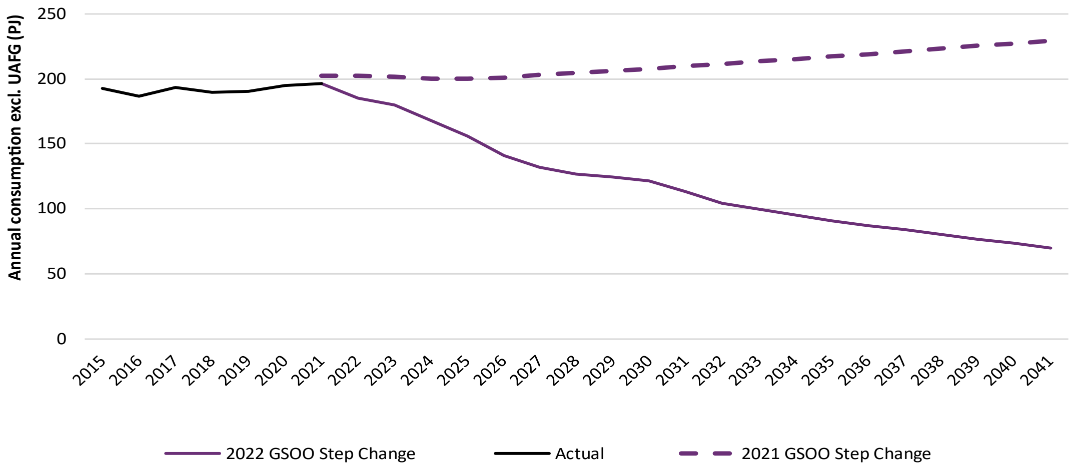
Policy impacts

As governments turn their focus to decarbonising residential and commercial heat, they are looking to electrification as the easiest option to replace gas, given the uncertainties and constraints on renewable gases such as biogas and hydrogen. Consumer policy support to date has targeted electrification, such as subsidising electric replacements for gas appliances. This has the potential to accelerate decline in demand for gas network services. Policies are being introduced to cap new customer growth by discouraging or banning gas connections in new developments.

These are logical steps for governments pursuing decarbonisation goals, but could have significant implications for gas networks and their customers, leading to faster decline in gas demand than previously anticipated. As an example, the recently released Victorian Gas Substitution Roadmap projected a decline in household demand of over 50 per cent by 2030.

Expectations of future demand can change rapidly. AEMO's 2022 Gas Statement of Opportunities (GSOO) compares its latest scenarios with the previous year's. The 2021 Step change scenario forecasted residential and commercial demand in 2030 would be 208PJ (slightly higher than current levels), while the 2022 Step change scenario forecasts it to be 122PJ, or a 42 per cent decline. This is a huge change between forecasts only 12 months apart.

Figure 1: Actual and forecast residential and commercial annual consumption, selected scenarios 2021 & 2022 GSOO, 2015-41 (PJ)



Source: Boardroom Energy from AEMO, GSOO 2022 and 2021

Declining demand will require the largely fixed costs of each gas network to be recovered from a smaller pool of customers. The resultant price increase could be exacerbated as gas networks increasingly seek accelerated depreciation from the AER in their five yearly price determinations.

Gas networks

There are ten major (> 10,000 customers) gas distribution networks in Australia. They are listed in Table 1 below. In some cases, a “network” includes more than one contiguous network – i.e., Multinet in Victoria is mostly comprised of a network based in southeast suburban Melbourne and the Mornington Peninsula but also includes smaller separate networks in Gippsland and the Yarra Valley.

Table 1: Gas distribution networks and their characteristics

Network	jurisdiction	owner	form of regulation	customers	km pipelines	RAB ($m)	regulatory period
Multinet	Vic	AGIG	full	719,436	10,143	1,300	1 Jul 2023 - 30 Jun 2028
Australian Gas Networks (Vic)	Vic	AGIG	full	739,621	11,984	1,800	1 Jul 2023 - 30 Jun 2028
AusNet Services	Vic	Ausnet	full	778,752	12,337	1,800	1 Jul 2023 - 30 Jun 2028
Jemena Gas Networks	NSW	Jemena	full	1,476,686	25,481	3,400	1 Jul 2025 - 30 Jun 2030
Evoenergy	ACT	ACT/Jemena	full	157,205	4,614	390	1 Jul 2022 - 30 Jun 2027
Australian Gas Networks (SA)	SA	AGIG	full	466,417	8,484	1,800	1 Jul 2022 - 30 Jun 2027
Allgas Energy	QLD	APA/Marubeni/DAWM	light	100,000	3,218	n/a	N/a
AGN Queensland	QLD	AGIG	light	89,100	3,463	n/a	N/a
Tasmanian Gas Networks	TAS	Infrastructure capital group	uncovered	15,000	839	n/a	N/a
MWSWGDS[3]	WA	ATCO	full	780,000	14,000	1,486	1 Jan 2020 - 31 Dec 2024

Source: AER, company websites

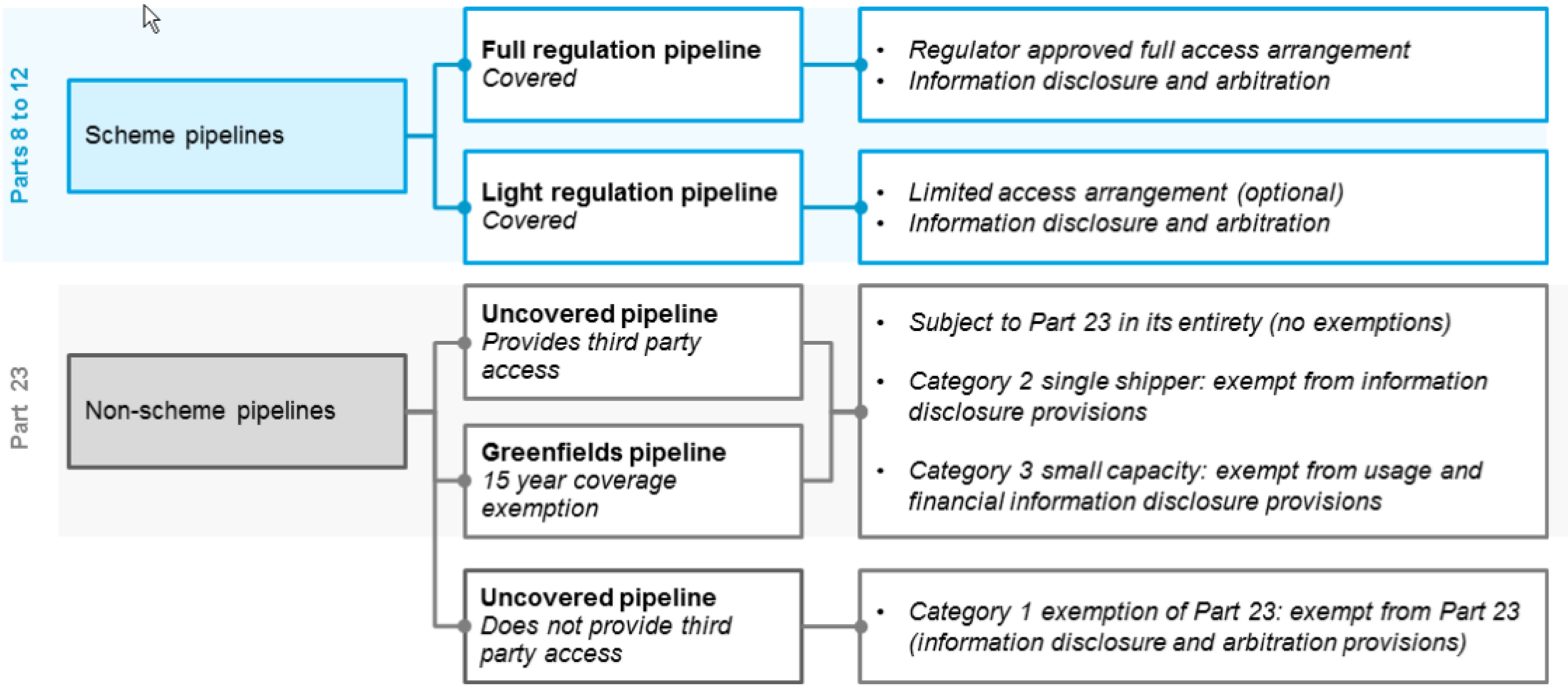
[3] The Mid-West and South-West Gas Distribution Systems

In addition to those listed there are a handful of small largely unregulated networks in regional Australia, including Alice Springs, Darwin, Albany and Kalgoorlie. Some of these are not connected to the gas transmission system and so are served by trucks carrying LPG.

Economic Regulation of gas networks

Most gas networks in Australia are subject to the National Gas Law and the National Gas Rules. Under these instruments, gas networks may be considered "scheme pipelines" or "non-scheme pipelines". Scheme pipelines, also known as "covered" pipelines are subject to either full or "light" regulation. Uncovered, or non-scheme pipelines are considered unregulated, although in practice they are still subject to certain information requirements and obliged to participate in dispute resolution processes.

Figure 2: Pipeline regulation menu



Source: AEMC

Covered gas networks are generally considered natural monopolies. That is, they are the only supplier of gas network services for a given area, because it would be inefficient to build duplicate networks. Accordingly, they are subject to economic regulation that controls the amount they can charge for their services. All the larger gas distribution networks in Australia are covered pipelines, and most of these are subject to full regulation. The majority of household and small business gas users are therefore protected by regulation. Most gas networks in Australia are regulated by the Australian Energy Regulator (AER), but in Western Australia, ATCO's network is regulated by the Economic Regulation Authority (ERAWA).

