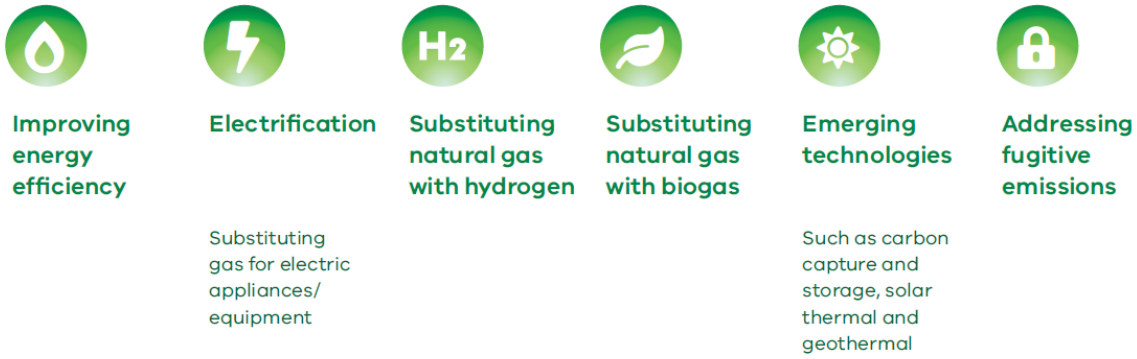
There are a range of emerging key pathways to addressing the carbon impact of gas in Victoria. These include:



<u>This questionnaire is completed from the perspective of primary float glass manufacturing by Oceania Glass</u>

Key questions

For each pathway:

- What are the key benefits, risks, and potential impacts on various end-users, on energy affordability, safety, security, reliability and equity?
    - *Improving energy efficiency* – Australia is a high-cost country to manufacture in. The only way we have been able to remain viable in Australia is through optimisation of all our input costs. Energy efficiency in glass making is the single largest input cost. Within the constraints of current economics, we have optimised energy efficiency as far as possible. This would be similar for most Industrial users, or they would not be doing their job properly.

      So, then the next blunt tool to drive the implementation of further energy efficiency measures will be to increase energy cost, which starts the slow demise of manufacturing,

      The interesting part is that glass products we manufacture, can reduce the energy losses from building by up to 30%. The uptake of these products has been slow over the past 10 years, with the largest use being in new construction. Australia has a large % of older houses that are just bleeding energy. At 60% of total use, if current residential losses are not curtailed it will be a struggle to meet these targets.
    - *Electrification* – At current market prices it is not economically viable to convert our gas usage to electricity. So, the question becomes which tool is used to incentivise this shift? Cheaper electricity or more expensive gas. There is a risk that the later will prevail, as the easier option for government to control.

In glass manufacturing the highest % gas/electricity replacement achievable is approximately 10% of our glass melting energy. Carbon fuels are used in 99% of the ± 400 float glass furnaces worldwide. The carbon in the fuel is an integral part of the chemistry occurring in glass manufacturing. There are large glass manufacturing companies doing research on replacement technologies, but there is currently nothing commercially available. This type of R&D is not possible in Australia with only one production factory. We will be reliant on international research and solutions.

Glass manufacturing is a very high temperature process (+1600˚C) and throughout the temperatures are controlled to within ± 2˚C. Sudden changes to these process temperatures can result in quality upsets and manufacturing losses. The reliability of energy source is fundamental to process safety and integrity. To this end, for the comparably small electricity load used in glass manufacturing, there are 3MW worth of back up diesel generators to ensure continuity of electrical supply. Even if it was possible to convert the furnace to 100% electricity, the back-up system for this amount of energy would be prohibitive. There is also a large back-up system of diesel, to replace gas in the event of a supply failure. Again, as an electrical supply this would be economically restrictive. A float glass factory without electricity is an unmitigated disaster, which will lead the massive equipment failure.

- *Hydrogen replacement* – There are cases of float glass furnaces using higher hydrogen content gasses. This was however only a percentage of total energy requirements and the chemistry need for carbon was offset by using heavy fuel oils as the balance of energy. Heavy fuel oils are a far dirtier environmental option than natural gas, which on balance would be a better outcome for the environment. Small quantities of hydrogen can be tolerated but does not make significant contributions to reduced carbon emissions.

