

Gas

Substitution Roadmap

VICTORIA
State
Government





Traditional Owners acknowledgment

We acknowledge and respect Victorian Traditional Owners as the original custodians of Victoria's land and waters, their unique ability to care for Country and deep spiritual connection to it. We honour Elders past and present whose knowledge and wisdom has ensured the continuation of culture and traditional practices. We are committed to genuinely partner, and meaningfully engage, with Victoria's Traditional Owners and Aboriginal communities to support the protection of Country, the maintenance of spiritual and cultural practices and their broader aspirations in the 21st century and beyond.

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MINISTER'S FOREWORD

The Hon. Lily D'Ambrosio MP

Minister for Energy
Minister for Environment and Climate Action
Minister for Solar Homes



Clean energy produced by household solar panels combined with modern, energy efficient electrical appliances is now the most cost-effective way to warm Victorian homes in winter, cool them in summer and power our households throughout the year.

And with gas prices rising steadily, and international events causing uncertainty in gas supply and price around the world – it's time we gave Victorians more choice when it comes to the future of our energy supply. Historically, fossil gas was the cheapest source of fuel to heat Victorian homes during winter. While our state currently processes more than enough gas for its own needs, it's getting too expensive, because Victorians are at the mercy of private companies exporting gas overseas, which has a real impact on the cost to Victorians at home.

This is a Government that puts money back in people's pockets. We're already doing it, with our landmark Solar Homes Program, Victorian Energy Upgrades (VEU) and through the Government's \$250 Power Saving Bonus – for which every single household in Victoria is eligible to claim.

Our next step in easing cost of living is our Gas Substitution Roadmap. It means we continue to do the work to make energy more affordable for more people and get Victorians the best deal when it comes to their home energy.

This Roadmap is also the next stage in our work to transition away from fossil gas and towards zero emissions energy that delivers cheaper bills for households and businesses.

The Roadmap lays out initiatives to protect Victorians against high gas prices and gives every Victorian the confidence that their energy is reliable – now and into the future.

The key changes described in this Roadmap include:

- Expanding the VEU scheme, with new incentives for switching to efficient electric appliances
- Phasing out VEU incentives for fossil gas residential appliances by the end of 2023
- Changes to the Victoria Planning Provisions in 2022 to remove the requirement for new housing developments to be connected to gas
- Retiring Victoria's 6 Star National Construction Code variation to allow for more efficient hot water systems as part of new construction and major renovations
- Move to a 7 Star Standard for new home construction, this standard takes account of home energy appliances and not just the thermal shell of the building, driving greater energy efficiency from the point of design

These changes are all about providing greater choice – there are no penalties for people who continue to use gas, just advice, options and support for those who want to make the change. Because we know households and businesses make these decisions every day as they build or renovate homes, or replace old appliances. The Roadmap delivers policies that will make it easier for Victorians to make choices that will save them money and reduce greenhouse gas emissions to protect our people and our planet.

Switching over to solar or electricity, from gas, means cheaper gas bills – this is good for people. It's also good for our planet.

Victoria has set ambitious emissions reduction targets to halve emissions by 2030 as we transition to a net zero emissions economy by 2050. To achieve these targets we must cut emissions across the entire economy, including the gas sector, which contributes around 17 per cent of Victoria's net greenhouse gas emissions.

The transition will harness Victoria's existing competitive advantages, including extensive gas networks, a highly skilled gas workforce, and world-class education and research institutions.

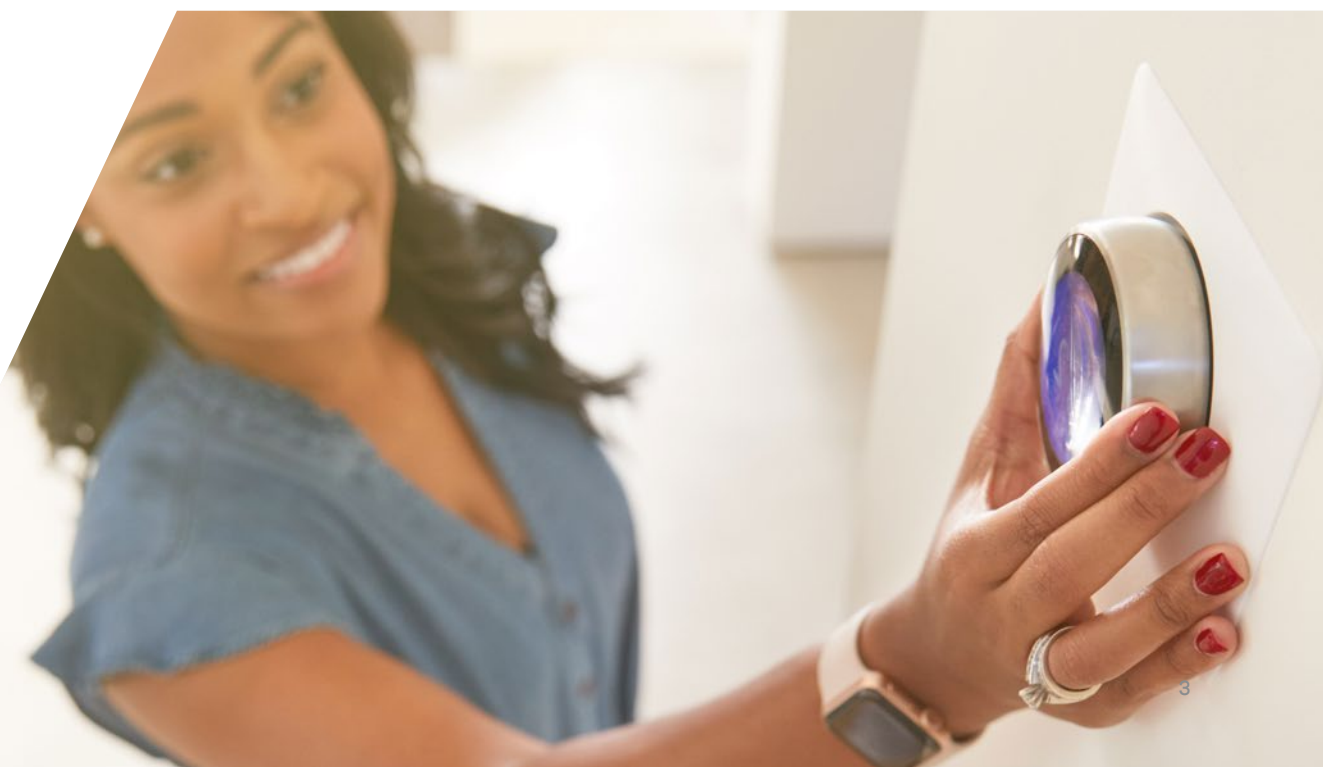
Victoria's strong industry and manufacturing capability means the state is well-placed to build greater capacity to work with different types of fuel and equipment, and to attract investment in zero emissions gas substitutes, like hydrogen and biomethane for businesses that can't readily switch to electricity, to Victoria. This has the potential to create sustainable and clean energy jobs for Victorians, in Victoria.

We're committed to a just and equitable transition that ensures energy affordability, reliability, security and safety for all Victorians.

With over two million Victorians using gas in their homes and businesses, the Victorian Government recognises the need to work with households and businesses throughout the transition.

The Victorian Government will continue to ensure that we have adequate gas supplies, as well as strong regulations to support a gas market that works effectively for all Victorians.

Making a choice to move away from gas is good for the planet, great for household budgets and welcome assistance to the cost of doing business.





Protecting Victorians against high gas prices

High international gas and coal prices as a result of the conflict in Ukraine, as well as domestic factors – including flooding in New South Wales and Queensland affecting coal supplies and several outages at coal-fired generators driving up demand for gas-powered generation, and unusually cold early winter conditions – have led to unprecedented price impacts on wholesale gas and electricity markets. Whilst these factors are likely to ease over time, the international market remains uncertain and price volatility may continue.

Since the commencement of gas exports overseas from Queensland Liquefied Natural Gas (LNG) plants, gas prices have been linked to the international market. Victoria processes more gas than it consumes and supports gas consumers in other east coast states. Collectively, Australia produces large amounts of gas – far more gas than the nation consumes – however much of this is exported overseas. The Victorian Government has long advocated for strong and effective gas export controls to prioritise gas for domestic use and to ensure Australians pay a fair price for Australian gas.

Victoria supports the Commonwealth Government taking action to reduce the impact of international gas prices on the domestic energy markets. The current design of the Australian Domestic Gas Security Mechanism (ADGSM) means that it primarily serves to address the risk of a domestic gas shortfall, not as a mechanism to provide pricing relief and certainty to domestic users.

Victoria is strongly supportive of a timely process to consider a redesigned east coast gas mechanism to prioritise domestic consumers and protect Victorians from these high wholesale prices.

The Victorian Government acknowledges that gas market regulators should have the tools they need to properly monitor and report on the health of the market. This, along with market reform to increase market transparency, is important to enhance competition in the gas market and promote fairer pricing.

Victoria is also supportive of the Commonwealth Government taking action to support small to medium enterprises (SMEs) and large commercial and industrial (C&I) customers, complementing supports already available from the Victorian Government. The Commonwealth has a wider range of levers than states and territories to provide SMEs and C&I customers with financial support.

Recognising the need for urgent action, the Victorian Government has a range of supports in place to assist households and businesses in managing higher energy costs, including:

The **\$250 Power Saving Bonus** which will help ease the cost of living for Victorian households

The **energy concessions program** which provides 17.5 per cent discount off gas and electricity bills for eligible concession card holders

The **utility relief grant scheme** which provides up to \$650 per utility every two-years to low-income Victorians experiencing unexpected hardship to pay utility bills

The comprehensive **Payment Difficulty Framework** under which retailers must offer tailored assistance to residential customers with arrears

Small businesses as well as households can use **Victorian Energy Compare** to compare their offer to others in the market and ensure they are on the lowest-price offer available

Retailers must give written notice to households and small businesses of price rises with clear advice about whether the customer is on the retailer's best offer

The Victorian Government recognises that these relief measures must be coupled with longer-term investment in activities such as energy efficiency and electrification that will unlock even greater energy bill savings.

Switching from gas to efficient electric appliances will help households to save money on their energy bills. For example, an existing detached dual-fuel home with rooftop solar photovoltaic (PV) that moves from using gas for heating, hot water and cooking to using efficient electric appliances could reduce its average energy bill by around \$1,250 per year. For a household without solar, going all-electric could save around \$1,020.

With rising energy prices, the savings from electrification increase. Firstly, a fully electrified household is no longer exposed to rising gas bills. Secondly, the efficiency of some electric appliances is significantly higher than their equivalent gas appliance. This means a household's exposure to higher electricity prices is also reduced (for example, a multi-split air conditioning system replacing a gas ducted heating system, is at least five times more efficient in delivering the same amount of heat into a building). Finally, electrification benefits increase further again where solar panels are installed.

Government programs are important to assist Victorians with upfront costs of efficient electric appliances, including the Victorian Energy Upgrades program and the Solar Homes Program. Policies that enable construction of all-electric homes will also provide occupants of new homes with lower running costs, relative to dual-fuel homes. The Minister for Planning is progressing changes to the Victoria Planning Provisions, to take effect in 2022, that will remove existing barriers to all-electric new developments.

The Victorian Energy Upgrades program is also being revised to further assist SMEs reduce their energy consumption and costs by improving energy efficiency. SMEs are also being supported to install solar panels through the Solar for Business Program, empowering businesses to generate their own electricity and minimise their bills. The Business Recovery Energy Efficiency Fund (BREEF) also provided grant funding to businesses to support energy efficiency and demand management projects.

Additional changes to the VEU will expand incentives for residential electrification and remove incentives for residential fossil gas appliances by the end of 2023.



Executive summary

Many Victorians still believe gas is a cheaper energy source than electricity. This used to be the case, but for too long now gas prices have been rising steadily around the world.

Very high gas and coal export prices driven by these international events have also impacted national electricity markets, emphasising the need to further accelerate investment in low-cost renewable electricity generation.

The rapid investment in low-cost renewable electricity generation in Victoria, combined with the much higher efficiency of many electrical appliances, has reduced the cost of using electricity for home heating, hot water and cooking. Some Victorians are making the switch already, but we know that for many families and businesses there is an attachment to their current appliances, such as gas cooking, or a lack of information about the effectiveness of alternatives like heat pumps or using reverse cycle air conditioners as home heaters. Decisions about home appliances can be complicated, but just as technologies like solar PV eventually became mainstream, the early adoption of efficient electric appliances today will help pave the way for wider uptake in the future. In the meantime, it is critical to focus on helping people to understand their choices and removing barriers to uptake, so bills are cheaper and we reduce greenhouse gas emissions.

Energy affordability and reliability are priorities for the Victorian Government. Using less fossil gas, through energy efficiency and electrification, can lower Victorian consumers' energy bills by reducing their exposure to high gas prices. It can also free up gas for industrial and other uses that cannot be readily electrified, and provide time to develop and scale up industries that supply renewable gas and hydrogen.

The Victorian Government is committed to reaching net zero greenhouse gas emissions by 2050 and, recognising the need to act now on climate change, has set ambitious emissions reduction targets to halve emissions by 2030.

Achieving this interim target is crucial to drive the investment needed in current and emerging technologies, grow jobs in clean energy, meet Victoria's net zero emissions targets, and help transform Victoria to a world-leading clean economy.

Achieving our interim emissions reduction targets will require us to cut emissions across the entire economy, including the gas sector which contributes about 17 per cent of Victoria's net emissions.

Enabling choice and removing barriers to electrification

EFFICIENT, ALL-ELECTRIC HOMES



Incentives



Victorian Energy Upgrades

Discounts for energy-efficient products



Solar Homes

Rebates for hot water, solar PVs and batteries



7 Star Homes Program

Improving construction supply chains

Policy and regulatory change



Victoria Planning Provisions to be changed to remove gas connection requirements for new residential subdivisions



Planning Scheme changes are underway through the Environmentally Sustainable Development Roadmap to strengthen support for energy efficiency and renewables



Plumbing Regulations will be aligned with changes to the National Construction Code 2022

Until recently, fossil gas was considered a lower carbon transition fuel. However, the transition of the electricity grid to 100 per cent renewable is well underway and accelerating.