The typical framework for full regulation of networks is set out below.

The basic framework is known as incentive-based regulation and is widely used in many jurisdictions around the world. For gas networks, the regulatory process is known as an access arrangement, and typically lasts for five years. The main part of the process is calculating the revenue that will apply to the business for the next five years, based on an estimate of the efficient costs of running the shared network. The main "building blocks" of the revenue calculation are as follows:

- Operating expenditure (opex): the day-to-day expenses of the business, including network maintenance, emergency response, network support payments and administration. The network produces a business plan that sets out its estimate of costs and the AER reviews and adjusts, based on its own analysis and stakeholder input. This is known as a propose-respond model.
- Capital expenditure (capex): investment in the infrastructure of the business, principally the pipelines and compressors that make up the network, but also motor vehicles and IT systems. This could be replacement of old assets (repex) or adding to the system (augmentation). As with opex, the process is a propose-respond based on the network's business plan.
- The (weighted average) cost of capital (WACC): representing the cost of financing capex, and constituting a return on debt and a return on equity. As gas networks are very capital-intensive businesses, the WACC is a very important number.
- The Regulated Asset Base (RAB) and regulatory depreciation: as capex will benefit gas consumers for years to come, it isn't added directly into the revenue cap calculation, as this would mean today's consumers pay for it all up front. Instead, it is added to the RAB – analogous to a company's fixed asset register and paid for over time. The rate at which it is paid off by consumers is determined by the depreciation calculation, which is based on the business's estimate of how long the asset will last – network infrastructure is typically depreciated over 50-60 years, while IT assets are depreciated over 3-5 years. The RAB is also adjusted annually for inflation.
- Tax allowance: The calculation assumes that the network will make a profit equal to its cost of equity allowance, which it will have to pay tax on (after typical adjustments like the difference between tax and regulatory depreciation rates). So, the revenue cap has to be grossed up to allow for its tax costs.

These building blocks are all put together in the following formula:

Revenue = opex + depreciation + (RAB x WACC) + tax allowance + incentive rewards/penalties.

For gas networks, the allowed revenue is then converted into a price cap for each of different tariffs that the network charges its customers. So, a key forecast is the aggregate demand for gas that the network's customers will have for each year of the access arrangement. If demand is lower than forecast, then the network will not recover all its expected revenue. Conversely if it is higher, then the network will make extra revenue. But its costs don't vary significantly with demand, so these outcomes translate directly into lower and higher profits respectively.

Light regulation

The two Queensland distribution networks, Allgas and AGN Queensland, have been subject to light regulation instead of full regulation since 2014-2015. For a light regulation pipeline, the operator can either lodge a limited access arrangement with the regulator where the pipeline operator determines its own tariffs, or it can simply publish the relevant information on its website. Accordingly, such pipelines are not subject to a building block approach and do not have a RAB to recover. They have flexibility to vary (annually) their tariffs in response to changes in demand. But they are not guaranteed to recover their investments.

Non-scheme pipelines

A number of very small distribution networks are not even subject to light regulation. They are still subject to certain information requirements and obliged to participate in dispute resolution processes.

Other regulation

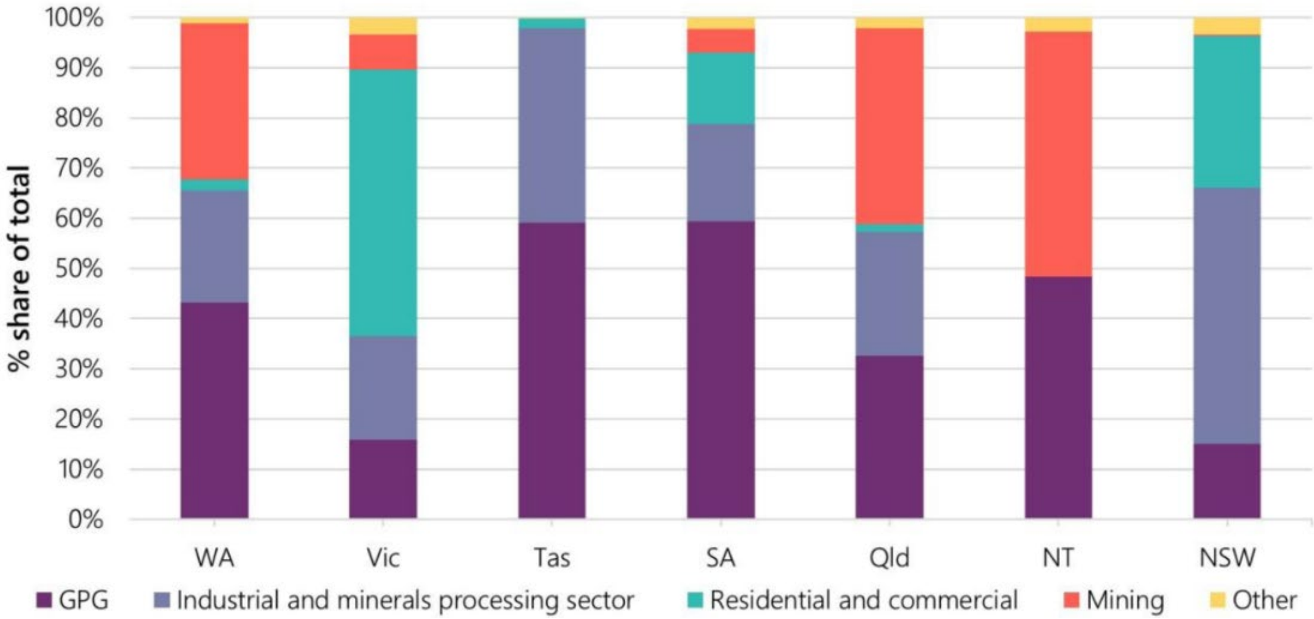
Natural gas is highly flammable, and so gas networks are subject to stringent safety requirements. These requirements are determined on a jurisdictional basis by the safety regulator for each state or territory. Economic regulation takes safety cases as a given. So, safety requirements may govern gas network decisions on how to carry out activities such as disconnection and on operating at lower pressures. There may be scope for different approaches that maintain the same level of safety in circumstances where the gas networks are being decommissioned. This merits some consideration, however, is beyond the scope of this report.

Gas consumers

Gas consumers range from large industrial users such as ammonia plants and brick makers through commercial users such as offices and restaurants, to households.

The mix of consumers and their usage varies across jurisdictions, as illustrated in Figure 3 below. The point of this is to illustrate the importance of residential customers' gas use to jurisdictional decarbonisation plans. As can be seen, household customers comprise a material proportion of overall natural gas use in Victoria followed by NSW, which includes the ACT. By contrast they have a much smaller share of total demand in Tasmania, Queensland and Western Australia. The share of household gas consumption is a factor in whether jurisdictional policies are focussed on encouraging switching or alternative decarbonisation options for households.

Figure 3: Natural gas consumption by sector, by state



Source: AEMO, WA GSOO. Note: GPG = gas powered electricity generation

Drilling down into household gas use statistics (Table 2), the penetration rates of residential gas reflect a combination of climate conditions and access to gas. The majority of Victorian households are connected to gas, and most of those have some form of gas heating, which is the largest component of household gas consumption. By contrast only 10 per cent of Queensland homes are connected, and very few of them have heating, reflecting the warmer climate in Queensland versus Victoria. Few homes in Tasmania are connected, due to reticulated gas only being available more recently, but those that are connected typically have gas heating. Conversely, a majority of Western Australian homes have gas but not for heating (Western Australia also has several very large industrial users, so total gas use in the state is high, but only a small proportion is household gas use). In all, around half of all Australian households (5 million) are currently connected to gas.

