Draft VBN Submission to the Victorian Gas Substitution Roadmap

The Victorian Bioenergy Network (VBN) is an association of people who share a common interest in bioenergy as a form of renewable energy. Our goal is to collaborate with government, industry and other sectors to increase the use of biomass to produce energy. The VBN would like to make the following submission to the Victorian Gas Substitution Roadmap.

It is disappointing that the Victorian Government chose not to consider district heating as an alternative option for meeting Victoria's gas use. These systems are widely used overseas and have the potential to deliver greater energy and emission reduction to the options that the Roadmap considers. District heating has been operating in some European cities for decades and is now being increasingly installed elsewhere in the world due to their higher energy efficiency. Modern systems now include cooling circuits which reduce the need for air-conditioning. More information on initiatives currently happening in Europe to reduce heating and cooling costs see: Celsius Initiative - Celsius Initiative (celsiuscity.eu) District Heating and Cooling (DHC) offers energy savings of up to 30% compared to using individual building heating and cooling and perhaps more importantly in the case of heat pumps, it shifts demand off the electricity grid, particularly at peak times. DHC is expensive to install but has a very long life and costs can be amortised over the life of the system. The proposed replacement of natural gas with hydrogen will require the upgrade of much of the gas network which would also cost a considerable amount and doesn't give the additional energy savings in summer.

The use of upgraded biogas from anaerobic digestion is a well proven practise but the limited nature of appropriate feedstock means this proposal cannot provide any significant contribution to Victoria's gas needs. According to the Australian Biomass for Bioenergy Assessment, there is approximately 1.9 million tonnes of organic "wet" waste available annually in Victoria. The yield of biogas varies considerably depending on the waste and technology used, from as low as 25 m3 per tonne to over 600 m3 per tonne. Using an average yield of 200m3 per tonne, the approximate amount of biogas which could be produced from the 1.9 million tonnes is 380 million m3. This would drop to 228 million m3 after upgrading to biomethane with an energy content of around 8.9 million GJ. This is less than 4% of the 230 million GJ of natural gas used annually. Given the inefficiency of biogas production and high plant costs, the use of biogas is best limited to specific sites and industrial applications.

The VBN recommends that the Victorian Government adopt the use of biomass combined heat and power technologies linked to DHC networks as an alternative to seeking a substitute for natural gas. There is currently up to 10 million tonnes of unwanted biological waste (biomass) available annually in Victoria. Most of that waste currently has limited value due to a lack of demand. Creating a "bioeconomy" based on biomass Combined Heat and Power (CHP) would create a demand for biomass which is likely to increase the available supply. Adopting mechanical harvesting of fire hazards instead of burning them could add another 2 to 3 million tonnes to the available resource. Establishing drought resistant energy crops such as Mallee eucalypts on marginal farmland is another option to increase available biomass. Combined it would be possible to increase the available amount of biomass to over 15 million tonnes. Using bioenergy also creates more jobs than any other renewable energy technology. According to a 2012 UK Study, up to one permanent EFT position per MW thermal (0.5 EFT per MW electrical) in plant operation and maintenance could be created. The required fuel supply chain could create another 0.5 EFT position. Many of these positions would be rural and regional areas.

Modern biomass CHP plants have an overall efficiency of over 90%, of which around 60% of the output of available energy is as heat. If 15 million tonnes of biomass were available for use in these types of plants, it would produce around 129 million GJ of heat which is equivalent to the amount gas used by the residential and commercial sectors. In addition, up to 18 million MWh of dispatchable electricity would be produced.

This is the equivalent of 2.4 GW of generating capacity at a capacity factor of 85%. Because heat is much easier and cheaper to store than electricity, it would be possible to use a more flexible generation technology, such as biomass gasification, which would allow the use of a much larger output for a shorter period from the same amount of biomass. For example, 5.1 GW of capacity at a capacity factor of 40%. Combined with hydroelectricity, this option would provide Victoria up to 6 GW of dispatchable generation to integrate with the variable outputs of wind and solar.

Meeting the states industrial gas needs with biomass could be achieved either with direct combustion or the use of syngas produced by biomass gasification. Meeting the 66 million GJ currently being used would require up to 7 million tonnes of biomass. One of the by-products of biomass gasification in biochar which can be used as a valuable soil improver in agriculture. This could prove challenging with Victoria but biomass can and is transported efficiently all around the world so it may be possible to import addition biomass from interstate. The existence of a district heating system would allow industrial users to export excess heat so reducing the amount needed from CHP plants.

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?

The production of hydrogen using electricity from the grid should only be undertaken when there is surplus electricity production available. The introduction of electric vehicles will pose a significant challenge to Victoria's electricity supply. The Victorian Government plans to make 50% of all new car sales electric by 2030. If 25% of the petrol-powered vehicles were to be replaced with electric by 2030 it would add up to 200 MW average demand on the electricity network. Since most charging will occur at night, this could increase peak power demand by up to 400 MW. If the existing petrol-powered fleet was changed to electric, overnight charging could add well over 1 GW to current peak demand. High peak time electricity charges would encourage users to charge their vehicles at off peak times but it will remain a significant demand issue. Replacing residential and commercial gas use would add over 1 GW to average electricity demand however this would rise to a peak of 3 GW during winter. Production of industrial heat from electricity instead of gas would add an average of 1.5 GW to current electricity demand. Combined, electrification of gas demand and electric vehicles would add 4 to 6 GW to Victoria's total electricity demand. Meeting this demand will require energy policies that facilitate the development of a substantial increase in electricity generating capacity.