It is particularly critical for Victoria to proactively prepare for and manage the shift to renewables because we have the highest use of gas for heating, cooking and hot water in Australia. This transition will involve guiding an orderly decarbonisation of the gas system over the long term. The Roadmap represents the start of this journey.

Decarbonising the gas sector requires immediate investment in the existing technologies that are available now – energy efficiency and renewable electricity – and in the new technologies that can play an increasingly larger role in the future, such as hydrogen and biomethane.

The combination of energy efficiency, electrification and alternative gases (such as hydrogen and biomethane) will provide the best pathway to decarbonise the gas sector.

The Roadmap takes this transition forward – highlighting priorities for policy and reform designed to unlock these technologies.

The Roadmap builds upon the record \$1.6 billion investment in Victoria's clean energy future, committed in 2020, and is complemented by \$331 million in the 2022-23 State Budget, to reduce emissions, secure Victoria's energy grid and drive down energy prices.

This Roadmap includes several initiatives to help households and small businesses invest in modern, highly efficient electric appliances and transition away from old gas appliances. This first package of actions will promote choice and address outdated regulatory barriers to deliver more all-electric homes and buildings.

Gas Substitution Roadmap

AT A GLANCE

Priorities for policy and reform, and opportunities for Victoria

Deliver more all-electric precincts

Remove regulatory barriers in 2022

Transition Government's own gas use

All electric, efficient homes

Promote consumer choice, help households upgrade to efficient electric appliances, lower energy bills and improve efficiency of homes

Industry

Continue to assist industry to improve efficiency, electrify and prepare to take up alternative gases

Solar

Electric hot water

Electric heating and cooling

Electric cooking

Complemented by \$331 million in 2022 to reduce energy emissions, secure Victoria's energy grid and drive down energy prices. Builds on \$1.6 billion for clean energy in 2020.



Build skills and capability

To realise opportunities from gas sector transition, including grants in 2022



Help Victorians cut energy bills



Unlock renewable gases and scale up hydrogen industry

Build on the growing number of innovative hydrogen projects including the Hume Hydrogen Highway



Maintain gas reliability throughout transition

New investments from 2023, new market mechanisms from 2025



International export

Removing barriers and enabling choice

At the centre of the transition to efficient, electric homes, is the Victorian Energy Upgrades (VEU) program, which will evolve and expand in 2022. The VEU program has provided households and businesses with discounted energy efficient products for more than a decade. The program will now be strengthened to support the shift to electrification. Government will develop new incentives through the VEU program to help replace gas water heating and space heating with efficient, low-emissions electric equipment while phasing out incentives for all residential gas products by late 2023. The program will also provide new electrification options and support for business, while continuing to help those businesses who can't shift off gas to make their operations more efficient. The Government will shortly be releasing discussion papers regarding these changes and will work with industry to implement them seamlessly.

Government will implement changes in 2022 to the planning system to remove barriers to all-electric homes and new developments and support the take up of efficient electric appliances. Amendments to the Victoria Planning Provisions will allow developers and homeowners to choose all-electric new homes.

Victoria is also committed to raising energy efficiency standards for new homes under changes to the National Construction Code (NCC). Proposed changes include increasing building efficiency from 6 to 7 stars and strengthening standards for fixed appliances such as heating and cooling, hot water and lighting. At the same time, the Plumbing Regulations 2018 will be aligned to ensure consistency with the changes to the NCC 2022. These changes will provide more choice to Victorians and make homes cheaper to run, more comfortable to live in and more resilient to extreme weather.

Households will also be given new information to help Victorian consumers lower their energy bills and better understand the benefits of switching to efficient electric alternatives.

These incentives and reforms build on existing programs:

- The 10-year \$1.3 billion Solar Homes Program, which is providing 778,500 rebates to support Victorian households to install solar PV panels, solar hot water and electric heat pumps, or battery systems at home
- The Solar for Business Program, which is supporting 15,000 Victorian businesses to install solar PV systems at their work premises
- The Big Housing Build program, with thousands of new energy efficient public housing units being built and upgrades of 35,000 social housing units underway, with all-electric specification wherever possible

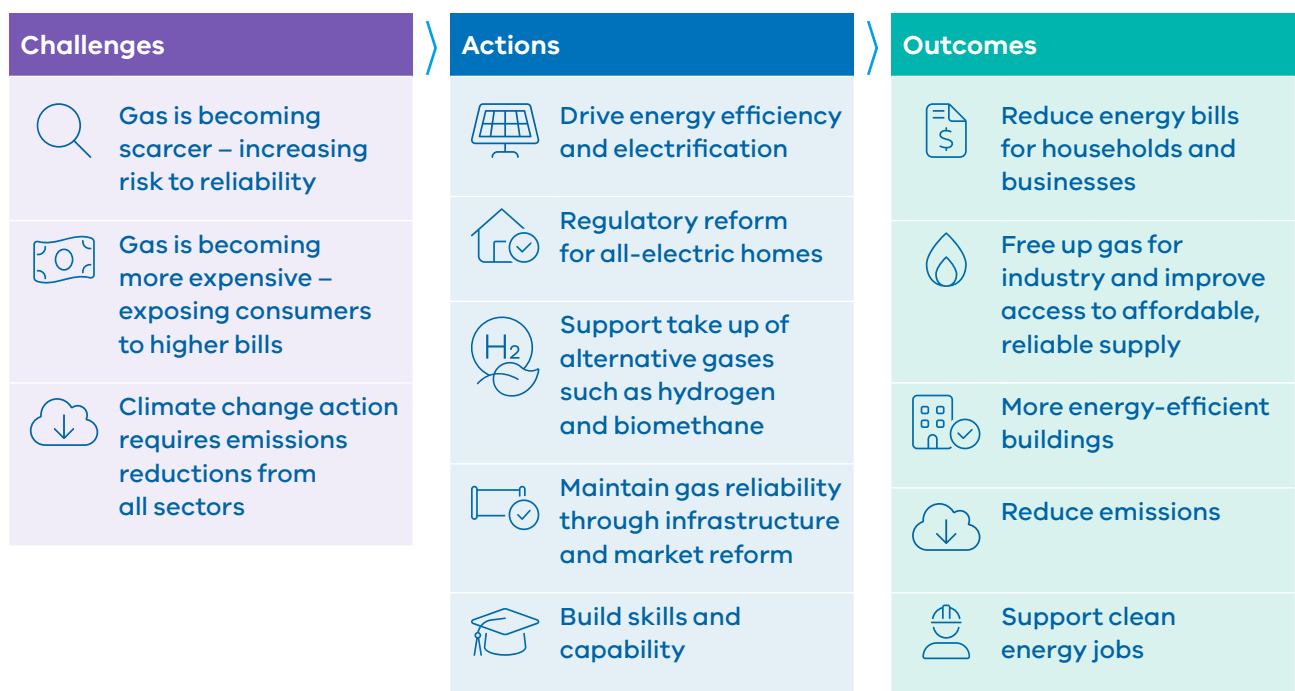
Some users cannot readily electrify, and they will require alternative gases as a gas substitute. This Roadmap describes regulatory and policy reform that will move the market towards a renewable energy future, while maintaining reliability, by developing frameworks to assist the large-scale uptake of renewable gases and hydrogen.



Together, these programs and policy reforms are expected to deliver major benefits to Victoria:

- Help Victorian households save on their energy bills by taking up rebates to switch to efficient electric appliances – with a focus on vulnerable Victorians.
- Free up a diminishing resource for industries and processes that rely on fossil gas, and improve energy security and reliability
- Support over 2,200 jobs and industry development, while reskilling and preparing the Victorian workforce to take up these sustainable employment opportunities
- Attract hundreds of millions of dollars of private investment to Victoria, including regional areas, and establish a thriving new hydrogen sector

FIGURE 1 Roadmap program logic





The Roadmap is informed by significant modelling and analysis, and extensive stakeholder engagement.

Modelling undertaken for the Roadmap found that emissions from Victoria's fossil gas sector may remain unchanged or even increase without immediate policy action. This analysis found that a combination of technology pathways – including switching to electricity, use of hydrogen and biomethane and energy efficiency – will better meet the energy needs of Victoria's diverse gas users than using any single technology pathway on its own. Electrification and energy efficiency will play a dominant role in reducing gas use this decade, and renewable gases and hydrogen will also be essential for the sector to reach net zero emissions.



Modelling has demonstrated that electrification reduces emissions and reduces household energy bills – effective immediately.

For example, an existing detached dual-fuel home with rooftop solar that converts to efficient electric appliances could save around \$1,250 per year. For an existing detached home without solar, going all-electric could save around \$1,020 per year. Further analysis demonstrated the significant value – both upfront and over time – to new home buyers of electrifying new homes.

Lowering energy bills is a high priority for the Victorian Government. That is why the Government is continuing to provide innovative programs that help Victorian homes and businesses access these savings by installing efficient electric appliances. The Roadmap analysis also finds that improving energy efficiency is critical to save on energy bills and remains an important way of reducing emissions over the next decade. This Roadmap outlines reforms to planning and building regulations, and action to implement higher standards for new homes and to lift standards for commercial buildings in 2025.

Consumers – particularly vulnerable households and gas-reliant businesses – will need help to switch from gas to efficient electric appliances where they make a choice to do so. The Government's programs are targeted to support those most in need.



Electrification reduces demand for fossil gas, freeing up gas for industrial users to secure it on more affordable terms.

The modelling shows that widespread electrification does not materially increase energy costs for users that do not switch, as increases in gas network tariffs (driven by declining volumes) are largely offset by reduced price pressure in the wholesale gas market. Effective and efficient regulation can help minimise network costs.



We must ensure Victorians can access affordable and reliable energy throughout the transition.

This need is particularly acute given recent unprecedented increases in east coast wholesale gas and electricity prices. The Roadmap outlines a range of actions the Victorian Government is taking to protect consumers from exposure to high and uncertain international gas prices and the actions that the Victorian Government is taking to accelerate the shift to low-cost renewables.

Even under the challenging conditions of winter 2022, Victoria has continued to play a critical role in supporting the east coast gas market, with gas processed in Victoria also flowing into northern states. This continues the role Victoria has played for many years as a net exporter of gas to the east coast market, meeting both its own needs and providing significant exports to New South Wales, the Australian Capital Territory, South Australia and Tasmania. For example, in 2021 Victoria processed 331 petajoules (PJ) out of the 553 PJ used for domestic consumption in Australia's east coast gas market.

Recognising the growing pressure on Victoria's traditional sources of gas and the wider gas market, the Roadmap includes important measures to maintain the reliability of gas through the transition.



The Victorian Government has supported the planning of, and investment in, necessary production, pipeline and storage projects to support reliable and secure gas supply, and is driving market rule changes to support increased gas storage. In 2022, the Victorian Government has actively ensured the following critical infrastructure projects:

- In March 2022, granting the pipeline licence for APA Group’s Western Outer Ring Main project. This project will improve the reliability of Victoria’s gas transmission system and will allow more gas to flow into storage at the Iona Underground Storage facility in the west of the state.
- Also in March, Esso Australia confirmed it would invest \$400 million to deliver an additional 200 PJ of gas over five years, with about 30 PJ to come online in 2023.
- In April 2022, the Victorian Government provided written support for the APA Southwest Pipeline expansion project, which subsequently passed through Final Investment Decision.



Alternative sources of gas will be essential for the gas sector to reach net zero emissions – and analysis indicates that action is needed now to develop options such as hydrogen and biomethane.

These options are particularly important for some industrial energy users, with activities that are harder to electrify.

Recognising this, the Victorian Government has supported universities, energy companies and other innovative organisations to advance hydrogen technology and to prepare to produce, and use, hydrogen at scale. In March 2022, the Government provided \$10 million for a renewable hydrogen highway transport backbone along Victoria’s busiest freight corridor, in addition to grants provided through the Renewable Hydrogen Commercialisation Pathways Fund and Renewable Hydrogen Business Ready Fund. Funding has been provided to most major Victorian universities, for hydrogen skills and products, through the Victorian Higher Education State Investment Fund.

As renewable gases and hydrogen are taken up at increasing scale, including blending in the network, effective market frameworks will be needed for cost recovery. Exploring these options – including a nationally consistent approach – will be a priority for Victoria. The Victorian Government has been leading on major reforms to enable a nationally consistent approach to regulating hydrogen blends and other renewable gases to facilitate blended hydrogen in the Declared Wholesale Gas Market. The Victorian Government will consider establishing a renewable gas scheme, and renewable gas targets, to help drive investment in gas substitution and guide transition planning for businesses, consumers and energy market participants.



The impacts of the transition of the gas sector to net zero emissions will be profound and far-reaching over coming years. An equitable transition is essential.

This transition brings tremendous opportunities for Victoria. New employment will emerge, such as in retrofitting buildings, making and installing efficient equipment, building new infrastructure, and producing biomethane and hydrogen. The Government will seek to retrain and reskill workers to take up these jobs.

The Gas Substitution Roadmap is just the beginning of the journey to a net zero emissions future. There is more to be done and collaboration across the Victorian community is vital to ensure the journey is smooth and well-coordinated. The Victorian Government is committed to continuing its engagement with all stakeholders as it progresses the actions set out in this Roadmap and continues to plan the path to net zero emissions, with regular public updates, starting in 2023, to this Roadmap process.



Introduction

Gas is an important energy source for many Victorians, and despite Victoria still processing more than we consume, it is becoming more expensive primarily due to increased export of gas nationally, creating greater competition for Victorian resources, as well as, more recently, international supply disruptions.



Many Victorians have faced higher gas bills in the last three years, with the trend towards higher gas prices influenced by links to international prices. Indications are that global events will continue to place upward pressure on global gas prices.