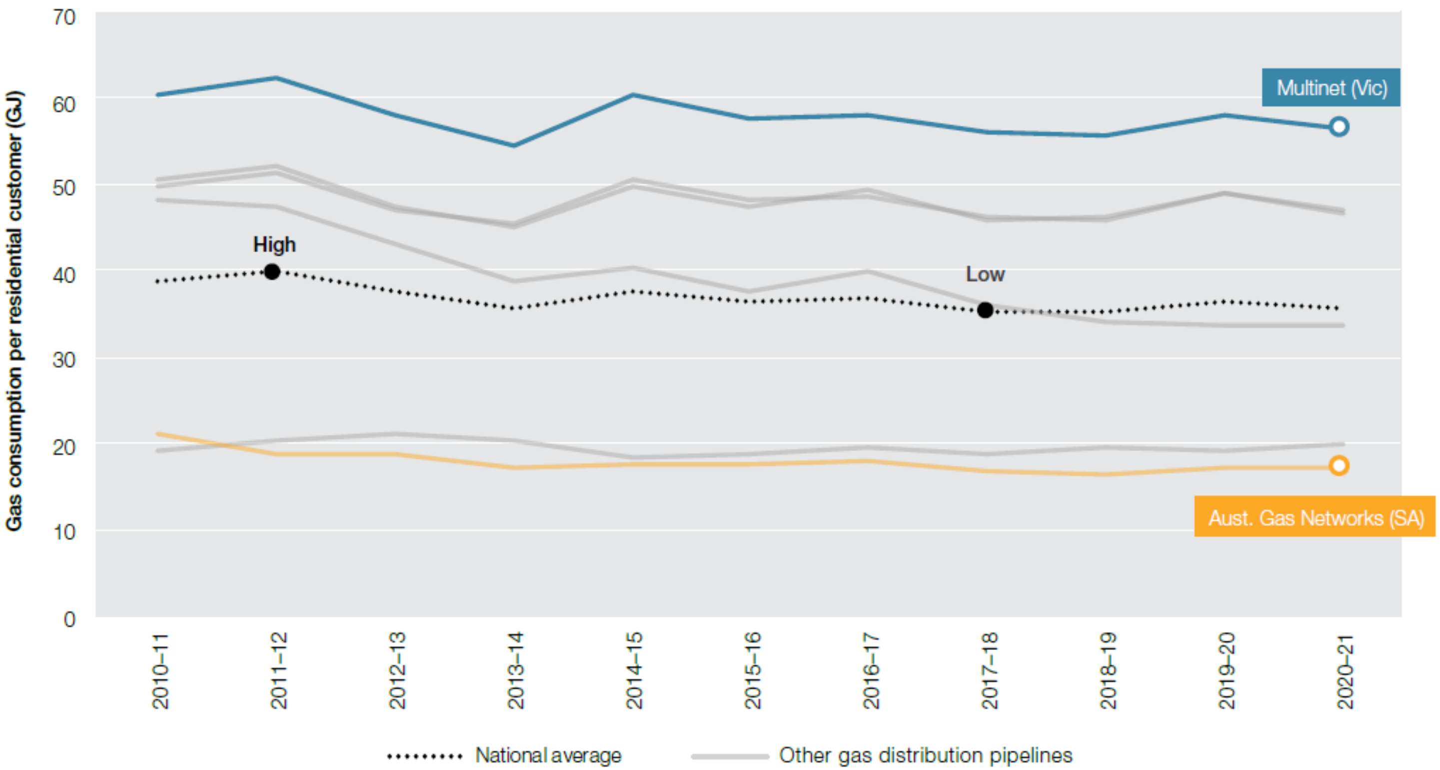
Table 2: Household gas use statistics by jurisdiction

Jurisdiction	Homes connected to gas ('000)	Percentage of homes connected to gas	Average household gas consumption (GJ pa)	Percentage of connected homes with gas heating	Percentage of connected homes with gas hot water
ACT	153	73%	33	64%	70%
NSW	1,491	43%	20	39%	78%
QLD	211	10%	9	4%	>90%
SA	450	56%	17	22%	91%
TAS	13	5%	30	83%	69%
VIC	2,089	76%	54	78%	90%
WA	757	68%	13	37%	87%

Source: Residential baseline study, ENA

Over time, household gas use has stabilised across different jurisdictions and networks. Customer numbers are slowly increasing across jurisdictions and consumption per household shows no sign of material decline.

Figure 4: Average household gas use over time, by network



Source: AER, State of the energy markets, 2022

The limited interest in proactively switching to electricity only is borne out by the ECA's latest consumer behaviour survey results. Nationally only 9 per cent of household respondents say they are seriously considering converting to electricity only, with a maximum of 13 per cent in the ACT (see Table 3. Two-thirds have not given it any thought. Small businesses are more likely to be seriously considering it, at 22 per cent, although this appears skewed towards home-based businesses (see Table 4).

Table 3: Consumer attitudes on removing mains gas supply - households

State/Territory	Seriously considering converting to electricity only	Have thought about converting to electricity only, but not seriously	Have thought about converting to electricity only, but decided not to	Haven't given it any thought
NSW	8%	18%	5%	68%
VIC	10%	18%	7%	64%
QLD	13%	17%	8%	63%
WA	6%	18%	7%	68%
SA	10%	21%	7%	62%
ACT	13%	35%	7%	44%
All households	**9%**	**19%**	**7%**	**65%**

Source: https://ecss.energyconsumersaustralia.com.au/behaviour-survey-oct-2022/

Table 4: Consumer attitudes on removing mains gas supply - small businesses

Business type	Seriously considering converting to electricity only	Have thought about converting to electricity only, but not seriously	Have thought about converting to electricity only, but decided not to	Haven't given it any thought
Operating from fixed location	18%	31%	19%	32%
Operating from home	28%	24%	8%	41%
Operating from mobile locations	20%	20%	15%	44%
All small businesses	**22%**	**27%**	**14%**	**37%**

Source: https://ecss.energyconsumersaustralia.com.au/behaviour-survey-oct-2022/

Government policies

While the Commonwealth government has a strong influence in energy and climate policies, the states and territories are the main drivers of policy relevant to gas consumption. Key policy positions are listed below by jurisdiction[4].

ACT

The ACT has the most advanced plan for a transition away from natural gas, with a goal of completing the transition by 2045[5] at the latest. It expects to do this primarily through electrification, although it also intends to "explore the potential for a renewable gas market where electrification is not a good option[6]".

The ACT has enacted a range of policies to assist in meeting this target, as set out in its Climate Change Strategy 2019-2025. These include removing the mandate for new suburbs to be connected to the gas network, all-electric new public housing, retrofitting of existing public housing stock, supporting financing options, including zero interest loans for low-income residents and the development of a detailed plan for achieving its goal by 2045, which may in turn trigger additional policy instruments. Earlier this year, the ACT government released analysis to support its strategy. This analysis included modelling of future gas demand and prices under different scenarios and implications for the local electricity network.

Victoria

Victoria's gas substitution roadmap was released in July 2022. Drivers for the roadmap include Victoria's net zero targets as well as concerns about declining local gas supply. Initial modelling in the policy development phase projected a 50 per cent decline in residential gas consumption by 2030. This led some stakeholders to assume the Victorian government was going to implement a range of strong policies to push households to deliver this reduction.

In practice the final roadmap contained more modest reforms, including new subsidies for electrification (financed through retail bills), removal of existing subsidies for efficient gas appliances, some changes to planning requirements to remove the obligation for new housing developments to be connected to gas (but no outright ban on new gas connections) and new building standards/codes to drive more energy efficient homes.

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[4] Given the very low number of distribution-connected customers in the Northern Territory, it has been excluded.

[5] https://energy.act.gov.au/

[6] https://energy.act.gov.au/

The government highlighted it was still a matter of choice for gas users whether to stay with gas or switch to electricity. It also acknowledged that some reticulated gas networks could be repurposed to supply renewable gas. Ultimately the Victorian government's final position means it does not see itself as responsible for phasing out gas networks. It will ultimately be a consumer-led process, where those consumers have agency to make such a decision.

NSW

The NSW government's Future of Gas paper, released in 2020, is focused on supply-side issues rather than decarbonisation. The primary supplier of gas network services is Jemena, which owns and operates the Sydney gas distribution network. Jemena is just embarking on its next regulatory determination (2025-30), and so it is too early to tell whether they are expecting a decline in use of their network or whether they will be seeking accelerated depreciation.

Queensland

The Queensland government's decarbonisation focus remains on its coal-dominated electricity sector, as indicated by its recently released Queensland Energy and Jobs Plan. This plan also seeks to promote the local hydrogen and bioenergy sectors, so it could lead to new renewable gas options in the future. But the household and business sections of the plan appear very oriented to decarbonizing electricity rather than gas. Natural gas supply is abundant, albeit with large parts of the supply earmarked for the LNG export market and gas use is primarily for C&I customers. Many households do have a gas connection, primarily in the densely populated southeast of the state, but with limited need for winter heating the volume used per residential connection is much lower than Victoria or the ACT.

South Australia

South Australia's decarbonisation policies do not to date include specific targets or goals for the gas network. As with several other jurisdictions there are energy efficiency policies, which may make electrification cheaper if the customer is able to benefit from them, but these policies are not specifically targeted at electrification. Efficient gas hot water upgrade is an eligible activity under the Retailer Energy Productivity Scheme, but this is only one among many activities, moist of which are aimed at electrical appliance upgrades or insulation.

Western Australia

The WA government's climate plans do not specifically include gas substitution, nor are there clear signs of consumers choosing to leave the Perth gas network *en masse*. WA's gas use is very heavily weighted towards large industrial users, with distribution networks only taking 6 per cent[7] of overall gas use, and residential consumption only accounting for 2 per cent. Gas supply is also less constrained in WA and price pressures are lower than on the east coast. So, the drivers for electrification are lower than in jurisdictions such as Victoria and the ACT.

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[7] AEMO, WA Gas Statement of Opportunities (GSOO), 2020

Developments in the small town of Esperance provide an interesting case study of a coordinated decommissioning process. The owner of the gas network announced in September 2021 that it was no longer commercial to operate the gas network and it would cease supply from March 2022. Following negotiations, the state government announced a package of support that included:

- deferral of the cutoff date to March 2023
- electrification of the 80 connections that are government owned housing
- subsidies to the other 258 residential customers to support electrification/conversion to LPG
- support for the 41 business customers.

The state has budgeted $10.5m for the support package, which amounts to $27,400/connection. The Esperance case is not a precise guide to how similar processes may play out in larger reticulated networks. The Esperance cost/connection would be prohibitive if scaled up to the 5 million households with a gas connection. But there should be some economies of scale for larger groups of network customers in the major cities. The kinds of support that would be required, and the broad timeframe of 18 months are useful reference points, however.

Tasmania

The Tasmanian Government is developing a Future Gas Strategy that will aim to better understand the future role of gas in Tasmania over the next 20-30 years. After releasing a Discussion Paper to elicit stakeholder feedback, the Draft Strategy was published in October 2022. The overarching position of the government is that it will continues to support fuel choice and will not introduce "mandates or moratoriums", but neither will it artificially extend gas use. In the meantime, they will continue to support renewable gas development.