  There are several adverse factors for using hydrogen. 1) It is a very poor energy transmitter due to its very low emissivity flame (0.1 H_2 vs 0.6 natural gas). This leads to very poor energy efficiency. It also has a very high flame temperature that can affect the material selections made at the time of constructing furnaces.

  Injecting hydrogen into the current natural gas pipelines, will be a problem for float glass manufacturing – probably most industrial users. All our process control equipment and gas systems are designed for the use of natural gas. The physical properties of the gas dictates the design of process equipment. The significant difference in these properties between hydrogen and natural gas means that small amounts of hydrogen can lead to large changes in gas composition, throwing out the accuracy of the control equipment. A stable energy source is very important for sustainable manufacturing.

The other concern would be the cost of hydrogen. It is currently very expensive. In any development of new sources there would be a period of optimisation where prices would reduce, before stabilising at a lower price. It is hard to envision how this occurs when step changes are required rather than the slow introduction of a new source?

- *Biomethane* – This would be the easiest change over from a float glass manufacturing perspective. It would have to be biomethane though, not biogas. This is due to the inherent need for very accurate temperature control in the manufacturing process. Having a gas with changing composition is problematic as explained prior.

  This option would be the lowest risk, but reliability of supply would need to be considered.

- *Emerging Technologies* – For float glass manufacturing there are no current emerging technologies that are a game changer to stop/reduce using natural gas. Solar is currently still not economically viable and there is the issue of day/night supply, with batteries being uneconomical.

  With a vague way forward and a lot of uncertainty about the availability of affordable, reliable, technically useable energy for float glass manufacturing, it makes the investment in a future plant very uncertain. The current float plant requires a decision to rebuild the furnace by 2024. Investment is an 18-20 year decision.

  It would be ironic that our drive to eliminate natural gas, could stop the only float glass factory in Australia, resulting in every piece of glass in a building having to be imported, adding not only carbon from less efficient international glass factories, but also from the additional carbon emissions from sea freight to get the glass here.

- What are the scale of opportunities and potential to accelerate uptake?
  - Electricity: 10% of total gas consumption. Uptake time dependant on economics.
  - Hydrogen: uncertain
  - Biomethane: 100% of total gas consumption. Dependant on economics, availability and reliability.
- What are the key technical, regulatory and economic barriers?
  - Technical – Dependant on international R&D to develop and prove replacement technologies. Electricity reliability and back-up supply cost.
  - Economic – electricity supply and equipment is still too expensive.

- What are the roles to be played by government, industry and how will consumers preferences be accounted for in the transition?
    - Government – There is currently no recognition/ allowance made for companies that produce products, using natural gas, that reduces the consumption of natural gas by consumers. Glass inherently makes buildings more energy efficient (Low E glass). The benefits should be offset against the emissions.
- What are the likely timings of technical maturity and economic viability?
    - Unknown
- What are the best ways to maintain social acceptability and consumer confidence?
    - Clear, timely information regarding future options, the benefits and risks.
- What are the inter-dependencies and trade-offs with other pathways (are pathways complementary or alternatives)?
    - Current pathways are complimentary, and a combination could result in optimum outcome.
- What are the key uncertainties and potential for unintended consequences?
    - Uncertainties: Electricity cost &reliability, H_2 cost &reliability, Biomethane cost &reliability.
    - Additional costs can make Australian manufacturing economically uncompetitive with our main competition in South East Asia.
    - The replacement measures could have adverse impacts on throughput rates or product quality.

Fugitive emissions:

- What are the opportunities and barriers to further reductions in fugitive emissions?
    - Not applicable.

Key issue 1

Maintaining electricity reliability with new sources of demand

- What policies are needed to ensure that the electricity network can reliably serve new sources of demand from hydrogen production, electric vehicles and electrification of gas demand?
    - Industrial needs must be prioritised over domestic consumption and mechanisms need to be implemented to create ceilings for electricity and gas cost to create investment certainty.

- What is the role for gas-fired power generation and hydrogen in maintaining electricity reliability?
    - If that is an option, it would be far more efficient to keep the float glass furnace on natural gas firing than to convert it to electricity.

Key issue 2

Transitioning to more sustainable gaseous fuels with minimal disruption to end-users

- What are the key technical challenges in converting existing gas networks to accommodate more sustainable gaseous fuels?
    - Processes and control equipment need to be redesigned for new gas compositions. This requires advance knowledge of new gas properties and step changeovers from one type the other.
- What are the potential costs and opportunities in switching to more sustainable gaseous fuels for consumers?
    - Require technical specs before this can be assessed.