Recent events in Ukraine and Russia are already having energy market impacts, including international gas prices increasing dramatically and impacting domestic gas prices. This is on top of existing predictions that domestic gas prices will rise into the 2030s due to tight supply.¹ Alongside price pressures, tight supply is also increasing the risk to gas supply reliability.

Over two million Victorian households and businesses currently use fossil gas. The Victorian Government is taking steps to support a reliable and affordable supply, while freeing up gas for other customers, particularly industrial customers who are reliant on gas to continue manufacturing. These actions include exploration and production of new gas resources to ease pressure in the short term, but the longer term solution is to shift away from the use of fossil gas. To give more Victorians more choice, the Victorian Government is acting to remove barriers to all-electric homes, making it easier for Victorians that wish to switch away from gas, to do so. Analysis for the Roadmap shows that, for many customers, switching to efficient electric appliances will provide significant savings on their energy bills.

At the same time, the gas sector must decarbonise if Victoria is to meet its interim greenhouse gas emissions reduction targets, on the path to net zero emissions in 2050. The Victorian Government is committed to reaching net zero greenhouse gas

emissions by 2050 and has set emissions reduction targets to halve emissions by 2030 to get us there. Achieving our interim targets, and ultimately net zero emissions, will require us to cut emissions across the entire economy – including from the use of fossil gas by households, industry and commercial businesses.

The Roadmap will help Victoria achieve these interim targets and navigate the path to net zero emissions, while helping guide the gas sector through the unprecedented changes it already faces, in light of global pressure on gas supply and record prices, and depleting local gas supplies. For many households and businesses this will be a big change, and the Government won't be forcing people to make the switch before they are ready. But with such clear benefits for many consumers, we can start the transition by encouraging and assisting those that want to reduce their dependence on gas.

The Roadmap sets out what we have heard from the Victorian community and industry in submissions to the Roadmap Consultation Paper and through other consultation (see [page 17](#)), and advice of others, including Infrastructure Victoria. And the Roadmap has been informed by detailed multi-sector modelling, which examined potential transition technologies and pathways for the gas sector (see [Appendix](#)).

¹ Australian Competition and Consumer Commission, August 2021, July 2021 interim report; Lewis Grey Advisory, 2021, report to Australian Energy Market Operator, Gas Price Projections for the 2021 Gas Statement of Opportunities – Public Version

Public consultation activities supporting the Roadmap

Reducing emissions on such a broad scale will affect many stakeholders. The Victorian Government has sought the views of community and business stakeholders to better understand the opportunities and challenges that transitioning the gas sector to net zero emissions will bring.

This Roadmap has been informed by extensive community and industry consultation, including:



Stakeholder forums

Two stakeholder forums in February 2022, where findings of interim modelling were shared and discussed by around 300 attendees.

More than 100 stakeholder interviews, conducted over 2021, to help inform analyses to support the Roadmap.

A series of stakeholder forums held in late May 2021, with representatives from the gas and electricity supply industries, market regulators, consumer and social welfare organisations and environment and climate change groups. These forums provided valuable insights into key issues for each sector. A public forum, held on 13 July 2021, allowed for broader discussion of gas decarbonisation pathways and the Consultation Paper.



Public Consultation Paper

A public Consultation Paper, released in June 2021, which presented a range of potential decarbonisation pathways, as well as key issues related to the gas sector transition. A broad spectrum of stakeholders participated in this engagement, representing Victoria's diverse community, critical commercial and industrial sectors, natural and built environments, and growing energy industry. The consultation received 287 responses - 150 from individuals and 137 from organisations.



Household consumer survey

To understand households' preferences for gas and electric appliances for cooking, heating, cooling and hot water. Current home owners, likely future home owners and landlords were all engaged through [this survey](#).



Targeted industrial gas user survey

Conducted confidentially in mid-2021 to understand energy management issues and the energy preferences of industrial large users of gas and their capacity to switch to more sustainable energy sources.



Responses to the Gas Substitution Roadmap Consultation Paper

Total submitters	287
Formal submissions	162
Responses to questions	208

Individual consumer 150

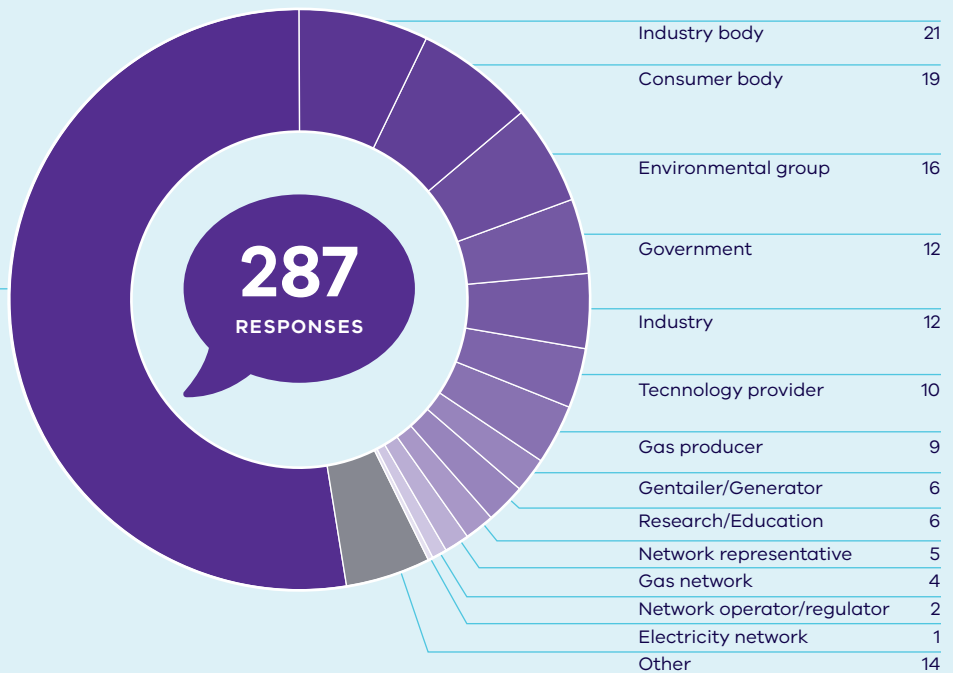


FIGURE 2 Alignment of Roadmap actions to stakeholder feedback

		
CONSULTATION PAPER ISSUE	FEEDBACK	ACTIONS AND OUTCOMES
 Maintaining the reliability, affordability and safety of gas supply	<p>Potential challenge of inconsistent gas blends and the need for controls</p> <p>Reliability of supply continues to be highly valued including by industrial customers</p> <p>There is a need to appropriately balance reliability and affordability</p>	<p>Energy efficiency and electrification can free up gas for industrial users</p> <p>Maintain reliability by supporting infrastructure investment and making market and regulatory reforms</p>
 Transitioning to more sustainable gaseous fuels with minimal disruption to end-users	<p>Transitioning away from gas is not possible for every user</p> <p>Consumers need to be supported in the transition</p>	<p>Actions free up gas for industrial users</p> <p>Develop renewable gases – building on hydrogen projects and preparing the market for take up at scale</p>
 Maintaining electricity reliability in light of new sources of demand	<p>Electricity system security was a key concern in light of increased electrification</p> <p>Electric vehicles and other decarbonisation impacts have to be considered</p>	<p>Improve energy efficiency, to manage demand</p> <p>Work closely with the market on demand and supply projections and to support timely infrastructure investment</p>
 Supporting Victoria’s workforce, industry and the institutions that support them	<p>Opportunity to leverage and transition existing skills to support industry development</p> <p>Requirement to act now to ensure there is not a skills shortage or major job impacts</p>	<p>Build skills and capability, through Clean Economy Workforce Skills Initiative, and provide support to upskill to install electric and renewable technologies</p>
 Managing uncertainty in the transition	<p>The transition will require ongoing engagement across all representative groups</p> <p>Clear government planning and goals, with the implementation of a phased approach can help reduce uncertainty</p>	<p>Roadmap identifies priorities, advances all technologies, and guides a considered and ordered transition</p>
 Transitioning the Victorian economy efficiently and equitably	<p>Opportunity to expand existing support programs to facilitate an equitable transition</p> <p>Reform regulation to enable the transition by improving minimum standards (e.g. of appliances; for rental accommodation)</p>	<p>Incentives for efficient electric appliances target vulnerable consumers</p> <p>Actions, including regulatory reform for all-electric homes, enhance consumer choice</p> <p>Training and upskilling for workers</p>

Infrastructure Victoria's advice to the Victorian Government on gas infrastructure

The Gas Substitution Roadmap has been informed by Infrastructure Victoria's analysis of Victoria's gas infrastructure needs, as detailed in its Final Report, **Towards 2050: Gas infrastructure in a net zero emissions economy**.



[infrastructurevictoria.com.au/
project/infrastructure-victoria-
advice-on-gas-infrastructure/](https://infrastructurevictoria.com.au/project/infrastructure-victoria-advice-on-gas-infrastructure/)

Parliamentary inquiry into renewable energy in Victoria

On 4 March 2020, the Victorian Legislative Council Environment and Planning Committee was tasked with providing an update on Victoria's progress in the transition to 100 per cent renewable energy.

As part of this, the Committee was asked to identify the benefits and implications of the transition, the public and private investment required, how government could enable a just transition, and what opportunities exist to further reduce emissions.

In May this year, the Committee's report, **Inquiry into renewable energy in Victoria**, was tabled in Parliament and included 32 recommendations to government. The inquiry explored the transition away from gas in Victorian homes and businesses, and found that "switching Victorian households from gas will contribute significantly to lowering carbon emissions, save household costs and help to avoid the health risk associated with gas".

The Victorian Government, through its existing energy programs and through the actions outlined in this Roadmap, has already made progress on a number of these recommendations. The Government welcomes the report and is currently considering recommendations.



Fossil gas today

Gas has been a crucial part of Victoria's energy mix for many years, but with rising gas prices and instability globally in regard to supply, this will need to change. It will help achieve Victoria's emissions reduction targets, while also improving energy affordability.

Gas is an important energy option for many Victorians. In fact, many Victorian households and businesses currently consume more energy in the form of gas than they do electricity. Gas is used in all sectors of the Victorian economy, including in the manufacturing, construction, agricultural and chemical industries. The use of gas by around two million Victorian households and businesses for heating, cooking and hot water is currently greater than in any other state or territory in Australia.

Using fossil gas also contributes significantly to Victoria's greenhouse gas emissions. Recent estimates indicate that the gas sector contributes about 17 per cent of the state's net emissions.² These emissions arise from burning gas directly for heat ('direct combustion') and from fugitive emissions associated with the production and transport of fossil gas.

Meeting our emissions targets requires action to reduce fossil gas use

Achieving the emissions reduction targets set out in [Victoria's Climate Change Strategy](#) requires that all sectors of the Victorian economy make substantial contributions to meeting these targets. Victoria is on track to meet its 2025 emissions target, but action must increase if our state is to meet its more ambitious 2030 targets.

Victorian gas use and associated emissions have both grown since 2005, the base year for setting Victoria's emissions reduction targets. Modelling undertaken for the Roadmap indicates that, if no action is taken, Victorian gas consumption will remain broadly at today's levels for at least a decade.

² DELWP analysis of National Greenhouse and Energy Reporting scheme data and Australian National Greenhouse Accounts, 2019



It will take years to shift from our historic investment and reliance on fossil gas. To achieve our end goal of net zero emissions, action is essential now, through increasing energy efficiency, adoption of efficient electric appliances across households and businesses, and strategic investments and policy reform to build Victoria's hydrogen and biomethane industries.

Other renewable energy technologies, such as geothermal energy and concentrated solar thermal energy, can be utilised to decarbonise gas. If proven to be technically and commercially feasible in Victoria, these could become an important part of decarbonising gas use.

The Victorian Government is actively supporting the commercialisation of innovative, emerging renewable energy technologies through the Energy Innovation Fund. In the first round of funding, the Government invested almost \$38 million to support three offshore wind projects. The second round was open to any renewable technology type that met the eligibility criteria, and funding outcomes are expected to be announced later this year.

The priorities and commitments outlined in this Roadmap will promote consumer choice and help guide planning and decision making of businesses, consumers and energy market participants. Over time, the changed context and aspirations of our community will be reflected in investments, technologies will mature, and the private sector will build momentum in taking up gas substitutes.

Over the course of the transition, more investment and reform will be essential to accelerate the decarbonisation of the gas sector. Government will work with business, industry and consumer groups to develop and put in place further actions to increase fossil gas substitutes and emissions reductions from the gas sector, for a smooth transition to net zero emissions. Following the release of this Roadmap document, we will undertake further consultation with industry and the community, and publish a Roadmap update in 2023 to further progress the transition.





2

**Actions to support
electrification,
lower energy bills
and decarbonise
the gas sector**



Promote consumer choice, help households upgrade to electric appliances, lower energy bills and improve energy efficiency of homes

Victorian Government actions

Rebates and incentives to support efficient, electric homes

The Victorian Energy Upgrades (VEU) program supports households and businesses to reduce their energy costs by installing energy efficient equipment. The VEU has been in operation for a number of years and will now evolve to take advantage of electrification to deliver lower bills. The Government will develop new incentives through the VEU program to help replace gas water heating and space heating with efficient, low-emissions electric equipment while phasing out incentives for all residential gas products by late 2023. The program will also provide new electrification options and support for business, while continuing to help those businesses who can't shift off gas to make their operations more efficient. The Government will shortly be releasing discussions papers regarding these changes and will work with industry to implement these changes. Replacing gas appliances with efficient electric appliances has the potential to save households with solar panels around \$1,250 per year. For households without solar, going all-electric could save around \$1,020 per year.

The Victorian Government's landmark programs to support household electrification and lower energy bills will continue to support efficient, electric homes:



The \$1.3 billion Solar Homes Program is providing 778,500 rebates to support Victorian households to install solar PV panels, solar hot water and electric heat pumps, or battery systems at home. To date around 57 per cent of program applicants have had a combined household income of less than \$100,000 per year. More than 200,000 solar panel, battery and solar hot water systems have been installed through the Solar Homes Program since its launch in 2018.