The Government aims to "ensure that the eventual decarbonisation of Tasmania's gas network is as orderly as possible and that for example the adoption of alternative renewable fuels by some users does not result in gas customers facing unaffordable transmission costs"[8], although it doesn't set out how it will ensure this. It also commits to help low-income and vulnerable customers to transition with policies such as no-interest loans for concession card holders, and energy efficiency upgrades for public housing. Both of these will be useful and are appropriately targeted, but are unlikely to fully address barriers to transitioning.

Accordingly, the ACT and Victoria are the clear leaders in considering the decarbonisation of gas networks and implementing policies to both encourage electrification and prevent or discourage new gas connections.

Nonetheless, if other states and territories are to reach their net zero by 2050 targets, the question of how to decarbonize household and business gas use will need to arise at some point.

[8] Tasmanian Government, Draft Future Gas Strategy, October 2022

Regulatory developments

In November 2021, the AER, released an information paper setting out a framework for considering issues arising from the risks that gas networks may cease to be economically viable. The problem is that customer defection – if it happens will not happen all at once, but likely be spread over a couple of decades. The AER paper identifies that the following problems could start to emerge:

- There will be fewer customers to cover the largely fixed costs of the network, so prices will rise
- Future customers will be picking up the tab for past investments that the departing customers benefited from
- Some of the network assets may be economically stranded
- Uncertainty about their ability to recover future costs may inhibit gas networks from spending money even where it is economically justified (replacing old compressors for example).
- The price impact could cause even more customers to leave the network

The AER's paper considers a range of options for how it could manage or mitigate this problem, should it need to – the status quo is still an option. The options for action include:

1. Adjusting regulatory depreciation - recognising that if the assets are depreciated over the usual 50-60 years, the business may never recover all the capital cost. This option brings forward more of the cost of long-term capital investments to the present day, leaving a lower capital base to be funded by future gas users.
2. Compensating for stranded asset risk - essentially an entitlement to recover higher charges today representing the value of the assets that would otherwise be stranded in the future.
3. Removing capital base indexation - compensation for inflation is deferred under the existing model, because the business is allowed a real WACC and then gets inflation through indexation of the RAB by CPI each year. This option would instead mean that compensation for inflation is recovered each year via a higher (nominal) WACC.

The three options above are all broadly similar in that they protect the business partially or fully against a stranded asset. They do so, by bringing forward revenues, meaning current consumers pay more.

4. Sharing costs under capital redundancy provisions - this option relies on a provision in existing rules to remove an asset from the RAB where it is underutilised or no longer required. In principle, it could be returned to the RAB if circumstances change, for example if a gas network successfully converts to renewable gas.
5. Revaluation of asset base - rather than identifying individual assets, this option entails scaling down the entire asset base due to expectations of lower future demand.

These two options are very different from the first three. They entail the business charging less now. The point is to attempt to avoid a "death spiral" where network tariffs rise, causing more customers to leave the network, resulting in even higher network tariffs and so on. Unsurprisingly, gas networks to date have not favoured these options, preferring to request accelerated depreciation instead.

6. Introducing exit fees – “Levying exit fees on customers who disconnect from the gas network can reduce the amount of unrecovered costs associated with their connections remaining in the RAB, thereby reducing the potential for price rises that remaining gas customers would face[9]”. This option would be a significant disincentive to disconnect from the network, and would be hard to reconcile with jurisdictional decarbonisation policies.
7. Increasing fixed charges - this option simply seeks to mitigate the financial impact of lower demand on gas network revenues by recovering more of the revenue via fixed costs rather than volumetric costs. But this is of limited value if demand is falling because customers are leaving rather than just using less gas.

While the AER is careful to point out that it will make any decisions on a case by case basis, they appear to clearly favour accelerated depreciation. EvoEnergy is the first network to have successfully sought shorter asset lives with reference to the impact of government policy. Victorian distribution businesses (and the transmission business are also seeking shorter asset lives in their current access arrangement process).

The WA regulator, ERAWA has not released a standalone paper on such options, but recently allowed a gas transmission network, the DBP, to accelerate its depreciation.

Accordingly, accelerated depreciation has emerged as the most likely regulatory response to declining demand on the network. The impact of this approach on customers is discussed further in the later section on Gas tariffs.

Risks and costs of electrification

There may be material costs associated with disconnection from the gas network, even before incurring conversion costs to switch to electric alternatives. Permanent disconnection may require removal of the service pipe to the customer’s property, for which gas networks can charge around $700-$1000. At present, those customers who do choose to disconnect are usually not charged this fee, as gas networks would prefer to maximise the opportunities for reconnection. Gas networks’ approach may change if the rate of disconnection increases, and/or gas networks form the view that their network is in terminal decline. The potential level of costs depends on whether the disconnection is viewed as temporary or permanent.

Disconnection costs

Gas networks can implement temporary disconnections by either using locks or plugs at a gas meter in order to prevent the withdrawal of gas at the by the customer or by removing the meter. This is the typical process if a customer is temporarily disconnected for non-payment of bills. It may also be used when a customer indicates they wish to cease taking gas but does not insist on service pipe removal. Disconnection costs are typically in the range of $60-$120 (see Table 3).

Abolishment fees

Abolishment costs are incurred when a customer is fully disconnected from the network. They typically represent the cost of full removal of the service pipe connecting the property to the nearest gas mains, as well as meter removal and capping at the main. Gas networks may not levy abolishment fees at present for two reasons.

[9] Regulating gas pipelines under uncertainty, AER, 2021

1. They wish to make it easy for the customer (or a future customer at the same property) to reconnect.

2. They incur the costs but don't seek to recover them from customers. This is likely to be for reputational reasons as such costs will be unpopular. Given that the retailer bears the network cost in the first instance and concerns about recoverability of such costs from an existing customer are likely to lie with the retailer rather than the network. This approach would cease to be sustainable if disconnection levels increased.

Abolishment fees are significantly greater than disconnection fees, reflecting the greater effort required to remove a service pipe.

Exit fees

While abolishment fees are associated with the specific costs of closing off a connection, exit fees represent recovery of outstanding capital costs related to servicing the customer who is seeking to disconnect.

At present no network has sought to charge exit fees. The AER's paper on regulating gas pipelines under uncertainty canvassed it as a potential option, however.

Table 3 below shows the latest charges each network levies for both temporary and permanent disconnection.

Table 5: Disconnection and abolishment fees by network

Network	Disconnection fee ($)	Abolishment fee ($)
Multinet	62.72-72.15	950
Australian Gas Networks (Vic)	87-124	950
AusNet Services	66.13	825.90
Jemena Gas Networks	102	1047
Evoenergy	137	705
Australian Gas Networks (SA)	79	Quote (not a reference service)
Allgas Energy	58.22	Quote but cut off service is $452.98
AGN Queensland	78	Quote but cut off service is $695
Tasmanian Gas Networks	110-275	Quote
MWSWGDS	97.35	875.75
Average charge	**87.74**	**892.27**

Source: Draft Access Arrangements, annual tariff variation statements, company websites

Disconnection fees are either for locks/plugs or for meter removal. Many networks charge the same for both activities, some only present one as a standard service and a few charge slightly different amounts.

Not all distribution networks have a standard abolishment fee, in some cases even small customers have to request a quote. It's unlikely that such quotes would be materially lower than the typical standard charge that other networks have published.

Costs of electrification

Many reports have been published regarding the costs and benefits from electrification of gas appliances. A selection of these is summarised in the table below:

Table 6: Analyses of switching costs

Source: Boardroom Energy, from reports listed in leftmost column

Report	Author	Year	Retrofit/ new build	Review process	Key takeouts	Abolishment costs	Electrical upgrade costs
Household energy choice in the ACT – Modelling and analysis	ACIL Allen	2020	retrofit	ACT	Many customer archetypes are financially better off, but not all. Tariff structure changes could influence results	no	no
Saving money with efficient, all-electric homes	Renew	2022	new build	Inquiry into Renewable Energy in Victoria	New build cheaper for all-electric plus ongoing savings	n/a	n/a
All-Electric New Homes Cost assessment	GHD	2022	new build	Victoria Gas Substitution Roadmap	All-electric lower cost and manageable on single phase	n/a	n/a
Are We Still Cooking with Gas?	Renew	2014	both	n/a	New homes cheaper to go all electric providing efficient appliances chosen, unless gas appliances subsidised. Existing homes dependent on multiple factors.	no	no
The Household Fuel Choice in the National Electricity Market	Renew	2018	both	n/a	New homes cheaper to go all electric (although dual fuel still competitive in Adelaide/Sydney). Existing homes dependent on jurisdiction/number of gas appliances/rooftop PV.	n/a	n/a
Flame out - the future of natural gas	Grattan	2020	both	n/a	A new all-electric house is generally cheaper to live in than a dual-fuel house. But switching all small users to electricity is more expensive than continuing to use natural gas (on system cost basis)	800	3000
Castles and cars	Rewiring Australia	2021	retrofit	n/a	large savings on average from electrification	no	no
Cost of switching from gas to electric appliances in the home	Frontier Economics	2022	retrofit	Gas Substitution Roadmap	Electrification could be costly, especially if replacing ducted heating, due to electrical upgrade costs	no	$2150-12500

The reports do not all agree on whether electrification is cheaper than maintaining gas appliances, and under what circumstances. Results may vary depending on which jurisdiction a customer is in. The reports were prepared at different times and use different input assumptions. So they will be robust in aggregate. The cost per consumer will vary but be within a range. But there is no definitive answer as to whether it is financially beneficial to electrify.