What is the role for gas-fired power generation and hydrogen in maintaining electricity reliability?

Victoria currently uses gas-fired power generation as a supplementary peaking supply to overcome the variability of wind and solar. It's likely there will be a need for this type of generation for the foreseeable future. The use of hydrogen in this role seems unlikely given the predicted high cost of production and distribution compared to natural gas. The Australian Hydrogen Market Study predicts the delivered cost of hydrogen to be the equivalent of \$24 per GJ by 2030 and \$18 per GJ by 2050. The current cost of natural gas is \$8 per GJ.

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?

As previously indicated, converting the existing gas network to either hydrogen or upgraded biogas would be either expensive or impractical. In addition, the seasonal nature of residential and commercial gas use would make replacing natural gas with hydrogen very expensive. This is due to either the substantial production capability required during a period of the year when solar, the lowest cost electricity technology, is at a minimum or it would require huge amounts of gas storage which would have an enormous cost. Hydrogen also produces considerably more Nitrous oxides when combusted, which is 300 times more potent greenhouse gas than CO2. Given that, DHC technology, unlike hydrogen, is proven and well established there would be few technical challenges. Hydrogen on the other hand is completely unproven, particularly for residential use, and its widespread use could create numerous technical challenges.

What are the potential costs and opportunities in switching to more sustainable gaseous fuels for consumers?

A 2018 report produce for the UK Government titled Appraisal of Domestic Hydrogen Appliances indicated that conversion of existing appliances may be impractical and they would need to be replaced, along with many of the gas supply components. Hydrogen cannot be safely used in a mixture with natural gas above 10% which means that the changeover to hydrogen would be an "all or nothing" process. Entire sections of the supply network between the hydrogen production facility and customers would have to be shut down for a considerable period while the network is upgrade/replaced and all appliances replaced. The potential disruption and cost to gas users would be huge and likely to be very unpopular. This is likely to place a significant cost on consumers with hydrogen fuelled appliances expected to require significantly more maintenance. The safe use of hydrogen in domestic situations would also be an issue. Given these issues, the opportunities are likely to be in supplying electrical alternatives to gas

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?

As previously stated, replacing gas with bioenergy and DHC systems is the lowest cost, most reliable and safest option.

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?

The rollout of a DHC network would occur in parallel with the existing gas network without disruption to the gas supply. Once in place, the changeover to DHC could occur when convenient and affordable for consumers. This approach would allow the roll out of DHC to an entire community for the minimum cost without disadvantaging the vulnerable or impacting industry. Policies to allow parallel installations to occur would need to be in place

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?

Installing a DHC system is well within the capabilities of the current plumbing industry so no new workplace skills would be needed. A shortage of people with existing plumbing skills will be the main issue.

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?

As previously stated, the primary issue is the availability of trained plumbers. As installing DHC systems across the state will be a major operation spread across an extended period, there will be significant opportunities for people to establish a long-term career in the industry.

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?

The development of DHC systems will create a large number of job opportunities with a wide range of roles needing to be filled. Opportunities will be created for heating engineers to design systems, manufacturers to produce major components such as pipework and heat interface units as well as plumbers and installers to install the various components. Installing district heating systems in built up areas will also require significant use of horizontal drilling so training and accreditation in this technology will be required. The scale of developing DHC systems, together with the associated biomass CHP plants, will ensure that development occurs over an extended period which will lead to the creation of many long-term jobs.

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?

The key uncertainties will be the cost of the alternate energy supply and its reliability. The government can play a key role in allaying the uncertainty by supporting the installation of pilot and demonstration schemes to provide real world examples of actual costs and reliability.

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?

Because DHC systems can be installed in parallel with other energy sources, people have a choice of when or if they connect. The biomass CHP plant that supplies the heat for the heating system generates most of its income from electricity sales not heat, and large heat users, such as hospitals, hotels and aquatic centres, would be connected from the start. This arrangement means installations are financially viable from the start without the need of 100% of potential customers being connected. This ensures costs are spread across multiple sites within a community ensuring they are borne as equitably as practically possible

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

For DHC systems, the cost of the system, including the installation of individual Heat Interface Units (HIU) is recovered over the life of the system via heating charges. The HIU would be connected directly to a home's hot water system but funding support for low-income and vulnerable households will be needed to change over gas stoves to electric and gas heaters to hydronic air heaters. These appliances operate in a similar manner to reverse cycle air-conditioners without the high cost or large electricity consumption.

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?

The uncertainty of future supply and increasing price of gas is making home owners reluctant to upgrade to more efficient gas systems. Many will be waiting until their current gas appliance fails before installing an electric alternative.

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

Insulation provides significant improvement to a building's thermal efficiency and there would be opportunities to increase the installation of more home insulation by providing subsides and rebates on insulation purchases.

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

Improving the inclusion of passive solar design in new homes will reduce the need for winter heating (and summer cooling).

Yours sincerely,

Daryl Scherger – Secretary,

Victorian Bioenergy Network.