The Home Heating and Cooling Upgrades program is supporting vulnerable and low-income Victorian households to install efficient electric reverse cycle air conditioners for heating and cooling.



The Big Housing Build program is well underway, with thousands of new energy efficient public housing units being built, with all-electric specification pursued wherever possible. The Energy Efficiency in Social Housing Program is also upgrading 35,000 social housing properties and will not install gas appliances, with efficient electric alternatives installed instead.

Products eligible under these programs may also be reviewed to ensure that technologies provide strong support for electrification, energy efficiency, and maximise consumers' benefits from solar PV and potential emissions reductions.

Removing barriers to all-electric developments and improving energy standards



The Victoria Planning Provisions, which give gas distribution businesses a formal approval power for new residential subdivisions, will be changed in 2022, to remove the effective mandate to connect to gas, giving consumers more choice about how they source their energy needs. This will mean more all-electric homes will be available to consumers that want them.



The Victorian Government is proposing stronger efficiency standards for new homes to be introduced through the 2022 National Construction Code (NCC), including a move to 7 stars and new requirements for fixed appliances such as heating and cooling, hot water systems and lighting, to come into effect. Victoria will also align the Plumbing Regulations 2018 to ensure consistency with the changes to the NCC 2022, and to remove barriers to the installation of efficient electric hot water systems, helping households to capture further benefits from investing in solar panels, and supporting those who choose all-electric new homes. This change is linked to stronger energy efficiency requirements for new homes, planned for adoption from the last quarter of 2022 with a transition period.

Under NCC 2022, new homeowners and developers will be able to choose a mix of fixed appliances that suit them (including heating, cooling and hot water) provided they meet the new whole of home energy budget. The whole of home energy budget provides for installation of on-site energy generation and storage (e.g. solar panels) and will be supported by new tools through the Nationwide House Energy Rating Scheme (NatHERS).



Minimum energy efficiency standards for rental homes are being introduced to cut bills and improve comfort for renters. A new heating minimum standard took effect in March 2021, with standards for ceiling insulation and draught proofing proposed for future consideration.

Information for households to electrify and improve energy efficiency



Public education, targeting households in winter, will explain the practicalities and benefits of reducing or switching away from gas. Using reverse cycle air conditioning to heat homes, for example, can free up significant gas demand – including at peak time – and can save households on bills.



Through the Residential Efficiency Scorecard program, homes can receive an energy star rating and advice on how to save money on energy bills. Assessments and information are tailored specifically for each individual home and are delivered by government-approved assessors.



The disclosure of the energy performance of homes provides householders with actionable information about ways to improve the energy efficiency of their home. A draft national disclosure framework was released in 2022. The document outlines the settings for state and territory governments to implement disclosure schemes. Over 2022, a national cost-benefit analysis on options for the disclosure – including mandatory disclosure – will be prepared, which will help inform future disclosure policy in Victoria.

Household energy bill savings and outcomes of electrification

There are immediate benefits to consumers that switch to efficient electric appliances, through lower energy bills (see [Box 1](#)).

A more major switch – to an all-electric home – significantly reduces household energy bills.³ This is, in part, because avoiding a gas connection charge itself is a significant saving; connection charges vary, but are generally between \$250 and \$300 per year. Modelling analysis finds that a household living in an existing, typical detached house that moves from using gas for heating, hot water and cooking to using efficient electric appliances could reduce its average annual energy bill by around \$1,020 per year. If that household has rooftop solar, the same switch could achieve savings of around \$1,250 per year (in addition to the approximately \$950 per year average savings a typical household could expect from installing a 6.6kW solar PV system alone).

BOX 1

Illustrative energy bill savings, switching from gas to electric hot water and space heating

Upgrading hot water systems and space heating offer major savings:

- Replacing an old electric storage water heater with a heat pump can save around \$500 per year, and replacing an old gas storage or instant water heater with a heat pump can save between \$100 and \$200 per year.
- Should the home have solar panels installed, the bill savings increase significantly, with solar power supplying most of the heat pump's electricity usage.
- Replacing an old gas room heater with an individual split system reverse cycle air conditioner can save \$150 to \$200 per year on bills. If a multi-split reverse cycle air conditioning system replaces an old gas ducted whole-of-house heating system, it can save in the order of \$500 to \$600 per year.

³ The modelled potential household energy bills savings do not include the upfront costs of replacing appliances. The modelling assumes end-of-life appliance replacement, but different homes will be in different situations regarding the need for, and costs of, appliance upgrades.

FIGURE 3 Residential energy bills, detached dwelling, 2022

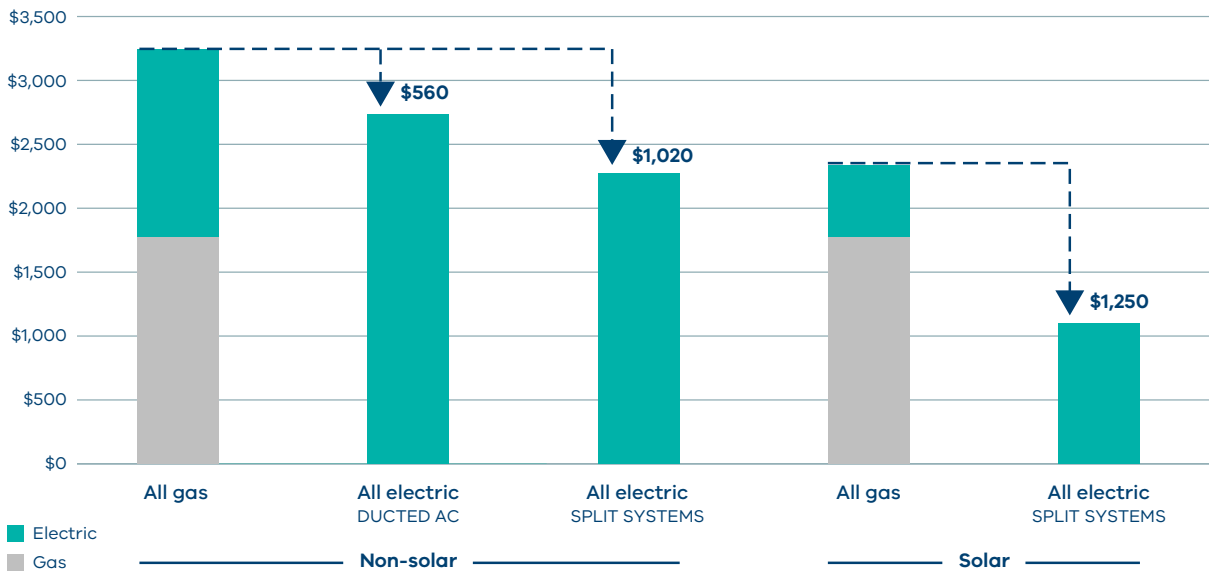


Figure 3 compares combined electricity and gas bills⁴ for a typical, existing detached home with different appliance choices. These savings assume that the home does not take steps to improve its energy (building) efficiency, which could further increase savings.

Not all energy users will want or be able to switch to electric appliances. Consumer survey results suggest that – combined with complex or inadequate information – inertia, and preferences for selected features of gas appliances, may prevent investment in electric appliances, even though they can be more efficient and have lower running costs. At present, many are confused about the potential savings and options, and are missing the opportunities presented through electrification. Government support through the Solar Homes and Victorian Energy Upgrades programs will help to overcome these barriers, and help consumers realise the benefits of going all-electric. The Government will also provide

information to Victorians about the benefits for reducing – or switching from – gas use.

Households that take advantage of the Government’s incentive programs are likely to achieve significant bill savings but, crucially, households that do not, are expected to be able to continue to use gas without significant bill increases.

For new homes, there are major benefits if they are all-electric. They avoid the cost and disruption of switching from gas to electricity in the future, and all-electric precincts can also avoid the cost of building new gas mains and reticulating gas infrastructure around the building. Analysis suggests that standard electricity connections are suitable for new homes to be all-electric. New all-electric homes can also save on costs upfront since they will have one heating and cooling system, instead of two separate ones (i.e. gas heating, electric cooling). The Government’s regulatory changes will help ensure many more all-electric homes are available for Victorians that want them.

4 Government modelling, rounded to the nearest \$10.

Accessing affordable energy during the transition

Victoria's nation-leading energy consumer protection framework, retail market reform and information help ensure Victorian households and businesses have access to affordable energy:

To ease cost of living pressure and help Victorians get a better deal on their energy bills, the 2022-23 Victorian Budget invested \$250 million so all Victorian households can apply for the new **\$250 Power Saving Bonus**. All households are eligible for this payment, if they use the Government's **Victorian Energy Compare** website – the only free independent energy comparison website with all generally available gas, electricity and solar offers in Victoria.

The Victorian Government's **Energy Fairness Plan** further strengthens access to affordable gas supply, by banning retailers from using high-pressure sales tactics like door-to-door sales and unsolicited telemarketing, and strengthening the investigation and enforcement powers of Victoria's independent energy regulator, the Essential Services Commission.

Requirements for energy retailers mean that clear advice will be provided to Victorians, enabling real comparisons between energy offers and informed decisions about their gas supply. Retailers must proactively provide information to consumers facing payment difficulty about available support, and tailored options to help manage their bills. The payment difficulty framework sets minimum standards of payment assistance so that disconnection of supply for non-payment of a bill is a measure of last resort.

The **Energy Info Hub** web platform provides comprehensive information for community organisations to help consumers find an appropriate energy offer.

Impact of electrification on non-energy emissions

It is also important that electrification is supported by good management of refrigerant gases used in appliances such as reverse cycle air conditioners and heat pump water heaters. These gases commonly have a much greater effect than carbon dioxide on global warming – sometimes several thousand times greater per unit of mass. At the same time, using these technologies to decarbonise gas does result in a significant net reduction in emissions.

Modern refrigerant gases have much less global warming impact than those found in older appliances. This means that the lowest impact refrigerants must be used in any future transition involving electrification, and maintenance and end-of-appliance-life management must also be considered.

The Victorian Government recognises this issue must be managed effectively to ensure that electrification reduces emissions as much as possible. Our 2020 Industrial process and product use sector emissions reduction pledge sets out plans for Victoria to improve the management of refrigeration and air conditioning (RAC) equipment and refrigerant gases at a state level, while advocating for further national action to reduce emissions from RAC equipment and accelerate the transition to lower-emissions alternatives. For example, the Victorian Government's Home Heating and Cooling Upgrades program only funds the installation of heat pumps using low global warming potential (R32) refrigerants.⁵

The Government is also working with Victorian industry to provide targeted guidance on how to reduce leakages of refrigerant gases in industrial settings.

⁵ Less than 700 times the global warming impact of the same mass of carbon dioxide.

Historically, gas provided a lower-emissions energy source than electricity, primarily due to Victoria's heavy reliance on brown coal generation. This is changing rapidly as wind and solar play an increasing role in Victoria's electricity mix, and as old brown coal power stations retire.

The high efficiency of many electric appliances, such as reverse cycle air conditioners and heat pump

water heaters, complement this cleaner grid, and mean that adopting efficient electric appliances now reduces emissions ([Box 4](#)).

The Solar Homes and Victorian Energy Upgrades programs take advantage of these trends to push Victoria's emissions down, contributing to the state's interim and long-term emissions reduction targets.

BOX 4

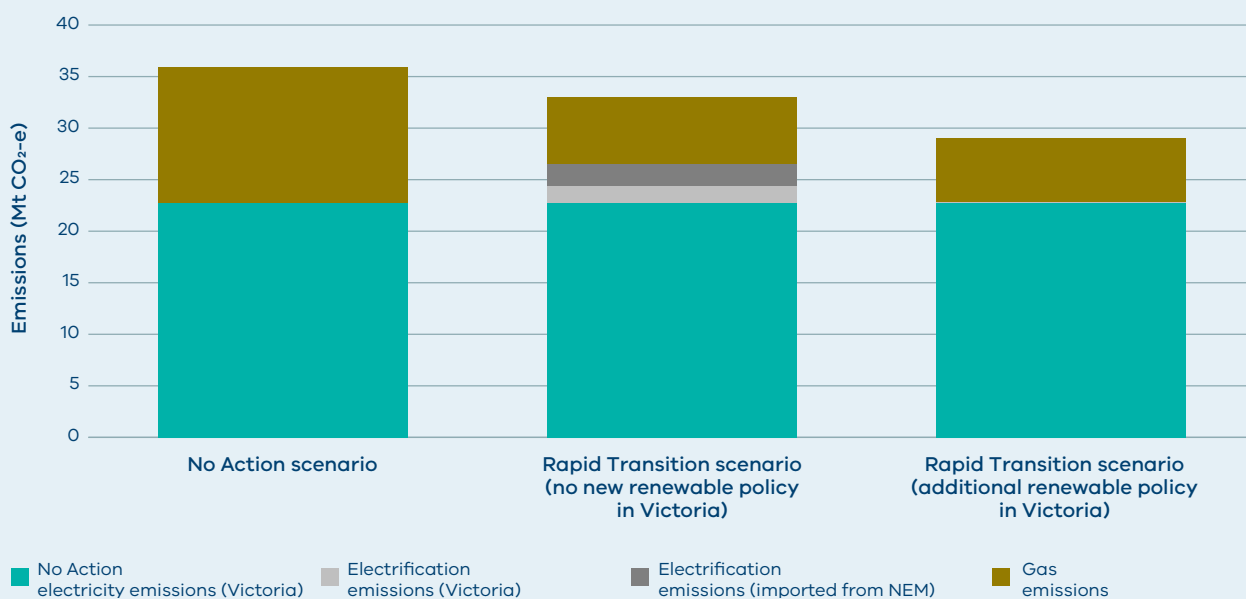
Electrification reduces emissions

The Roadmap scenario modelling finds that electrification – switching from gas to electric appliances – will reduce emissions in the near term. This is possible despite the high emissions-intensity of Victoria's brown coal generators because only a small portion of the additional demand from electrification is provided by brown coal. Rather, the incremental demand is more typically met by increased output from coal generators in other states, gas generators, or by additional low-emissions generation that would have been wasted without the additional electricity demand.