Many of the reports consider that electric-only homes are lower cost for new builds. This is because new appliances have to be purchased, and even if the electric equivalents are more expensive than the gas ones, they have lower running costs. Even this finding may be dependent on the relative prices of gas and electricity, which can change over time. There is also a saving in not having to pay for a gas connection.

The trade-off is different for converting existing gas appliances to electric, especially when this covers heating, cooking and hot water, as is common in Victorian homes (but less so elsewhere). While all appliances need replacing eventually, there is extra upfront incremental cost associated with replacing gas appliances before their end-of-life. Even with this taken into account, some analyses consider that conversion is financially beneficial for the average consumer. The efficiency gains of the heat pump where space heating is part of the conversion, and the avoidance of gas fixed costs are key reasons for these outcomes.

However, few of the reports envisage any costs arising either from disconnection from the gas network (abolishment fees) or costs to upgrade the electrical supply. The latter could entail conversion from single-phase to three-phase, new or replacement circuits, increased single-phase current (63A). The actual costs will be highly dependent on the property and its existing electrical set-up, and may be negligible (for example, modern homes will typically already be on 63A supply), so it is hard to factor in the kinds of system-wide analyses considered here. But a broad estimate of these types of upgrade, where required, is around $3,500-6,500.[10] Consumers may not know whether conversion entails additional upgrade costs.

There may be other costs associated with conversion, especially for homes with ducted gas heating. Heating ducts are commonly underfloor. However, a reverse cycle system that provides heating and cooling needs to have ducts higher up for the cooling element of the system. So, the old ducts would need to be filled in and new ones installed for conversion to a whole of house electric system. The alternative is to switch to having individual reverse cycle units in key rooms, especially if combined with energy efficiency improvements. There is still likely to be some remediation costs involved in filling in the floor ducts in this scenario, though. Around 40 per cent of homes in Victoria have ducted heating, so this issue will impact a material proportion of gas-connected households.

If hot water systems and cooktops have different dimensions to those being replaced, that may also result in additional costs. This indicates that it's preferable to combine the changeover with renovation activity when such costs will be incurred anyway.

In summary, it's likely that some consumers will be financially better off (i.e., the present value of their lower future energy bills outweighs the upfront cost of changing over) but it's not clear that all will be. Individual consumers should do their own due diligence on the likely costs and benefits before making a decision to electrify based on the financial impacts. Where there are material costs over and above those of new appliances, a net cost to households is more likely to be the outcome. Some households may still prefer to convert even in this scenario if they see other benefits associated with electrification (safety, health, environmental).

There will also be an impact on the cost of the electricity system. Some of the analyses in Table 1 above consider this issue. However, this report is reluctant to draw clear conclusions given the many uncertainties about the impact:

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10 https://www.kennerelectrics.com.au/residential/supply-upgrades-melbourne

- The pace of change is uncertain. Electricity networks (and the generation fleet) can better manage the impact if the pace of change is slower.
- Simultaneously, the electricity system will be adapting to the take-up of electric vehicles. The pace of this change is also unknown, and it's unclear how charging at peak times will be managed.
- The need for upgrades will vary by sub-network, depending on the existing capacity headroom and how other drivers of demand interact, including population growth.
- Electric hot water has the potential to be a flexible load that supports the network rather than puts pressure on it. Whether this occurs is dependent on policy, regulation and other factors.
- Costs of upgrading networks will be offset by the fact that the networks will be carrying more demand. Whether this results in higher or lower unit costs is unknown.

What can reasonably be inferred is that pressures on the electricity system will be greatest in regions where gas is currently used for space heating, as this will be the largest new load and one that is likely to peak at the same time (during winter early mornings and evenings, so unlikely to complement solar PV output). These regions include Victoria, the ACT and parts of NSW. The best way to mitigate these pressures will be through improving the energy efficiency of buildings.

Aside from the financial impacts, there are non-financial factors that may be relevant to both consumers and society that impact these choices. At the household level, consumers may perceive qualitative differences between gas and electric for heating and cooking. Electrification advocates point to studies that indicate potential health consequences arising from the particulates that result from natural gas combustion. At both an individual and societal level there is some extra resilience from having two separate energy vectors rather than one.

On the emissions side, arguments have been presented on both sides for whether gas or electric result in lower total emissions. What is clear, however, is that electricity supply is getting progressively less emissive and so will be definitively lower emissions than natural gas at some point (if not already).

Nonetheless the financial outcomes of electrification will serve as both a driver of and a barrier to electrification depending on household circumstances. This could exacerbate existing energy equity issues.

Risks and costs of remaining on the gas network

Gas tariffs

Gas network costs are - to a large degree - fixed. That is, they do not vary significantly with demand. This means that other things being equal, falling demand will result in higher network tariffs per GJ. This is illustrated by resubmissions by Victorian gas distribution networks following the release of the gas substitution roadmap. Despite revising their demand forecasts significantly (for example, Multinet changed from a 10% fall in demand to a 25% fall in demand,) their opex plans barely changed. Multinet decreased its capex plan by 7%, but as capex is recovered over many years, this would have little impact on prices initially.

Some costs may even rise with falling demand. For example, more frequent reviews of network stability would be required to ensure issues were identified before customers experience supply issues. These reviews would identify the need for investment to reduce the capacity of network regulating stations to ensure they could reliably control the network at lower pressures.

The biggest driver of increased gas tariffs, however, is likely to be accelerated depreciation. This is explained further below.

Accelerated depreciation

Depreciation is the economic and accounting term for the rate at which the assets of a business are used. To take a simple example, if a business buys an asset for $1,000 that it expected to use for five years, then it will recognise $200 of costs for each of the five years. For a capital intensive business like a gas network, depreciation is a major building block in determining the costs of the network.

Absent an end date for the use of the network, most of a gas network's assets - mains and service pipelines - will last for decades. So, their depreciation rate is very slow, around $16 in every $1,000 per year.

However, as decarbonisation trends, such as electrification, and policy interventions become bigger factors, the likelihood that the gas network will be terminated increases, and with it a progression towards an end date for the use of this asset by consumers.

If depreciation rates are not adjusted, then this would leave a portion of the RAB that would become a stranded asset, with no likelihood that it will ever be paid back. Gas networks are able to obtain finance at low rates because of an underlying assumption that they will be able to recover their RAB in full. If this assumption no longer holds, then even if stranding is a decade or more away, the network will begin to find it harder to finance the current RAB as well as any new capex. This situation is explored further in a later section.

Networks and their regulators recognise this problem. The AER explored a range of options in its paper regulating gas pipelines under uncertainty. In it they note "Bringing forward the cost recovery of the efficient investments that regulated businesses have already made would increase the certainty that incurred costs would be recovered, thereby reducing stranded asset risk". However, it also stressed that accelerated depreciation could only be justified on the basis of the long-term interests of customers.

Once an asset becomes fully depreciated, the gas network is not entitled to further depreciation or to a return on capital for that asset. So, in the event that depreciation is accelerated faster than necessary, there could come a point where consumers no longer have to pay for that asset. But they will have endured higher charges in the meantime.

Potential impact on tariffs

It's not possible to precisely forecast how high network tariffs, and in turn retail tariffs, could rise. Modelling here and overseas indicates that – over time – price rises could be very significant. The ACT commissioned modelling that projected an accelerated decline in gas demand could increase gas retail prices by 300 per cent by the mid-2030s. Internationally, modelling in California projected increases in retail gas prices from US$1.50/therm to US$19/therm (around 2c/MJ to 28c/MJ) by 2050 under an unmanaged transition where a high proportion of customers convert to electric only buildings. A key driver of these price outcomes is the decreased utilisation of the gas network.

While the initial impact of the gas substitution roadmap on the Victorian distribution network proposals initially appears modest, this is partly because tariff projections are only for a five year horizon. For example, Multinet is proposing a 3% real price increase[11] whereas its initial proposal was a 1% decrease, while AGN is proposing a 3% decrease

[11] Before revenue smoothing is applied.

instead of a 10% decrease. However, this are changes to *revenue,* not prices. When projected changes in consumption of gas are accounted for, the equivalent per GJ price would need to increase by 28% over the five year period for Multinet versus an original 9% proposal (15% and -4% respectively for AGN).

The distribution component is lower in Victoria than in other jurisdictions, which means the retail impact of such changes is moderated. Assuming gas transmission charges are similarly affected, then absent any other changes, household retail gas prices would increase by c. 9%/5% for Multinet/AGN. While apparently modest, these price increases would in practice be on top of the recent large increases in gas commodity costs, and would impact low income households the most. Of course, this is only the initial impact. Longer term, if consumers continued to leave the gas network, prices would need to rise much faster.

Operational issues

Operational issues can arise in a gas network as the volume of gas throughput falls. Pressure regulating stations are designed to supply gas reliably at flows between upper and lower limits. If a station is required to operate continuously at a significantly lower flows than designed, its pressure control may be less reliable and modification or changes in operational equipment and practices may be required.

Each network is broken down into sub-networks known as “control areas”. In general, these span a couple of suburbs. Each control area has dedicated feed points which run the risk of reduced control due to reduced flow. Therefore, each control area would need to be managed (or decommissioned) depending on how many customers leave.