Key issue 3

Maintaining the reliability, affordability and safety of gas supply

- What are the affordability, reliability and safety considerations related to gas supply and gas infrastructure, both in the short term and during a long-term transition to a decarbonised gas sector?
    -
- What policies are needed to ensure that the gas system continues to operate reliably and safely and remain affordable for end-users during this transition?
    - You would need to nationalise gas assets, because gas companies will stop investment and withdraw from the market at their soonest opportunity to minimise their losses in a dying industry.

Key issue 4

Supporting Victoria's workforce, industry and the institutions that support them

- What workforce skills and industry capabilities are required to transition to new and emerging energy sources?
    -
- How can government, industry and unions best work together, including through the Victorian TAFE and Training system, to help to build these skills and capabilities, and support existing workers through the transition?

-

- How do we maximise local job opportunities, including for industry training centres such as that operated by the Plumbing Industry Climate Action Centre, to prepare workers for the future?
  -

Key issue 5

Managing uncertainty in the transition

- What key uncertainties should the Roadmap take into account, and what is the government's role in reducing these uncertainties?
  - Energy cost availability and reliability.
  - Clear policy and engagement with industry are the cornerstones to confidence for local manufacturers to make investments in capacity and new capabilities, such as technology to produce high tech energy efficient coated glass products in Victoria, that contribute significantly to reduced energy use in buildings and offer greater amenity through access to natural light.

Key issue 6

Transitioning the Victorian economy efficiently and equitably

- How can we ensure that the costs of transition to lower emissions energy sources are borne equitably?
  -

- How can we help low-income and vulnerable households manage any upfront costs in changing energy sources?
  -

- What are the barriers for households in improving the efficiency of their use of gas for heating, cooking and hot water and/or switching to solar/pump hot water in existing homes?
  -

- What are the opportunities for the Victorian Energy Upgrades program to incentivise efficient gas use, thermal upgrades of buildings (e.g. insulation) and electrification?

- The Victorian Government in it's 'Climate Change Strategy', published by The State of Victoria Department of Environment, Land, Water and Planning, May 2021 rightfully identifies and recognises the role the glazing (through double glazing) has to play in improving the thermal fabric of buildings. Whilst the use of double glazing is to be encouraged, there are missed opportunities to upgrade existing private and public housing stock from original single uncoated glass to single glazed energy efficient coated Low Emissivity (Low E) Glass whereby no substantial changes and therefore cost to the existing frame is required. We believe this should be considered as a part of the Victorian Government communication and incentive schemes, in addition to double glazing that often requires significant remediation or replacement of pre-existing window framing.
- We would note some information on the Sustainability Victoria website whilst well-meaning is incorrect, stating that Low Emissivity glass is generally only used as a compliment to double glazing. Oceania Glass manufacture durable Low E glass in Victoria that has been used extensively in single glazing for over 20 years to improve the energy efficiency of homes. We would be happy to assist Sustainability Victoria with information about glazing options from single to double glazing.
- Passage below accessed 29.7.21: Home window glazing | Sustainability Victoria

Low emittance glass (Low-e glass)

In Victoria, adding a low-e coating to the internal pane of glass will help make your house warmer in winter by reflecting radiant heat back into the room. Low-e glass is generally only used as a complement to double-glazing to reduce winter heat loss through windows. The use of low-e glass to control heat gain is not recommended for Victorian conditions as it also reduces the amount of solar gain in winter.

- Mandatory disclosure at the time of sale of the energy efficiency of existing buildings could contribute to creating a more informed market place, provide a mechanism for evaluating value and areas for improvements to existing stock and encourage more energy efficient buildings and reduced emissions.

- What issues and elements do you see as most important to improve the energy and emissions performance of new homes?

- The 2022 NCC (National Construction Code) changes and adoption of the trajectory for low energy buildings by COAG Energy Council will help drive the adoption of greater and higher level energy efficient glazing solutions for residential buildings. The potential role of energy efficient performance glazing is well documented and widely accepted.
- We would however note the importance of ensuring compliance of new housing and the use of the nominated products and materials that were specified and relied upon in the energy rating process are ultimately used in construction.