The scenario modelling analysed a sensitivity where there was no additional policy-led investment in low-emissions generation in Victoria. **Even under this assumption, the mix of generation that supplies additional demand still produces less emissions than the gas use it displaces.**

The scenario modelling reflects the Victorian Government's long-standing commitment to decarbonising the electricity system and assumes that additional demand from electrification will be broadly matched by investment in new Victorian renewable generation. This reduces the incremental emissions from electricity to almost zero and significantly increases the emissions saving from electrification ([Figure 4](#), right-hand column).

FIGURE 4 Victorian combined gas and electricity emissions 2030



source Roadmap scenario modelling

Increased electrification can have impacts on non-energy emissions (Box 3) and on the electricity grid, but these can be managed. The Roadmap’s scenario modelling confirms that electricity demand, including demand at peak times (in winter), would increase because of electrification, but also shows that this investment in the grid is worthwhile.

The full costs of generation and network investment were included within each scenario and compared at a total system cost level, and the modelling still selects electrification as a critical and economically efficient path to lower emissions.

Electrification of gas load will require significant investment in electricity infrastructure, but we have time to prepare and plan for this. Electrification, alongside increasing adoption of electric vehicles and ongoing population growth, will start to noticeably impact peak electricity demand as we approach 2030 (see Figure 5).

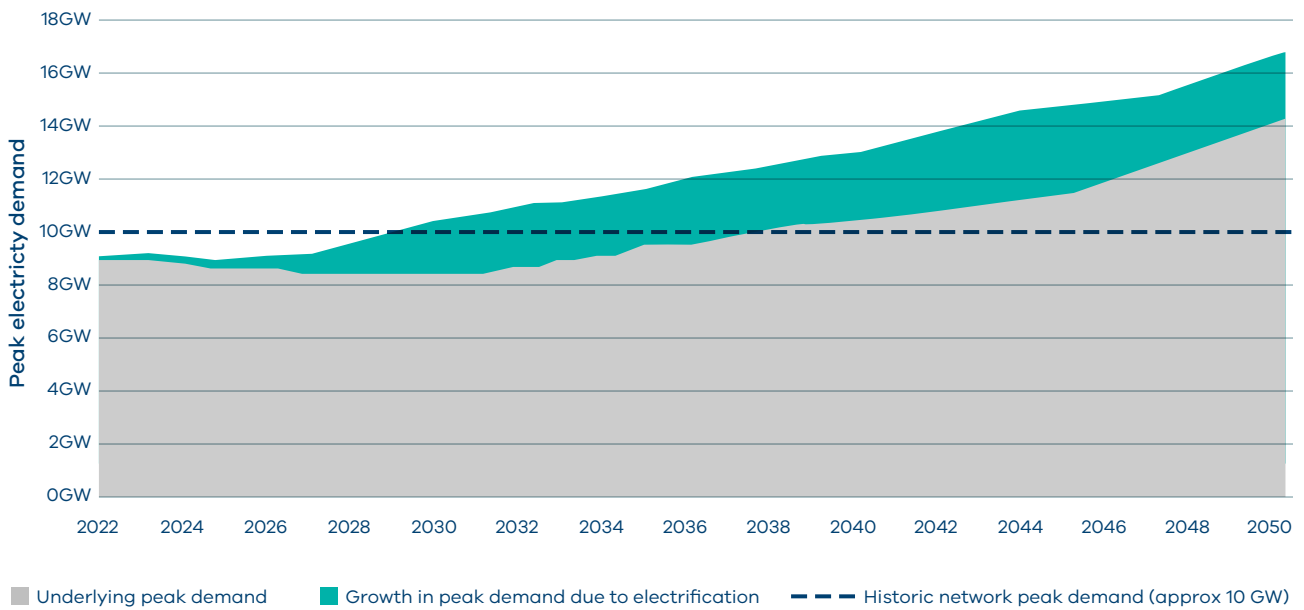
This effect is delayed because Victoria’s electricity grid has significant ‘headroom’ in winter – winter peak demand is consistently two gigawatts less than summer peak demand. This investment task will require timely action from key players across the energy sector, especially alongside the likely growth in demand from electric vehicles.

This includes close monitoring and timely action by the Australian Energy Market Operator (AEMO) and other market agencies to address emerging challenges, government action on key market reforms, and timely investment from network companies and generation investors.

The growth in demand and required investment is likely to occur over many years, but early planning is necessary to ensure that this can be delivered in time.

The Victorian Government will work with electricity distribution businesses to understand the potential investment required, well ahead of their next revenue determination period (starting in mid-2026).

FIGURE 5 Projected growth in peak demand RAPID TRANSITION SCENARIO



SOURCE Roadmap scenario modelling



What we heard

Electrification and energy efficiency

A number of stakeholders emphasised the important role energy efficiency and electrification can play to manage energy use and greenhouse gas emissions

“ Victoria has the highest national level of gas reticulation and residential gas use but this presents an opportunity to capture low-cost energy efficiency and electrification opportunities and take bold, innovative action to embrace the opportunities.

AGL

“ The key benefits of energy efficiency for the end users include reducing the need for gas (and electricity). The co-benefit of energy efficiency is that it lowers operating costs, reduces load on the grid, improves occupant comfort and enhances the resilience of the buildings to extreme weather events, as well as improving safety ...

PROPERTY COUNCIL OF AUSTRALIA

“ AIRAH believes the best approach is to focus on measures and technologies that are achievable and available now. Many excellent opportunities already exist to slash emissions, improve affordability and safety, and enhance the wellbeing and health of occupants. ... electrical appliances such as heat pumps for air conditioning and water heating are already available and more energy efficient than their gas equivalents.

AUSTRALIAN INSTITUTE OF REFRIGERATION, AIR CONDITIONING AND HEATING

“ Electrification of many activities will be more efficient and will result in lower emissions. As the electricity grid moves to higher renewables penetration, electric appliances get increasingly de-carbonised as a result. As more roof-top solar PV gets installed, further de-carbonisation results.

LIGHTER FOOTPRINTS

“ For households, there are a range of existing electrical appliances available that can heat and cool the home, be used for cooking and hot water heating that are far more efficient than their gas equivalents. The electricity network also has the potential to become 100% renewable in future years.

CONSUMER ACTION LAW CENTRE









Helping Victorian businesses cut energy bills

Victorian Government actions

New and continuing Victorian Government programs that help businesses reduce their energy bills and emissions include:

-  The Solar for Business Program, launched in May 2021, will support up to 15,000 Victorian businesses to install solar PV systems at their work premises, empowering businesses to generate their own electricity and minimise their bills.
-  The VEU program provides businesses with upfront incentives to reduce their gas use by installing new equipment such as efficient water heaters, space heaters and commercial and industrial gas boilers; a new commercial and industrial heat pump hot water activity was introduced in February 2022. Businesses can also earn credits for bespoke 'project based' energy efficiency, electrification and fuel switching activities that cut emissions. These projects have the potential to achieve significant reductions in gas consumption for businesses; work is underway to streamline activity requirements and to further encourage renewable energy investment through these projects.
-  The VEU program will soon drive more change in large energy users. It will incorporate a new exemption framework that will allow certain large energy users to opt-out of the scheme if they adopt accredited energy management practices. This will manage costs for these businesses, while helping them reduce energy use and emissions.
-  Victorian manufacturers will also benefit from nearly \$20 million provided in the 2022-23 Victorian Budget, including to invest in renewable energy and low-carbon component manufacturing, and to help their workers transition into highly skilled, digital jobs.



Stronger energy efficiency standards for new and refurbished commercial buildings will be developed for the 2025 edition of the National Construction Code. The Victorian Government will engage with industry on this and prepare them to meet new standards.



Sustainability Victoria's Small Business Energy Saver Program (run until June 2022) provided \$5 million in discounts to small businesses upgrading to more energy-efficient equipment, including hot water systems and efficient reverse cycle air conditioners.



\$60 million over 5 years will support Victorian farmers to improve on-farm energy efficiency and incorporate renewable energy into farming systems to make Victoria's agriculture industries resilient and internationally competitive.



In addition, the \$31 million Business Recovery Energy Efficiency Fund, allocated 110 grants across more than 25 industries in 2021, with these projects now helping businesses improve their energy efficiency and reduce energy costs through investment in capital works and energy demand management technologies.

Gas is used in a broad range of Victorian businesses, from heating commercial buildings to powering industrial processes in the manufacturing sector. Some of these businesses will be able to switch from gas to electricity to reduce their emissions and manage their energy costs. The commercial sector primarily uses gas for space heating, water heating and cooking, and so will often be able to switch these activities to efficient and widely-available electric technologies similar to those used in households. The use of gas in the industrial sector is more diverse, ranging from low temperature water heating requirements and low and medium temperature steam raising across sectors such as food and beverages and pulp and paper, to very high temperature needs in sectors such as metals, glass and ceramics.

Roadmap scenario modelling shows that whilst electrification is key to decarbonising the commercial and industrial sectors, as well as households, it also shows that for many users, particularly those with high temperature process energy needs, alternative types of gas are a lower cost decarbonisation option – this is discussed further in the next section, [Unlocking alternative gases and establishing a hydrogen industry](#). Lower temperature requirements are often well suited to electrification, in particular because high efficiency electric technologies can often meet these needs. For example, heat pumps are an electric technology that can heat water or lower-temperature steam using three to four times less energy than a gas boiler. Such high efficiency electric technologies may offer many businesses both emissions and energy bill savings.





Due to the diverse sizes, processes and energy needs of the commercial and industrial sectors, it is difficult to generalise about the potential savings from electrification or energy efficiency upgrades. As part of the Roadmap development, the Government surveyed a broad range of industrial gas users and found that many businesses are uncertain about potential savings and options for decarbonisation, and seek support for further investment. The Government will help a broad range of businesses, and particularly Small to Medium Enterprises, achieve significant energy bill savings with a range of existing programs.

The same survey indicated that Victorian industrial gas users have a strong interest in decarbonising, with energy efficiency their preferred decarbonisation action. Capital costs was still cited as a barrier; respondents noted that funding support, incentives and consistent energy policy are crucial for increasing uptake of decarbonisation options. Industry also called for help to better understand costs, commercial and technical viability of existing alternatives to gas (e.g. for heat).

Small businesses can access government support to electrify, improve efficiency and reduce energy bills now. The VEU program provides businesses with upfront incentives to upgrade water heaters, space heaters and commercial and industrial gas boilers – as well as many others. In 2020-21, more than 14,900 businesses received upgrades through the program. Thousands of small and medium businesses are also currently benefiting from additional discounts provided through the Small Business Energy Saver Program. The Solar for Business Program is also available for those wishing to install solar PV systems at their work premises. The Government continues to monitor the affordability of gas supply and will consider further measures as required to ensure Victorian small businesses can access affordable gas.

The Victorian Government will also build on its past investments in energy efficiency by driving improved performance of commercial buildings, through improved standards for new and refurbished commercial buildings under the National Construction Code from 2025. This will complement policy efforts to improve the efficiency of residential buildings. It will drive innovation and reduce energy use, in particular gas for space heating – delivering major bill benefits for many business tenants.



What we heard

Electrification and energy efficiency

Several stakeholders identified significant potential for commercial and industrial businesses to electrify and become more energy efficient.

“ Over the last two years A2EP [the Australian Alliance for Energy Productivity] has completed more than 20 studies assessing renewable alternatives to fossil fuelled process heating... we estimate that 35% or 20PJ of [Victorian] industrial natural gas heating demand can be reduced with energy efficiency measures or displaced economically with electrification.

AUSTRALIAN ALLIANCE FOR ENERGY PRODUCTIVITY

“ Improved efficiency is possible on virtually all [industrial] sites, and some sites can entirely eliminate gas use by adopting heat-pump water heaters for lower-temperature hot water. Some sites that need higher-temperature hot water can use heat-pumps to pre-heat water to a moderate temperature, and use gas-fired systems to take the water to the temperature that is required. While this will not fully decarbonise the natural gas use, it can significantly reduce gas emissions.

ENERGY EFFICIENCY COUNCIL

“ Through Green Star [a building efficiency rating tool] we are introducing requirements for new and existing buildings to be fully powered by renewables and be fossil fuel free ... while the rating tool acknowledges there may be a role for green gas or other renewable gaseous fuels in the future for specific uses, for most typical buildings the best, simplest, and cheapest solution will be electrification.

GREEN BUILDING COUNCIL OF AUSTRALIA





Unlocking alternative gases and establishing a hydrogen industry

Alternative gases, such as hydrogen and biomethane, are likely to play a significant and growing role in Victoria's energy future and will be critical to meeting our 2050 net zero emissions reduction target. This includes attracting new industries to Victoria, such as hydrogen exports and the production of renewable products such as fertiliser or metals and providing a flexible fuel for electricity generation to complement wind and solar. These gases also provide an important energy option for existing Victorian gas users.

The Victorian Government has set out its vision for renewable hydrogen⁶ in the [Renewable Hydrogen Industry Development Plan](#) – and the steps it will take to get there. Government actions will build industry capacity, create long-term jobs through new career pathways, drive innovation and reduce greenhouse gas emissions.








Modelling for the Roadmap confirms that hydrogen and biomethane play an important longer-term role in the gas transition to net zero emissions. Across a range of modelled scenarios, hydrogen and biomethane use grows through the 2030s and 2040s, particularly for industrial users.

Another important role for gaseous fuels is to provide a flexible fuel for electricity generation. Gas currently plays a 'firming' or 'peaking' role, turning on quickly to maintain reliability of supply during periods of high demand or drops in supply from other sources. The modelling suggests that, under some scenarios, gas-fired generation may continue to play a small role into the 2040s to complement growing renewable generation, which may be replaced with hydrogen-powered generation. Hydrogen and renewable gases can also play an important role in decarbonising the transport sector, which is a major focus of the Government's hydrogen funding. Both hydrogen and biomethane are currently higher cost energy options, and the technologies are not widely used in Australia.