In principle this should be manageable from a technical standpoint. Gas networks can use “linepack” or the retention of gas volumes in the network, to assist in maintaining pressure. At a certain level of reduced demand, though it would become necessary to modify the regulating stations to ensure pressure control.

At very low levels of demand, if gas remains in the system for an extended period, the odorant that gives natural gas its recognizable smell could be absorbed into the mains. It’s important for safety reasons that gas retains its odour.

There are implications of low demand for future replacement and repair of mains and other assets. Capital expenditure such as mains replacement or end of life upgrade of other equipment must be justified in terms of consumer safety, but must also be economically sustainable. If the expected future demand on a section of mains is so low that the expected future revenue from customers connected to that section of mains is insufficient to cover the cost of replacement, then it is not prudent for the gas network to replace it, opting for decommissioning instead. Noting that decommissioning activities require expenditure to ensure public safety, and all customers on the decommissioned section will have to disconnect regardless of their preference to remain connected or their ability to cover the costs of transitioning to an alternative energy source.

Under certain circumstances, gas networks may be able to delay the decision to replace, but the safety case for the network will not allow an old pipe to be operated indefinitely. So, if replacement is uneconomical, then the network will eventually have to decommission that part of the network.

It’s expected that this type of decommissioning will happen in a planned, orderly manner and that customers would be given notice of when it would take place and thus when they would have needed to make the switch to electric or other alternatives.

However, customer protections may be strengthened by establishing some regulatory norms around the length of the notice period and the methods of communication to customers.

Even with notice, customers who face barriers to switching will still need assistance in switching. These include low income households, renters and potentially CALD customers.

Network financial issues

The regulatory framework that applies to most gas networks in Australia is predicated on the presumption that the businesses will be able to recover their RAB through future revenues from customers. This enables them to be financed at relatively low rates.

While a decline in demand for gas networks raises some risks that this may note possible, accelerated depreciation is intended to mitigate these risks by allowing networks to recover their RABs more quickly.

But decisions on how fast to accelerate depreciation are taken under uncertainty. When there are technological or competitive pressures that could lead to customers of a regulated business switching away from that business, then there is a window of opportunity in which to adjust depreciation at a rate that allows the business to recover its capital despite the shrinking customer base and without driving further switching so fast that it creates a death spiral.

The last time at which this could take place as defined is when the “window of opportunity is past, or WOOPS.[12] Beyond this point, any attempt to accelerate depreciation results in a rate of switching that the business cannot keep up with. This could be the case even if it was no longer price regulated and was free to set its own tariffs.

Gas networks are highly capital intensive businesses and have to go to the capital markets (primarily the debt markets) frequently in order to maintain and increase their capital. Accordingly, once it becomes clear that the WOOPS has occurred, it will become very difficult for the business to continue to finance itself. This could occur if, for example, new government policies accelerated electrification and gas demand reduction faster than previously anticipated (and noting that gas network revenues are only set every five years).

This would put remaining customers of the network at risk. If the business cannot finance itself, then it may no longer be able to maintain and operate the gas network safely and securely.

While it may be assumed that regulators and governments would seek to step in at this point to ensure continued safe supply to the remaining customers, this may not be a straightforward process, and would need to be prepared for in advance. For example, the options available to governments would be constrained by existing legislation and regulations, both of general bankruptcy processes and of gas sector-specific regulation. At the very least, a review of the existing frameworks is worthwhile carrying out to clarify whether there are any barriers to ensuring continued supply.

To date, it has largely been assumed that the regulatory framework provides effective protection against network financial distress, and even in cases where stranding risk has been discussed, it typically assumes there will be some solution that makes the business whole. But this effectively means government filling the revenue gap and it’s not clear whether governments would prefer to do that or to manage the consequences of financial distress. Either way the issue merits consideration well before it arises, as while it is still a remote risk, the consequences for customers of an affected network could be very severe.

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[12] *Economic Depreciation and the regulated firm under competition and technological change, Crew and Kleindorfer, 1992*

In the meantime, it is understandable that gas networks are pursuing a twin track of attempting to ensure their assets remain viable through decarbonisation by promoting the use of renewable gases while also seeking accelerated depreciation in case this does not succeed. This does not mean that all proposals for accelerated depreciation are necessarily in customers' best interest, but they at least merit consideration.

Retailer exit

While gas networks have the critical role of transporting natural gas, they do not directly bill consumers. Instead, consumers select a gas retailer who procures wholesale gas, pays the network tariff and bills the consumer.

The risks that consumers face in respect of their retailer is that retailers elect to exit the market. If gas use declines and consumers leave the gas network, it will become progressively less attractive for retailers to participate in the market. Initially this will manifest as a lack of new entrants. Existing retailers have already invested in obtaining a gas licence and setting up customer systems, and so will likely stay in the market until a trigger point such as the need to upgrade their systems. This could occur due to new regulatory requirements, for example.

Over time the risk is the number of retailers in the gas retail market will decline. While much doubt has been cast over the years about how well competition works for services such as energy supply, this trend will still, other things being equal, reduce customer choice and the best deals will disappear.

Retailers leaving the market will not lead to loss of supply - customers will just have to find another retailer from a shrinking pool.

At the same time, retailers' cost structure is likely to increase. Large retailers procure wholesale energy and manage around the risks that their customers use more or less than they have contracted for. But in a declining market these risks will become asymmetric with the risk of their over procuring gas overshadowing the risk of under procurement. As the market shrinks, they will also look to procure smaller volumes. Both factors will tend to result in higher costs for the wholesale component of gas. While smaller retailers avoid these risks by buying load-following contracts that match their customers'' usage, all this does is pass the risk to their counterparty (typically a larger retailer). So, the risk premium for such contracts will rise.

In principle there is no material direct cost to a retailer from a customer choosing to stop receiving gas. There will need to be a final meter read and as noted above the retailer will need to consider its exposure to having over procured gas. Aside from a modest administrative charge, it's not clear what basis a retailer would have for charging an exit fee over and above any charges such as abolishment costs that it was passing on from the network.

There have been reports of where a retailer has sought to levy an exit fee and the customer has referred them to the ombudsman. As such instances are not reported on separately in ombudsman case statistics (and individual cases are confidential) there's no evidence of whether this is a systematic problem or a one-off issue. However, ombudsmen and regulators may need to monitor such fees as more customers leave the network to ensure such charges are reflective of actual costs incurred by the retailer due to the customer exit.

Some types of consumers are at greater risk than others, due to particular difficulties they may face in converting to electric alternatives. The main groups of consumers affected in this way are listed below.

Renters

Renters typically do not have control over the hot water, heating/cooling or cooking appliances in their homes. Landlords have no incentive to spend money on conversion to electric, especially when rental markets are tight. This is the classic “split incentives” problem that arises when considering energy efficiency improvements, consumer energy resources such as rooftop PV, etc. If there are likely to be ongoing energy bill savings from electrification, then in principle, a landlord could pay for the conversion and agree higher rent with their tenants, but in practice, such agreements are hard to strike, not least due to the uncertainty over the level of savings. Allowing landlords access to subsidies for electrification mitigates this challenge but is unlikely to solve it. Requiring electrification as a minimum standard of a rental property is highly interventionist, although if an “endgame” is reached where there are few properties left on the gas network, it could be seen as a justifiable component of the winding up process to ensure the last few customers can make the changeover.

Low income customers

Electrification requires up-front spending by consumers (households). Regardless of whether future bill savings mean that this investment pays off, low-income customers may not be able to afford the spend. This barrier is exacerbated if they have to pay abolishment fees too. Subsidies for electrification of the level currently available reduce the capital requirement but are not so high that they eliminate it. It’s possible that specialist financing companies that currently focus on assets such as solar can help address this problem, but low income customers may have negative experiences of debt and be reluctant to take up this option.

Multi-unit dwellers

Residents of apartment blocks often have shared hot water or heating facilities. This may preclude individual residents even if they own their own home from unilaterally pursuing electrification. In principle, in most cases, individual apartment owners can collectively make decisions to convert the shared services, in practice there may be challenges in co-ordinating this decision. If body corporate management has been outsourced to a third party, then the “split incentive” problem may also arise where the body corporate has little interest in carrying out the work necessary in a conversion project.

Culturally and linguistically diverse communities (CALD)

CALD communities may have a lower awareness of energy system changes and their switching options. This may make them more likely to be caught out if a gas distribution network needs to curtail supply. Some groups may be especially reliant on gas cooktops for traditional cooking techniques (e.g., wok-frying).

Building awareness and trust within CALD communities requires a more in-depth approach than simply making information available in community languages. It’s an approach that smaller organisations such as not-for-profits or local councils may be better suited to.

Hard to convert businesses

While the barriers to households switching away from gas are not technical in nature, there are several business uses that are constrained under current technologies from effectively switching. This may mean technology is immature or not yet commercially viable, even if it exists. Where processes are integral to a business, caution will be applied in making a switch to a different approach. Some examples include:

- Cafes and restaurants - where chefs are used to cooking on gas and it facilitates particular cooking techniques there will be barriers to switching to electric alternatives. Rewiring or electrical upgrades may also add materially to the cost.

- Aquatic centres - electric alternatives for heating swimming pools exist but place heavy demand on the network and may trigger expensive network upgrades that the centre would have to pay for because they triggered the requirement.
- Food processing - challenges may include heat pumps are not yet at the stage where they can efficiently produce temperatures over 100C for steam processes; electric boilers may not be available at the required scale; alternative approaches such as using infra-red light for sterilisation may impact the quality of the end product in unexpected ways.
- Brick-making and other high temperature processes - electric heating does not provide high enough temperatures. Hydrogen burns differently from natural gas and so would produce a different environment inside a brick kiln for example.
- Fertiliser/explosives - rely on gas as a feedstock as well as a heat source, so electrification not a complete solution.