⁶ Renewable hydrogen is hydrogen produced from entirely renewable energy, through a process called electrolysis (where hydrogen is separated from water). It produces no emissions during its production as well as when combusted, making it a zero emissions fuel source. Blue and grey hydrogen are not renewable as they are produced from fossil fuels (usually gas and, sometimes, coal). Blue hydrogen involves carbon capture and storage of resultant emissions, whereas grey hydrogen does not.

Victorian Government actions

Victoria is leading the way in building the foundations for a thriving hydrogen economy, as outlined in the Renewable Hydrogen Industry Development Plan, and preparing for the supply and take up of renewable gases at scale:

-  \$10 million for the Hume Hydrogen Highway program, a renewable hydrogen highway transport backbone, including at least four refuelling stations and around 25 new hydrogen-powered long-haul heavy freight vehicles, along Victoria's busiest freight corridor – the Hume Highway between Melbourne and Sydney.
-  Support for the education sector to build the required skills and develop the practices and products to grow the Victorian hydrogen sector through the Victorian Higher Education State Investment Fund which has included:
 - \$10 million for Swinburne University of Technology's Victorian Hydrogen Hub
 - \$9 million to support Deakin University's Hycel Technology Hub
 - \$4.7 million for the University of Melbourne's Zero Emissions Energy Lab
 - \$12 million to support Swinburne University of Technology's Aerostructures Innovation Research Hub
-  Support for the establishment of four regional Victorian Hydrogen Technology Clusters and the launch of the Victorian Hydrogen Technology Cluster Network.
-  \$6.6 million in grant support for projects that will see Victoria produce and use renewable hydrogen in real-world applications through the Renewable Hydrogen Commercialisation Pathways Fund.
-  \$600,000 in grants to support eight recipients to develop businesses cases or feasibility cases to support their transition to renewable hydrogen through the Renewable Hydrogen Business Ready Fund.
-  Working with the project proponents, Australian Gas Infrastructure Group and ENGIE, on the proposed Hydrogen Park HyP Murray Valley, backed by funding from the Australian Renewable Energy Agency.
-  Robust analysis of cost recovery options to drive the uptake of renewable gas will be undertaken, including a renewable gas certificate scheme, which could provide long-term, off-budget investment in hydrogen and biomethane.

It is important that Victoria continues to develop the industries and the capabilities needed to scale up production of renewable gases and hydrogen, to meet both domestic and export demand in the longer-term. Victoria has extensive gas infrastructure, and it may make sense to continue to use this infrastructure, but replace fossil gas with substitute fuels. The Australian Hydrogen Centre is looking at the technical feasibility for hydrogen blending and conversion in Victoria's gas distribution networks, which could commence with regional towns ahead of a broader transition.

Many existing gas users are seeking guidance and support to transition smoothly to new alternative fuels.

Biomethane is compatible with existing appliances and infrastructure, but is not likely to be available in large enough quantities to meet all renewable gas needs. Switching to hydrogen will generally require significant modifications to, or replacement of, existing gas-using appliances – particularly for industrial appliances – and the Victorian Government's 2021 survey of industrial gas users indicates both the technical challenges and upfront costs of switching are seen as potential barriers to taking up hydrogen. The Victorian Government has provided assistance to gas consumers to move to renewable hydrogen through grants offered under the Renewable Hydrogen Business Ready Fund, and will continue to build capacity through its partnerships and supply chain activities.

If hydrogen is to be taken up at scale, increased investment – and effective markets, regulation and cost recovery frameworks – are essential.

The Victorian Government will consider establishing a renewable gas scheme, and renewable gas targets, to help drive investment in gas substitution and guide transition planning for businesses, consumers

and energy market participants. We will report back in 2023 on the development of these proposals.

As alternatives to fossil gas are taken up at increasing scale, including blending in the network, effective market frameworks will be needed for cost recovery. Exploring these options – including a nationally consistent approach – will be a priority for Victoria.

Hydrogen Energy Supply Chain and CarbonNet projects

The Hydrogen Energy Supply Chain (HESC) project is demonstrating the conversion of Latrobe Valley coal and biomass to hydrogen for export to Japan. In January 2022, the world's first liquefied hydrogen carrier departed Victoria to transport hydrogen to Japan. For the project to progress to full commercial scale, it must achieve successful carbon capture and storage (CCS), as part of the CarbonNet project. Victoria's CarbonNet project is developing a CCS network in Gippsland through field investigations at the project's Pelican site in Bass Strait, off the South East coast of Australia. CarbonNet stands apart internationally for its potential to capture emissions from multiple sites. This network of sites brings together multiple carbon dioxide capture projects, including HESC, and transports the carbon dioxide through a shared pipeline for injection in deep underground offshore storage sites.

The HESC Project is delivered by a consortium of top energy and infrastructure companies from Australia and Japan – including Kawasaki Heavy Industries, J-Power, Iwatani Corporation, Marubeni Corporation, Sumitomo Corporation, and AGL – with the support of the Japanese, Commonwealth and Victorian governments. Over the next two years, the HESC project partners will undertake extensive research and development to determine the technical and operational requirements for a commercial-scale project. A commercial-scale project could enable Victoria to continue use of some fossil gas and produce hydrogen while meeting climate change emissions targets. Projects such as these are important to advance technologies that can deliver gas substitutes and help us lower emissions.

What we heard

Hydrogen and biomethane

A number of stakeholders emphasised the important role hydrogen and biomethane can play to decarbonise gas use, particularly for high-temperature industrial processes:

“ The [Australian Energy Council] sees great potential for hydrogen to replace natural gas for [industrial process heat and feedstock]. The emissions from industrial processes requiring feedstock gas and intense heat represent some of the most challenging emissions to eliminate. Depending on the process, either electricity or hydrogen may be the most cost-effective solution to replace gas.

AUSTRALIAN ENERGY COUNCIL

“ It is important to distinguish between the energy sources required by industry, and the ability for companies to adopt alternatives. Large scale, high heat applications cannot be readily electrified and will likely continue to need to be met by the capability of gaseous energy.

CHEMISTRY AUSTRALIA

“ Approximately half of Victoria's large commercial and industrial gas use is unlikely to be able to be electrified, meaning that hydrogen or biogas would need to be used to replace natural gas. The cost of replacing commercial and industrial gas equipment with electrical equivalents also needs to be considered against the use of hydrogen or biogas.

AUSTRALIAN ENERGY MARKET OPERATOR



What we heard

“ Because natural gas remains such an important and valued part of the energy mix, renewable gases like hydrogen and biogas represent a significant opportunity for Victoria to achieve its targets, while making use of Victoria’s extensive gas network and minimising costs.

AUSTRALIAN GAS INFRASTRUCTURE GROUP

Gas users emphasised that switching fuels would be financially and technically challenging, particularly hydrogen due to its different characteristics to fossil gas. However, gas networks and appliance manufacturers expressed confidence that these challenges could be overcome. Organisations from across the supply chain had deep interest in the development of alternative gases and many are already investing.

“ Industrial gas users are also facing stranded asset risk where they have significant capital invested in plant and equipment that is reliant on gas. Even if hydrogen were to emerge as a viable fuel switching opportunity, existing plant and equipment may not be compatible, leaving the customer with a choice of either significant re-investment or plant closure.

ENERGY USERS ASSOCIATION OF AUSTRALIA

“ If natural gas was to be replaced by renewable hydrogen, both gas networks and customers would need to make investments to replace their assets to be compatible with hydrogen. These additional costs may add upward pressure on sustainable gas prices, making them less attractive than other energy sources.

AUSTRALIAN ENERGY REGULATOR

“ There are technical challenges for gas appliances [to accommodate more sustainable gaseous fuels], but from preliminary research and development undertaken by manufacturers there is a high level of certainty these challenges can be overcome. Rather, the current challenge is a lack of certainty that there will be a commercially sustainable market for such appliances.

GAS APPLIANCE MANUFACTURERS ASSOCIATION OF AUSTRALIA

“ Large manufacturing and industrial processes will need financial and technical support to change processes and upgrade equipment for a gas specification different from today’s natural gas specification. An advantage of injecting biomethane into the Victorian gas network over hydrogen is that it will not change the gas specification.

BRICKWORKS

“ Biomethane is uniquely placed to utilise existing gas infrastructure, making it an affordable and quickly deployable opportunity to decarbonise Victoria’s gas network.

BIOENERGY AUSTRALIA

“ As we deepen our knowledge of hydrogen supply chains and technology limits, we hope to be able to increase the amount of green hydrogen we can take. We have made the commitment to invest in green hydrogen as a responsible asset owner with no current alternative to the use of high-heat content gaseous fuel.

ENERGYAUSTRALIA





Maintaining gas reliability throughout the transition

Victorian Government actions

The Victorian Government recognises that millions of businesses and households will continue to use gas during the transition. A package of robust mechanisms will support ongoing gas reliability and help to manage any risk of a potential gas supply shortfall, in close collaboration with market and regulatory bodies, and to assist Victoria's manufacturing industry to secure reliable and affordable gas, including in managing contracts. Actions include:

- Supporting measures to enhance use of gas storage.
- Working with gas infrastructure proponents to ensure timely investment to support secure and reliable supply while avoiding overbuild and minimising the risk of stranded assets.
- Policy and regulatory reform to support reliability that considers supply (e.g. storage) and demand side options which could be triggered by the market operator in the event an acceptable standard of reliability is not met.
- Ensuring any reliability reform provides an appropriate balance between reliability and affordability to ensure customers pay no more than is necessary.
- Improve regulatory coverage of emerging gas production assets such as distribution connected hydrogen or biomethane facilities.
- Coordinate research, policy work and feasibility studies to ensure all pathways to take up alternative gas remain open (for example, the potential for hydrogen to be used by industrials or as an input fuel for gas-powered generation).

Actions in this Roadmap that reduce gas use through energy efficiency, electrification and substitute gases will improve gas supply reliability and will increase the supply available for industry and other hard-to-transition customers. Even if international pressures ease, forecasts from AEMO and the Australian Competition and Consumer Commission (ACCC) show that the supply of gas from traditional gas fields such as those off the Gippsland coast is likely to deplete rapidly over the next decade, and likely faster than fossil gas demand will decline.⁷ These trends create pressures for Victorian gas consumers, in terms of both the reliability and affordability of gas.

New sources of gas supply and new infrastructure may be needed to maintain the reliability of gas supply. Potential investments include new conventional gas supplies, expanded pipeline capacity to allow gas to flow from interstate, new storage facilities or the establishment of LNG import terminals. Strong and effective gas export controls are also needed to reserve gas for domestic use and to ensure Australians pay a fair price for Australian gas. The Government continues to advocate to the Commonwealth and national bodies to ensure that the needs of the domestic gas market, including Victorian consumers, are prioritised, particularly in a time of heightened geopolitical tensions and increasingly volatile international energy markets.

The Victorian Government is working to support these necessary investments, while balancing the potential effects this investment could have on affordability. This balance recognises:

- An increasing tendency for gas retailers to engage in shorter-term contracts with gas suppliers, and some retailers and gas users who are relying on the spot market and are therefore facing greater volatility in wholesale gas prices.
- A growing hesitancy within industry to invest in new gas infrastructure due to policy uncertainty and concerns about potentially 'stranded' assets (i.e. where a potentially shortened asset lifespan may result in a failure to recoup the return on the initial investment).
- A decline in the gas customer base over the longer-term carrying the risk that the costs of maintaining ageing gas infrastructure could fall on a smaller group of customers and on those who are the most vulnerable and least able to transition, raising equity concerns.

Through actions in this Roadmap, the Government will pursue all appropriate action to help mitigate the risk of gas shortfalls or supply disruptions during the transition. The Victorian Government has supported the planning and new investment in necessary projects to support reliable and secure gas supply, and driven rule changes to support gas storage ([Box 5](#)).

⁷ AEMO Victorian Gas Planning Report March 2022 aemo.com.au/energy-systems/gas/gas-forecasting-and-planning/victorian-gas-planning-report; ACCC Gas Inquiry 2017-2025: Interim Report January 2022, acc.gov.au/publications/serial-publications/gas-inquiry-2017-2025/gas-inquiry-january-2022-interim-report.



Victoria's gas reliability and supply actions

The Victorian Government has supported a range of necessary projects to support reliable and secure gas supply. This has been balanced to ensure consumer affordability and avoid overbuild, with the associated risk and costs of asset stranding as we move to net zero emissions. In 2022, the Victorian Government has actively ensured the following critical infrastructure projects:

- In March 2022, granting the pipeline licence for APA Group's Western Outer Ring Main project. This project will improve the reliability of Victoria's gas transmission system and will allow more gas to flow into storage at the Iona Underground Storage facility in the west of the state.
- Also in March, Esso Australia confirmed it would invest \$400 million to deliver an additional 200 PJ of gas over five years, with about 30 PJ to come online in 2023.
- In April 2022, the Victorian Government provided written support for the APA Southwest Pipeline expansion project, which subsequently passed through Final Investment Decision.

During the Energy Ministers' Meeting of June 2022, a commitment was made to actively progress rule changes to support gas storage. Victoria is working with AEMO and the Commonwealth to rapidly progress this. In the immediate term, this means ensuring that APA Group's Dandenong LNG storage facility, which plays a critical role for system security and reliability, is used effectively and in the most cost-effective manner. In the medium term, the Victorian Government looks forward to working with the Commonwealth Government on further storage projects to enhance Victorian gas supply security, including Lochard Energy's Heytesbury Underground Gas Storage project.

The Victorian Government continues to work to ensure the security and reliability needs of all Victorians are met, and that Victoria can continue to play its part in supporting Australian gas users more broadly. Further new supply proposals, which will be subject to relevant statutory consultation and regulatory approvals, include:

- The Golden Beach Project: development of the Golden Beach gas field in the Gippsland Basin, with a forecast supply of 43 PJ over two years and potential to transition the facility into a storage facility.
- Viva Energy's proposal for a Geelong Energy Hub, including an LNG import terminal.
- Vopak's proposal for an import facility in Port Phillip Bay.