Many of these businesses, some of which are large users of natural gas, are distribution connected and so would bear some of the extra cost if demand on the local network began to decline. In general, however, their network charges are a much smaller proportion of their overall gas cost than for households, and so the impact would be proportionally smaller. Conversely, large gas users are highly price sensitive and in combination with rising wholesale gas costs, a significant increase of network costs risks plant closures. Accordingly, while this paper is largely focused on household customers, the needs of and risks to business consumers also requires consideration.

Bottled gas

The primary concern of this paper is customers using the reticulated gas networks. Because it is a shared network, and the costs are largely fixed, some customers leaving the network impacts those remaining on the network.

Some gas consumers, however, are use bottled gas (LPG). Bottled gas use is comprised of propane and butane (which are denser than methane, making them better suited to bottles) and is primarily used for hot water or cooking. It accounts for around 2.5 per cent of household energy consumption, compared to 40 per cent for natural gas. While like any other product or service, the price and availability of LPG will be influenced by supply and demand, the cost base is less fixed, and supply is better able to scale up and down with demand than in the case of reticulated natural gas. LPG fuelled homes use an average of 16GW/year[13] – or around 2-7 LPG bottles depending on size.

LPG will also eventually be subject to decarbonisation objectives, but the smaller volumes give it a better chance of being substituted with biogas. Note that deriving biobutane/biopropane will require different processes to biomethane. Existing processes can produce biopropane as a co-product of the production of renewable transport fuels from vegetable oils[14], but there is no current local production.

Accordingly, LPG customers are less of a concern. LPG may even be a potential solution for reticulated gas customers who are obliged to find other fuel sources due to price or partial network decommissioning. However, to the extent this occurs it's important to note that LPG supply is not subject to the same level of customer protections as natural gas.

[13] Boardroom Energy calculation based on data from Residential Baseline Study 2021 update, EnergyConsult, 2021
[14] NNFCC, Biopropane: Feedstocks, feasibility and our Future Pathway, September 2019

International experience

Most other countries are seeking to decarbonise their economies, and so those with reticulated gas networks will be grappling with the same issues as Australia.

A complete review of the international landscape is beyond the scope of this report. However, a literature scan indicates that no jurisdiction has discovered a complete solution to these issues.

Some jurisdictions have begun the process by instituting bans on new gas connections.

Netherlands

The Netherlands is an example of a country with a clear policy to decarbonise current natural gas use. The focus is specifically on heating load, but as this is the major use of natural gas in buildings, it's likely that this would be accompanied with a phase out residential and commercial natural gas connections.

To date, however, there has been little conversion of existing buildings, with most of the gas-free building stock arising from new developments (since legislative changes in 2018).[15] Even so, 20 per cent of new houses still had a gas connection, so there is not yet a total ban on new connections.

The policy framework is based on core principles of affordability and feasibility. In principle this should mean that gas consumers are somewhat protected in the transition, but in practice, current policy instruments are fairly conventional with subsidies for electric appliances, minimum energy requirements and taxes on gas consumption.

Notably, the transition is to be led by local governments. They will need to develop a plan with clear time frames for decarbonising heat networks. Alternative solutions could look quite different from Australia, as the Netherlands, like many other European countries has a high penetration of district heating.

The gas network companies are all government owned[16]. This will help mitigate financial issues, but may mean that Dutch taxpayers have to foot the bill for decommissioning of the networks.

[15] https://www.amsterdam.nl/en/policy/sustainability/policy-phasing-out/

[16] https://www.iea.org/reports/the-netherlands-2020

USA

California is proposing to become the first US state to ban sales of natural gas domestic appliances[17] by setting a zero emission standard for such appliances from 2030. This measure would not mandate retrofits in existing buildings. Some cities within the state have gone further, with Berkeley being the first of around 40 municipalities to ban new gas appliance sales in 2019.

California is different to Australia, as the relative prices of gas and electricity mean that retrofitting is currently unlikely to be a cost saver for many households. This may be mitigated by increasing rebates for electric alternatives. Gas prices are expected to rise significantly over a twenty year horizon, but these projections are somewhat circular as they are predicated on an expectation of much lower demand.

Localised debates on the future of natural gas are taking place elsewhere. In Washington DC, there is an active debate on whether decarbonisation of homes should be based on renewable gases or electrification. The risks of a death spiral scenario under electrification have been recognised, with one not-for-profit arguing that provisions should be put in place for low-income customers to be among the first to electrify. RMI notes that as wealthier customers leave the gas system, "low-income customers will be left to pay for the gas infrastructure maintenance costs, further increasing rates. For these reasons, it's important that low-income ratepayers be among the first, not the last, to electrify[18]".

As is so often the case in American politics, there has been an equal and opposite reaction, with Arizona, Tennessee, Oklahoma and Louisiana all passing laws that prohibit local governments from adopting electrification measures or natural gas bans similar to the ones passed in California.

Federally, the focus is on providing incentives for electrification rather than curtailing gas use. As part of the mammoth Inflation Reduction Act, the High-Efficiency Electric Home Rebate Program will provide a rebate up to $8,000 to install heat pumps[19] that can both heat and cool homes, and a rebate up to $1,750 for a heat-pump water heater. Homeowners can also obtain up to $840 to offset the cost of a high-efficiency induction cooktop. The program also recognises that electrification will in many cases require an electrical upgrade, for which $4000 is available as well as $2,500 for rewiring costs. The program is means-tested but only very high income households are excluded.

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17 https://ww2.arb.ca.gov/news/california-adopts-comprehensive-strategy-meet-federal-ozone-standard-over-next-15-years

18 https://www.utilitydive.com/news/district-columbia-electrification-sierra-club-gas-pepco-psc/623677/

19 https://www.bloomberg.com/news/articles/2022-07-28/here-s-how-manchin-s-climate-deal-could-make-energy-bills-cheaper?srnd=green

UK

The UK is on a twin track approach of pursuing both electric and hydrogen alternatives. While gas is used for cooking and hot water, the main residential load is heating, and so there has been a lot of focus on rolling out heat pumps while also requiring boilers[20] to be "hydrogen ready" and trialling hydrogen blends. Accordingly, the official position does not contemplate asset stranding. As the regulator, Ofgem notes "there remains some uncertainty on key questions such as the role of hydrogen in heat[21]".

The changeover to low carbon alternatives is supported by the Boiler Upgrade Scheme, which offers a subsidy of GBP5,000 (around A$9,000) for air-source heat pumps or biomass boilers (for rural properties only) replacing gas or oil-fired boilers. While generous, the issue is the same as with all such subsidies - the homeowner still needs to find some capital for the retrofit and so low income consumers may struggle to access the benefits. The previous subsidy scheme, *the domestic renewable heat incentive*, had a specific component to support upgrades by landlords of social housing, recognising the problem of split incentives.

Policy Implications

While the risks to gas consumers are longer-term in nature, changes in demand could happen quicker than expected. Once the risks of material price increases and cessation of supply begin to materialise it will be late to put in place the most effective policy support measures. Accordingly, policy makers – jurisdictional governments and regulators, the national energy market bodies – should begin considering the issues now. The big dilemma for governments is at what point do they need to decide whether a widespread switch to renewable gases remains feasible. An early decision that it is will not happen will be self-fulfilling – as policy and consumer interest is fully oriented to electrification, then even if renewable gas options emerge as an alternative, it may be too late for customers that have already left the network. This will make it harder for renewable gas to become cost-competitive for small customers. Additionally, if governments have given a clear signal that they are pursuing decarbonisation only through electrification, then gas networks will have a stronger case that any unrecoverable RAB is due to policy choices and that governments have a responsibility to make them whole.

Conversely, if governments choose to hedge their bets, then they may not be prepared to provide the necessary levels of policy support for customers if demand declines materially anyway and the remaining customers are facing much higher prices along with barriers to switching, or are facing disconnection due to mains decommissioning. The Tasmanian Draft Future Strategy has a useful schema dividing the gas transition into four phases as illustrated in Figure 5 below.