Longer term, hydrogen offers enormous potential as a clean and reliable alternative to fossil gas, transport fuels and industrial feedstocks. Integration of alternative gases, such as hydrogen, will need to be managed with minimal disruption to end users. Transitioning to alternative gases will not be straightforward for all gas users. For example, most existing gas appliances may not work reliably beyond a blend of about ten per cent hydrogen by volume (equivalent to about three per cent by energy).

To move to 100 per cent hydrogen usage will require either significant appliance modifications or complete replacements. If such a switch is undertaken, it should minimise the amount of time consumers are without gas and must consider timing and equity implications for industry involved. The United Kingdom, which is planning to convert almost four million customers over seven years from 2028, may offer some lessons.⁸

⁸ H21 North of England report, Northern Gas Networks, Equinor, Cadent. h21.green/projects/h21-north-of-england/



What we heard

Reliability

Many stakeholders emphasised the importance of both energy reliability and affordability, and the need to strike a balance between those two objectives.

“ MEU members are vitally interested in four key aspects – the cost of the energy supplies, the reliability of delivery for those supplies, the quality of the delivered supplies and the long-term security for the continuation of those supplies.

MAJOR ENERGY USERS

“ As a large user of natural gas across our Australian manufacturing footprint, BlueScope places great importance on both the cost of natural gas and the reliability of supply. ... Natural gas prices are already high for industrial users and substitution options have the potential to apply additional price pressure.

BLUESCOPE

“ New gas infrastructure investments and ongoing asset maintenance are necessary to ensure the reliability and safety of gas supply in the short term. However, this adds to the regulatory asset bases of gas network businesses, the cost of which will be recovered across a declining base of customers, pushing gas prices up for those customers.

AUSTRALIAN ENERGY REGULATOR

“ As Victoria transitions to a lower emissions future, striking a balance between the investment required to prevent shortfalls and avoiding long-term stranded assets will be critical.

AUSTRALIAN ENERGY MARKET OPERATOR

“ Moyne Shire hosts [businesses] that depend on a reliable, substantial and cost-effective supply of natural gas for their operations. ... Failure to ensure that a cost competitive and reliable alternative was available would critically impact the financial feasibility of these industries and risk loss of local employment.

MOYNE SHIRE COUNCIL







Preparing the future workforce

Build skills and capability to realise the opportunities from the gas sector transition

Victorian Government actions

The gas sector transition presents both opportunities and challenges for Victoria's workforce. The Victorian Government is committed to helping connect, retrain and upskill workers to take advantage of emerging opportunities through:

Retraining and reskilling trades and workers in transition

-  Solar Victoria is supporting the upskilling of gas plumbers and electricians in heating, ventilation and cooling, energy efficiency and renewable gas technologies, and providing training for plumbers to install energy efficient hot water systems including heat pumps. This is to be delivered in collaboration with industry experts and training providers such as the Plumbing Industry Climate Action Centre. This will ensure that Victoria has sufficient industry capability to install reverse cycle air conditioners for low income and vulnerable households through the Home Heating and Cooling Upgrades program.
-  Working closely with the Commonwealth and other state governments, the Victorian Government will develop nationally consistent training materials for producing, transporting and using hydrogen. In addition, the Renewable Hydrogen Business Ready Fund will help businesses build their knowledge and skills for future broader adoption of hydrogen as a replacement for fossil gas.



Registered and licensed gasfitters will undertake ongoing learning to ensure they maintain competence and develop new skills, especially as new technologies emerge, as part of the Government's development of a Continuing Professional Development framework for building and plumbing practitioners.

Building capability of a clean economy workforce



The Victorian Government has invested \$10 million to develop the skills needed in a clean economy which includes a focus on the renewable energy sector and supporting existing workers in transitional industries to reskill and upskill.



The Clean Economy Workforce Skills Initiative is being led by the Department of Education and Training in collaboration with other government departments and agencies such as the Victorian Skills Authority, Sustainability Victoria, Solar Victoria, the Department of Environment, Land, Water and Planning, the Department of Jobs, Precincts and Regions, and the Department of Transport.



Building on related programs and initiatives across government, this initiative comprises the:

- Clean Economy Skills and Jobs Taskforce which is a strategic advisory body of experts providing independent advice to government
- Development of a Clean Economy Workforce Development Strategy so that government investment in skills and training to address workforce skill needs as the economy decarbonises, is efficient and targeted
- Provision of grants under a Clean Economy Workforce Capacity Building Fund to support vocational education and training workforce capability, curriculum design, learning resources and collaborative learning platforms.



These actions build on existing work underway in Victoria, such as:

- The Victorian Skills Authority will deliver its first annual Victorian Skills Plan in 2022, which will identify training needs for local communities and industries across the state.
- Providing targeted training through the 7 Star Homes Program to help the residential building sector increase their skills in designing and constructing 7-star homes.
- Victoria's Residential Tenancies Regulations 2021 introduced mandatory gas safety checks to improve the safety of gas appliances in rental properties, increasing demand for gasfitters across the state. An amendment to the Gas Safety (Gas Installation) Regulations 2018 mandating Australian Standard 4575 for Type A gas appliance servicing came into effect on 1 June 2022.



The gas industry employs many Victorians, including in the extraction and production of gas, and around 20,000 registered and licensed gasfitters. Thousands of Victorian workers supply and manufacture gas appliances and equipment or maintain the safety of the gas system. Government is committed to a fair and effective transition that captures the opportunities of the transition to upskill and future-proof our workforce, particularly people who manufacture, install and maintain gas equipment today, to ensure they are ready for the energy jobs of the future.

The decarbonisation of gas, particularly the growth of hydrogen and expansion of electrification, will create new jobs and opportunities. Government is investing heavily to build new and emerging skills, capabilities and supply chains, including retrofitting buildings, making, installing and maintaining appliances and equipment, building new energy infrastructure, and producing renewable gases and hydrogen.

We recognise that a decarbonised gas sector will be more advantageous for some professions, skills sets and trades, while demand for others will change over time. At the same time, we must maintain a capable workforce to service traditional gas appliances and infrastructure to support the ongoing reliability and safety of energy supply for homes and businesses connected to gas, and to decommission infrastructure as required. Balancing the need to ready the gas workforce to transition, while ensuring safety of gas infrastructure is at the fore of workforce policy development.

The Victorian Government is taking strong action to build capability for a clean economy workforce and provide support and opportunities for workers in transition. Beyond these commitments and investments, Government will continue to engage with affected industries and regions to help navigate potential changes for Victorian workers – and to effectively involve them in delivering these new Roadmap actions.



What we heard

Submissions noted that a key aspect of the transition was the need to plan for future workforce needs and to ensure that workers along the gas supply chain were not left behind during the transition.

“ Fair and effective workforce transitions are a necessary precondition to achieving a decarbonised future. Without the skilled workforce to build, operate and maintain the new energy infrastructure then nothing else is possible. This means income support, retraining, job creation, economic diversification, direct public investment in new technologies and job creation.

UNITED WORKERS UNION

“ Investment is required in improving the skills of the professionals who will install and maintain these [heating, ventilation, air-conditioning and refrigeration] systems. And end-users will ideally be better educated in the importance of correct installation and maintenance.

AUSTRALIAN INSTITUTE OF REFRIGERATION, AIR CONDITIONING AND HEATING

“ The large number of jobs in the gas industry necessitates a transition that is planned over the long term and well-resourced by government. Workers should have certainty that the transition will lead to decent, well-paid jobs, otherwise they are likely to, understandably, oppose it.

BROTHERHOOD OF ST LAURENCE

“ The [Victorian Plumbing and Fire Protection Industry] strongly supports the comments in the Consultation Paper regarding the opportunity presented by hydrogen to utilise the extensive skills of Victoria’s 20,000 licensed or registered gasfitters. ... It is vitally important the Australian economy has the skills to take advantage of the hydrogen opportunity. The unavailability of the required skilled workforce could translate into a failure to take advantage of the hydrogen opportunity more broadly, at significant cost to the economy and community more broadly through the higher cost of the transition, climate change risks from a slowing of the transition, energy security related risks, and the risks of higher energy costs for consumers and businesses.

VICTORIAN PLUMBING AND FIRE PROTECTION INDUSTRY

“ The transition presents enormous opportunities to expand the clean energy industry, generate jobs, boost economic productivity, and position Victoria as a leader in clean energy technologies.

VICTORIAN GREENHOUSE ALLIANCES





Reducing fugitive emissions

Victorian Government actions

Reductions in gas fugitive emissions will be supported through such actions as:

- 📍 Advocating to ensure Commonwealth mechanisms such as the National Greenhouse and Energy Reporting scheme and the Emissions Reduction Fund can better support further reductions from the sector in fugitive emissions.
- 📍 Assisting industry to utilise best practice and knowledge sharing to help manage and reduce fugitive emissions.

Actions already undertaken to replace ageing mains in the distribution networks are contributing to a reduction from fugitive emissions – with the added benefit of making those parts of the network compatible with the future use of alternative gases. Industry is also being proactive. For example, the winner of the Australian Pipeline and Gas Association's inaugural 2021 Innovation Award went to a technology aimed at improving the identification and measurement of fugitive emissions.

Fugitive emissions represent about three per cent of Victoria's total greenhouse gas emissions with around 55 per cent of these arising from leaks, venting and flaring of gases in the extraction, production, processing, storage, and transportation of fossil gas.

As gas use progressively declines, fugitive emissions from the sector will also naturally fall, including as parts of the network are replaced.





Transitioning Government's own gas use

The Victorian Government has committed to reduce its greenhouse gas emissions by around 70 per cent from 2018-19 levels in the 2021-25 Whole of Government emissions reduction pledge, including by using 100 per cent renewable electricity by 2025. Reducing emissions from fossil gas will become an increasingly important feature of the Victorian Government's transition to net zero emissions.

The Victorian Government is responsible for approximately three per cent of Victoria's total gas consumption with major users including schools, hospitals and correctional facilities, alongside widespread use in office-buildings and other settings.

The Government is demonstrating leadership as an early adopter of electrification and alternatives to fossil gas, including by requiring all State Government infrastructure business cases, for buildings and facilities, to include options for all-electric developments. This will ensure that alternatives to gas are always considered in our new builds and major upgrades.

Victorian Government actions

In addition to a new requirement for businesses cases, for buildings and facilities, to consider all-electric options, policies are already in place to reduce reliance on fossil gas in Victorian Government buildings and infrastructure, including:

Public hospitals and health services



The Victorian Health Building Authority Guidelines for sustainability in health care capital works support the transition to all-electric public healthcare buildings when building new hospitals. This supports the decarbonisation of the public healthcare system when government operations move to 100 per cent renewable electricity from 2025.



In May, the Government announced funding for the new Melton Hospital, designed to be Victoria's first all-electric hospital powered by 100 per cent renewable electricity. The hospital's design will focus on sustainability initiatives such as maximising on-site solar generation, high-performing façades, efficient plant and equipment, and integration of green spaces within the hospital precinct.



ARTISTS IMPRESSION, MELTON HOSPITAL



The Victorian Health Building Authority is also supporting the replacement of gas infrastructure in existing healthcare buildings through its asset renewal grant programs. Recent examples include:

- Replacing central gas boilers at a large metropolitan hospital with a hybrid electric heating hot water and modular condensing gas boiler system to significantly reduce gas use, improve reliability to the existing heating system, and installing solar panels to reduce carbon emissions to offset the increased electricity use.
- Installing electric hot water systems and induction cooktops at two community health centres to eliminate the use of liquefied petroleum gas and installing solar panels to offset the increased electricity use.

Schools



The Victorian School Building Authority sets out in its [Building Quality Standards Handbook](#) the intention to phase-out fossil gas to school sites in the future as a key consideration when determining the appropriate heating for schools.

Social housing



The Energy Efficiency in Social Housing Program, which will support a range of cost-effective energy efficiency upgrades for 35,000 public, community and Aboriginal housing properties includes a strong emphasis on electrification, including installation of reverse cycle air conditioning to replace inefficient gas and electric heaters. This is part of the Government's Big Housing Build program, with all-electric specification wherever possible.





3

Next steps

This Roadmap is the start of a journey to a net zero emissions future for the gas sector. It sends a clear signal to the community and industry about the need to transition the gas sector, with actions setting out priorities for this considered transition.

- It gives Victorians more choice when it comes to the future of our energy supply
- It will save Victorians money on their gas bills
- It will reduce greenhouse gas emissions and help us tackle climate change

These actions are designed to give every Victorian the confidence that their energy is reliable – now and into the future.

As the Government delivers the actions of this Roadmap, we will engage with industry and Victorians to progress these actions and ensure milestones are met, including a public Roadmap update report in 2023 as well as next round of pledges to meet the 2030 and 2035 emissions reduction targets.

The Government will continue to work with industry to drive decarbonisation in the gas sector as we develop our state-wide emissions reduction targets for 2035. The Government will consider options for further action to promote a smooth and orderly transition to net zero emissions, including new actions to increase energy efficiency, electrification and uptake of renewable gases and hydrogen.

The Gas Substitution Roadmap is part of a much wider policy development, planning and investment process, to support Victoria's clean energy transition. Government will continue to consult with industry and the community on this. Areas for further exploration as part of this ongoing policy development process include:

- Accelerating the uptake of efficient electric appliances, including for households where such changes maximise benefits of installed solar PV
- Exploring options to recover costs of renewable gases, taken up at scale, and consider establishing renewable gas targets
- Monitoring energy market and technology trends to increase confidence in costs of gas substitutes, production capacity limits and consumer preferences
- Examining findings on the potential for hydrogen to displace fossil gas, including studies to be released by the Australian Hydrogen Centre
- Tracking and managing the effects of further electrification on the energy market and investment in generation, transmission, distribution and storage

Appendix

The Roadmap multi-sector scenario modelling

The multi-sector modelling developed for the Roadmap integrates industry-leading gas and electricity market models to examine the cost and feasibility of different technologies – such as energy efficiency, electrification and alternative gases – to decarbonise Victoria’s gas sector. The integration of the electricity model is necessary to accurately estimate the cost, peak demand and emissions impacts from converting gas use to electricity. While the modelling includes existing commitments such as the Victorian Renewable Energy Target, the Victorian Energy Upgrades program and the Solar Victoria programs, it does not include any assumptions about new policy interventions that might be implemented by the Government in the future.