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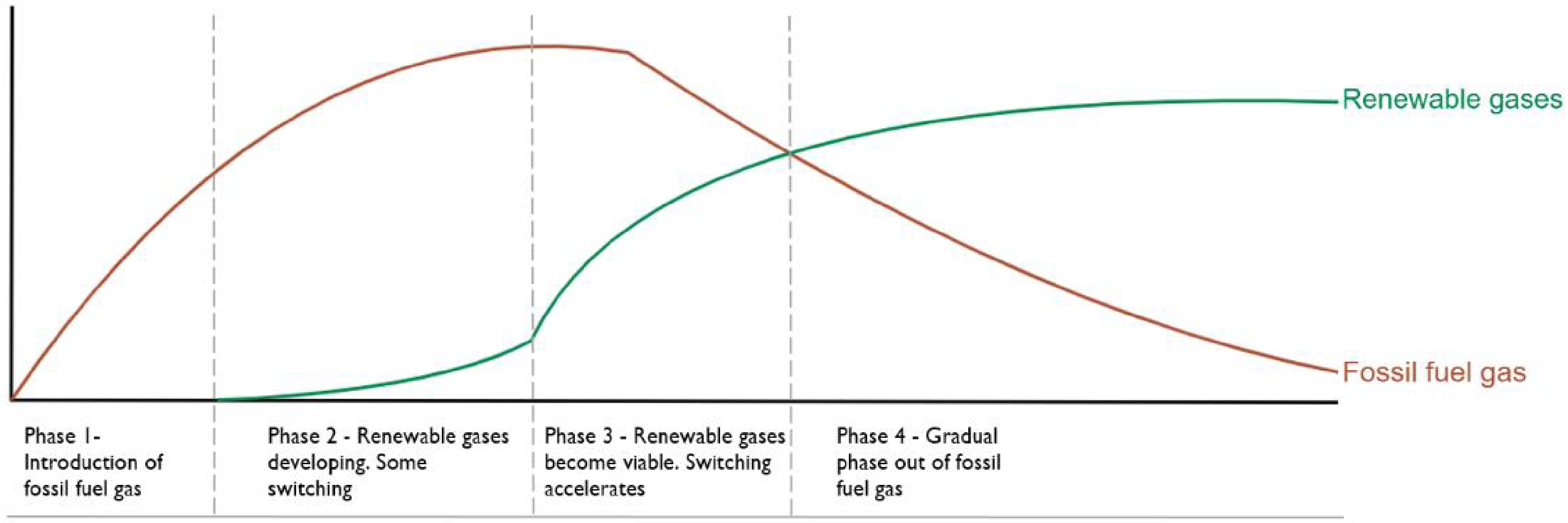
[20] In the UK, central or whole-of-house heating is typically based on hot water-filled radiators rather than ducted hot air as is often the case in Australia. So, most houses have a boiler that provides hot water as well as heating. The cooler climate means that reverse cycle air-conditioning is not common in the UK.

[21] https://www.ofgem.gov.uk/publications/202223-ofgem-forward-work-programme#low-carbon%20infrastructure

Figure 5: Phases in the gas transition



Source: Draft Future Gas Strategy

Phase 1 has already passed and so we are currently in phase 2. Renewable gases are being trialled but are not yet widely available or commercially viable. Natural gas use (fossil fuel gas in the above diagram) is plateauing, and some customers are switching away from the gas network, but not yet in large numbers. At this point, governments should consider policy options such as building awareness, removing subsidies that support gas use or mandates for new connections, as well as potentially banning new connections. This is also a good time to consider what will happen in the next phases, and for example examine the basis of abolishment costs.

Depending on how fast governments are seeking to accelerate through the phases, subsidies may be introduced to support switching at this point, which will accelerate the move into phase 3. It's at this point that governments will need to consider the prospective viability of renewable gases for small customers. This may be more a case of *where* will they be viable (e.g. parts of the networks close to biogas feedstocks, parts of the network primarily serving business users with hard-to-electrify processes) than a binary yes/no. The impact of declining demand on gas prices for the remaining users could become material during this phase and governments may find themselves in a situation during "phase 3" where they are subsiding both switching and ongoing gas use. Governments will also need to prepare for partial decommissioning and how this will be managed. In phase 4 switching - either to renewable gases or electric alternatives will need to be completed. Costs - at least on a per customer basis – may be highest at this point as the focus is on helping those who have found it hardest to switch. There may also need to be transitional support for gas networks to ensure an orderly decommissioning process.

These policy options are discussed in more below.

Awareness

A relatively low cost policy intervention is to develop communication campaigns to ensure all householders and businesses with gas connections are aware of their options and what risks and opportunities may lie ahead. Of course, there is much information on electrification options, the costs and benefits already, that has been issued by a range of organisations including community groups, local councils, enthusiasts, environmental groups, energy retailers and others. But there is still likely to be value in governments underwriting communications that are both broad and deep. Broad in the sense that they are designed to reach as many households and businesses as possible, including those that aren't already actively searching for such information. Deep in the sense that it reaches into communities that may not be responsive to broad campaigns, such as CALD communities. This will require a patient and tailored approach to ensure the messages are seen as trustworthy. Information alone will not be enough to prompt or assist all customers to switch to electrical or renewable gas alternatives.

Subsidies for electrification

Subsidies for appliances have become a common way to promote decarbonisation, as evidenced by the take-up of rooftop PV, for example. By reducing the up-front financial cost, they can help stimulate the market for new products. However, there are several considerations in designing any such schemes.

Subsidies alone do not address the key barriers to electrification that households face. Renters are unlikely to benefit from them. Low-income households may not, either if they lack the upfront capital that would still be required unless the subsidies were extraordinarily generous. This is borne out by the demographics of solar PV – which is least common among the top and bottom income quintiles.

Unlike rooftop PV at the time the renewable energy target and the premium feed-in tariffs were first introduced, electric appliances are already widely available, and as analysis shows, retrofitting can pay off for many households already. So, the barriers to electrification are clearly not purely financial.

If successful a subsidy scheme could drive a faster rate of defection from the gas network and potentially trigger a "death spiral" scenario.

A subsidy scheme could be expensive. Governments will be tempted to fund them using energy bills, as the Victorian government is doing by including the subsidy as part of its existing VEU energy efficiency scheme, which is ultimately paid for by energy consumers. Given that low income households may not be the main beneficiaries, this risks being a regressive way to fund the subsidy.

Designing a subsidy scheme that works for businesses with their much more diverse uses of gas is likely to be challenging.

So, while some form of subsidy is likely to form a part of a successful suite of policies for managing the transition, careful design and monitoring is required, and it is best targeted at those who most need it.

Subsidies for continuing gas use

Governments will need to monitor gas prices for small customers and their impact on vulnerable and low income customers. Where barriers to switching remain, temporary subsidies for gas users may be needed to mitigate price impacts while long-term solutions such as appliance switching are put in place.

Alternatively (or even additionally) if gas networks show signs of financial distress, they may need to support to ensure an orderly process of ongoing supply and progressive decommissioning of the network.

Abolishment costs

Abolishment costs averaging almost $900 per household (and potentially much more for business customers) will be a significant disincentive to customer switching and a material barrier for lower income households. It is not practical, however, to simply ban such fees to the extent they represent real costs that gas networks need to incur. This just results in the costs of service pipe removal or the risks of failure to remove service pipes reverting to the remaining customer base. Instead, policymakers should consider:

- What are the drivers of service pipe removal and the costs of doing so? Are there cheaper ways to make an unused gas connection safe?
- Do abolishment fee levels need greater scrutiny and how can gas networks be incentivised to reduce the fees?
- Are retailers simply passing on network fees or are they adding retail charges? If the latter what is the underlying basis for these additional costs?

The size of the prize in finding ways to do this at lower cost is significant. For households alone, abolishment fees could total $4.6bn to individually remove all service pipes across networks. Policymakers should also consider the possibility that gas networks may seek to levy exit fees on top of abolishment costs and consider how to manage this risk.

Managing partial decommissioning

There is no real precedent for how partial decommissioning should be managed. So, it is worth policymakers giving early consideration to how it can best be achieved. This is likely to include establishing minimum notice periods, noting that this needs to be practically manageable by gas networks as well.

Gas networks will have the primary responsibility for notifying affected consumers, but realistically there will need to be shared responsibility for managing such situations, as some consumers will need considerable assistance to prepare them for their gas supply being switched off. The Esperance case may provide a model, but it will need to be achievable on a far lower cost/connection than in Esperance.

Given that these will happen on a local scale, local organisations may be best placed to provide tailored support. For example, in the Netherlands, local councils are taking on a key role. But councils or community organisations seeking to help will need funding support.

New gas connections

Removing mandates that new developments must have a gas connection is a no-regrets policy that governments are already moving to implement (where they exist in the first place). It’s also useful to review planning regulations and building codes as necessary. For example, a quirk of Victoria’s regulatory regime effectively banned the installation of electric hot water in houses with a gas connection (on the premise that gas hot water was considerably more efficient than old-tyle electric resistive heaters.

The ACT is looking to go a step further and declare a moratorium on any new gas connections. It's less clear whether removing choice is the best policy for consumers at this stage, when full decarbonisation is still decades away and there is still some hope that networks may be convertible to renewable gas. Even without a moratorium, planning authorities may be able to encourage developers to go all electric if motivated to do so, as some local councils in Victoria are already doing.

At the very least it is worth policymakers considering under what circumstances banning new connections would be the best policy.

Supply chain management

A step up in the rate of electrification will likely create challenges in ensuring that sufficient appliances and trained installers are available to meet demand. While some delay or cost increase may be manageable, this could become problematic in cases of partial decommissioning where customer have a limited window to make the switch. While the market is generally good at reallocating resources as demand for different types of goods and services evolves, there are limits to its adoptability and sometimes there are systematic barriers that inhibit efficient reallocation. Policymakers would do well to monitor supplies of appliances and whether there are sufficient qualified installers, including whether training and apprenticeship processes are delivering enough new qualified installers into the workforce.

Energy efficiency

Energy efficiency – specifically improving the thermal properties of the building envelope can indirectly support consumers and electrification. Firstly, it can help make switching cheaper, specifically where space heating is a factor, by allowing smaller heat pumps to be installed. Secondly it will reduce the impact on electricity system. As only two per cent of housing stock is turned over each year, such policies would need to target retrofitting existing buildings as well as increasing standards for new buildings. It would also need to consider appropriate incentives or at least disincentives for improving rental properties. For example, tax deductibility of energy efficiency improvements.

Given the poor thermal performance of older Australian homes, a focus in energy efficiency would have many other co-benefits and be a no-regrets policy.

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- ACOSS
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- AGIG
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