This approach allows the broad economics of different gas substitution technology options under different cost, availability and uptake assumptions to be understood.

To do this, the modelling considers a ‘No Action’ scenario with no policy effort to reduce emissions, and three core scenarios where the Victorian gas sector was assumed to achieve net zero emissions by 2050 (Figure 6). Each scenario adopts different assumptions about future technology costs, availability and consumer uptake. This approach is used to examine whether the key scenario outcomes are sensitive to key assumptions about the future, and therefore how confident we can be about the need for particular policy actions today. **Scenario outcomes are not trying to “predict” the future, but provide strategic insights to guide policy making.**

FIGURE 6 Roadmap scenario modelling SCENARIO DESIGN

	No Action Scenario	Rapid Transition Scenario	Electrified Future Scenario	Zero Carbon Fuels Future Scenario
Applied emissions constraints	No emissions constraint for the gas sector	Net zero emissions by 2050 Below 2°C carbon budget		
Technology, costs, availability and consumer uptake	Moderate assumptions on technology costs and availability		Assumptions favour electric technologies	Assumptions favour hydrogen technologies
Purpose	Demonstrate magnitude of the task	Demonstrate a plausible combination of pathways	Test pathway sensitivity to assumptions	

The model estimates cost and emissions outcomes of different appliance and fuel choices. When appliances (in all sectors) reach their end of life, they can either be replaced with an equivalent appliance using the same fuel, or with an appliance that serves the same need but uses a different fuel. The model makes this choice based on the lowest cost option, including the upstream gas and electricity supply chain costs required to deliver the energy. The emissions constraints in the core scenarios also impact that choice by requiring the total emissions from the gas sector (and any new emissions incurred within the electricity sector) to fall in line with the applied emission constraints (e.g. the 2050 target).

This means users (and their appliances) move away from fossil gas appliances to electric, hydrogen or biomethane options over time, and also improve their energy efficiency.

The scenarios model estimates the following for each scenario over the period 2021-2050:

- Demand for, and supply of, fossil gas, electricity, biomethane and hydrogen
- The total cost of appliances, energy network upgrades and energy supply for gas-using sectors
- Greenhouse gas emissions
- Retail energy prices for consumers
- The effects of electrification on electricity grid peak demand and new electricity generation required

Multiple technologies are needed to achieve net zero emissions in Victoria's gas sector

All scenarios clearly demonstrated that to efficiently reduce gas sector emissions, a combination of technologies is needed over time – even when the scenario was designed to prioritise a selected technology. This indicates that using a mix of technologies will better meet the energy needs of Victoria's diverse gas users than a single technology on its own. Despite varying assumptions being used across the three core modelled scenarios, all three found that:

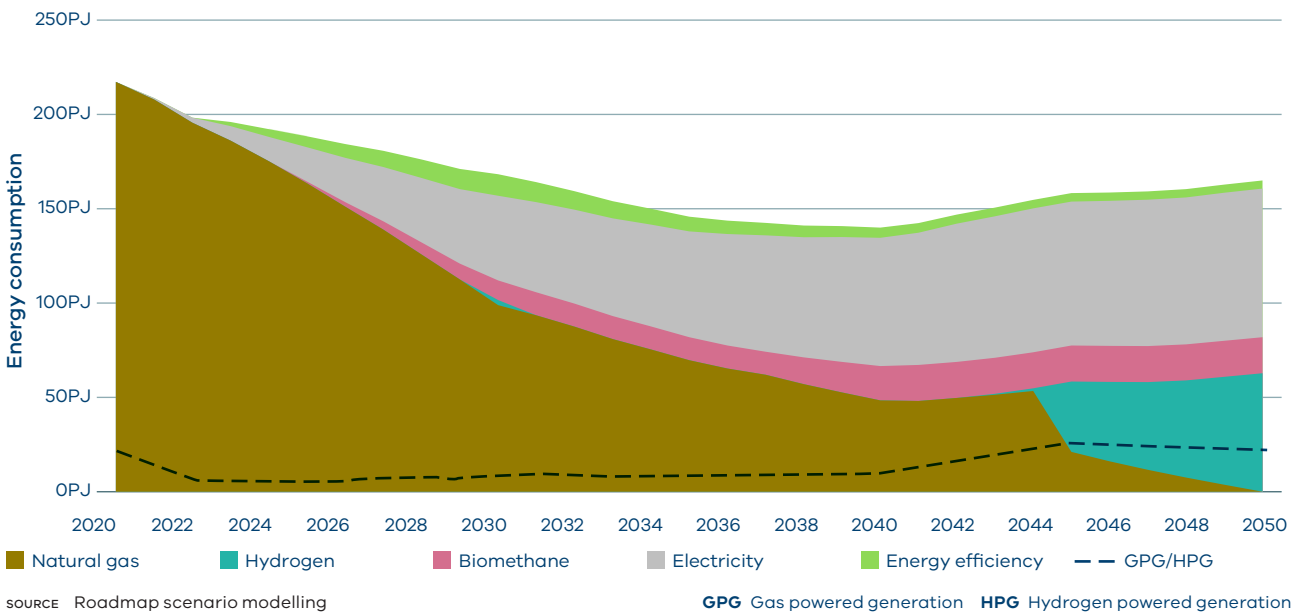
- Electrification and energy efficiency play an important role in reducing emissions before alternative gases, such as hydrogen and biomethane, become widely available. Early action to promote these technologies is critical to achieve Victoria's interim emissions reduction targets. This finding applies even in the Zero Carbon Fuels Future scenario, which assumes very low long-term hydrogen prices.

- Alternative gases play an important role, particularly for industrial users. Biomethane is blended into the gas network up to the amount assumed to be available, and the remaining gas supply is switched to hydrogen during the 2040s. This finding applies even in the Electrified Future scenario, which assumes that electric appliances will have higher efficiency and lower cost than under a Rapid Transition scenario.
- Gas-fired power generation plays a small role in supporting renewable electricity sources, along with other dispatchable 'firming' technologies such as batteries, although this may be replaced with hydrogen power generation at some point in the future.

These trends can be seen in the three charts below, depicting the three core scenarios.

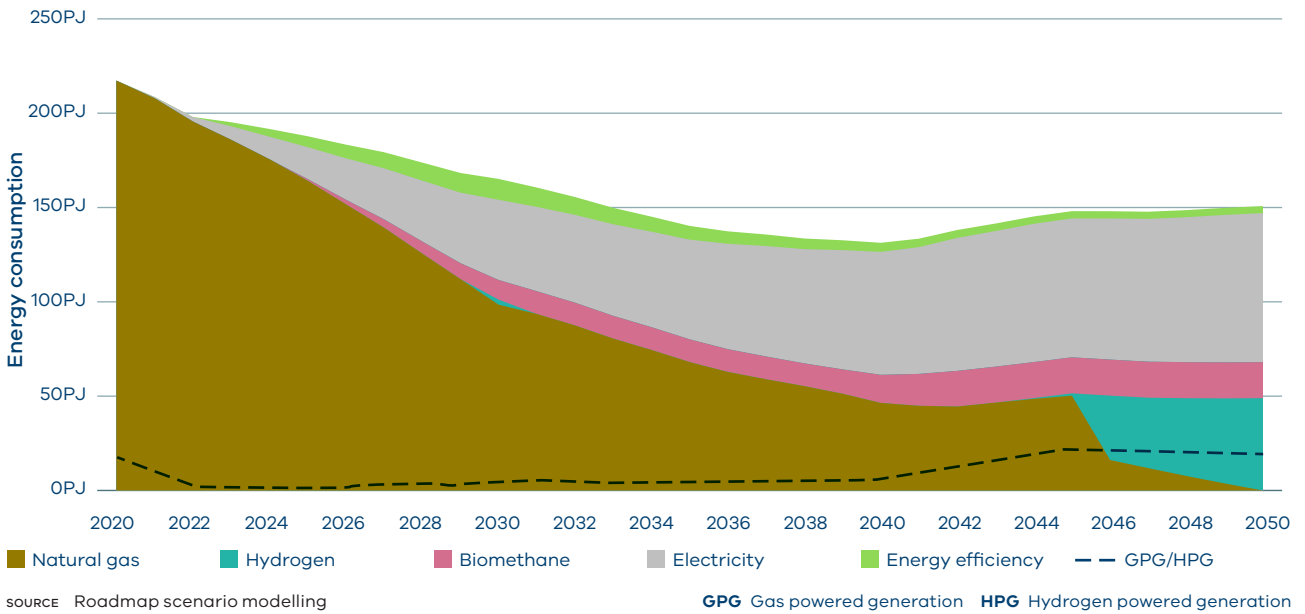
A Rapid Transition scenario (Figure 7) shows significant electrification during the 2020s and 2030s, with a switch over of pipeline connected gas users to hydrogen in 2045.

FIGURE 7 Energy consumption RAPID TRANSITION SCENARIO



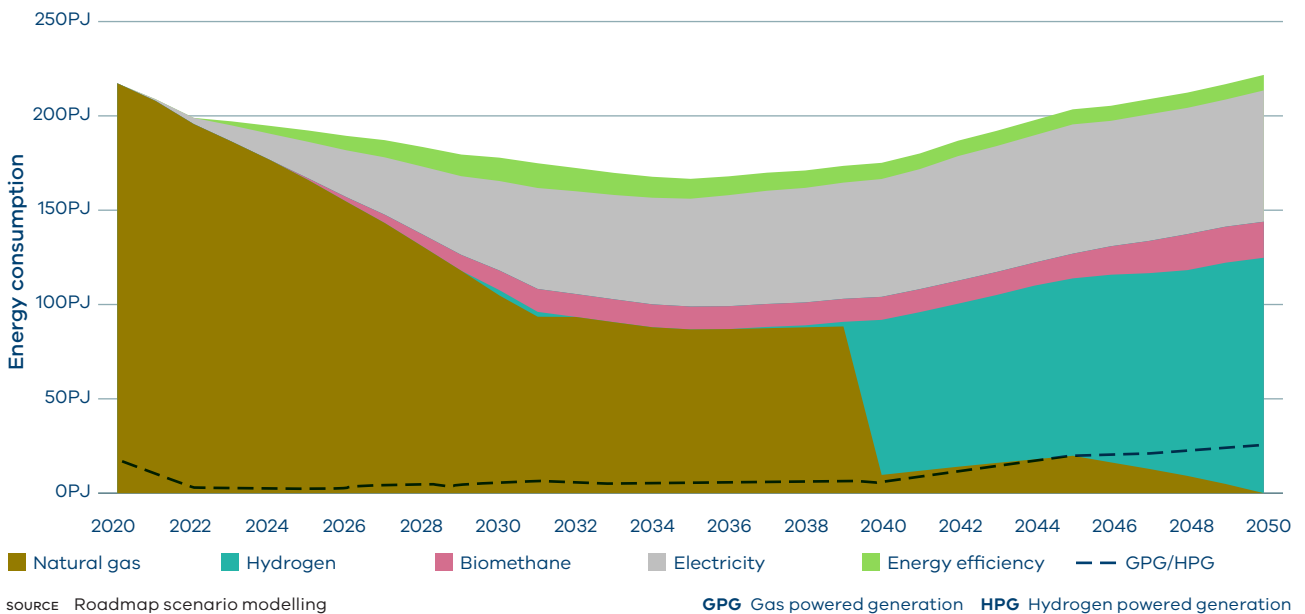
Despite using assumptions that are more favourable to electrification, the Electrified Future scenario (Figure 8) is very similar, with the hydrogen switchover delayed by just one year.

FIGURE 8 Energy consumption ELECTRIFIED FUTURE SCENARIO



The Zero Carbon Fuels Future scenario (Figure 9) uses assumptions that are more favourable to zero carbon gases, but still finds that electrification plays the key role in the 2020s. The Zero Carbon Fuels Future scenario sees an earlier switch to hydrogen – in 2040 – and greater volumes of hydrogen, but still relies on a mix of energy sources.

FIGURE 9 Energy consumption ZERO CARBON FUELS FUTURE SCENARIO



A combination of pathways serves the needs of different energy users and helps each of them to transition to clean energy sources. For example, increased electrification and energy efficiency in residential and commercial buildings reduces gas demand and frees up gas supply for industrial users that are less able to electrify. This also gives more time to increase the supply and reduce the cost of alternative gases, which underpins the long-term transition of many industrial users.



What we heard

Technology pathway combinations

A broad range of stakeholders identified that a combination of technologies is likely to be needed to meet the diverse needs of Victoria's gas users:

“ There is no silver bullet policy response that can address decarbonisation across the gas sector per se – bespoke approaches are required for each subsector.

BUSINESS COUNCIL OF AUSTRALIA

“ The three options [to decarbonise gas] are electrification of the end use of gas, replacement of natural gas with biomethane, and replacement of natural gas with hydrogen. The options are presented as standalone in the consultation paper but as we progress towards decarbonisation, all of these options will have some role.

ENERGY NETWORKS AUSTRALIA

“ Each pathway outlined in the consultation paper has some merit, however it is unclear how any single pathway could allow a transition to a net zero gas market by 2050.

ORIGIN ENERGY

“ In the long term, the [Clean Energy Council] expects that electrification will ultimately present the most efficient energy outcome for residential and business customers, and that renewable hydrogen and biomethane will be most productively focused on addressing hard-to-abate energy needs such as high temperature process heat (as well as heavy transport)

CLEAN ENERGY COUNCIL

“ A broad-based policy objective to achieve net zero that follows an objective rather than a prescriptive pathway will encourage participants and customers to respond flexibly with technology and at lowest cost

AUSTRALIAN PETROLEUM PRODUCTION AND EXPLORATION ASSOCIATION



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