Pathway to zero emissions for LPG

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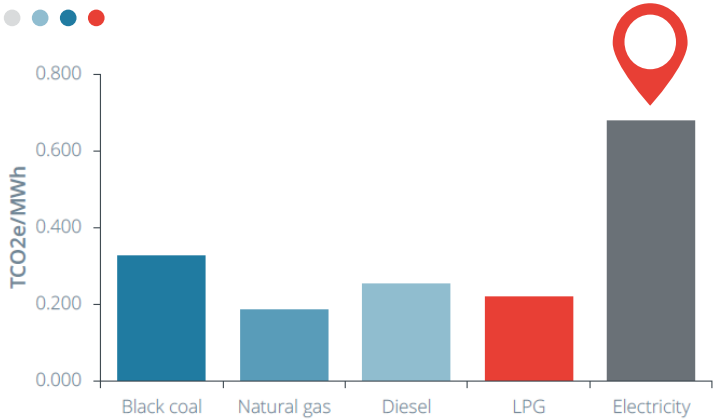
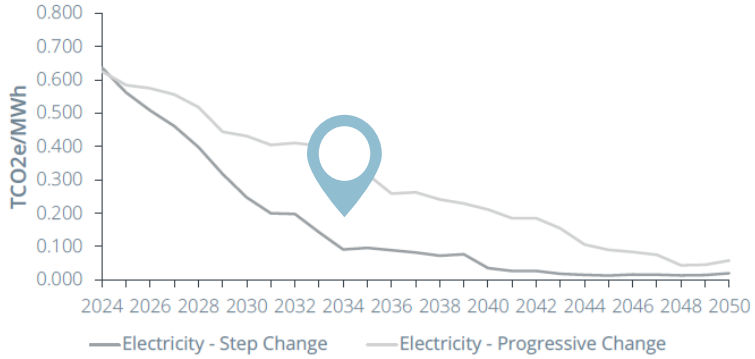
frontier economics

The decarbonisation challenge





All industries will face the challenge of decarbonising, to contribute to the transition to net zero. For the gas industry, there is the added challenge that electricity is often an alternative, and it is already on the path to decarbonizing.

Historically, electricity emissions have been higher than LPG

But the efficiency of electrical appliances is also high, so total emissions are increasingly competitive with gas appliances.

Electricity emissions are forecast to decline swiftly

As coal generation closes, and investment in wind and solar increases, emissions from electricity use are forecast to decline significantly.

Without a similar pathway to decarbonise LPG, calls to electrify LPG use will increase

There are many potential pathways to decarbonising LPG

BioLPG

BioLPG is propane produced from renewable feedstocks. It is a drop-in replacement.

There are many technologies for producing bioLPG. The credible pathway we've developed involves:

- **BioLPG from hydrotreating.** Also known as the hydrotreated vegetable oil (HVO) pathway. This is the conversion of vegetable oils to liquid hydrocarbons. HVO plant are operating globally, and a number are planned for Australia this decade. Mostly these are targeting SAF/biodiesel, with bioLPG as a byproduct.
- **BioLPG from gasification and FT**. Organic waste is gasified and then coverted to liquid hydrocarbons through chemical reactions. The technologies are established for fossil fuels, but less developed for biomass. Early stage commercial trials are underway internationally. Likely to target SAF/biodiesel, with bioLPG as a byproduct.
- **Renewable LPG through power-to-liquids**. Involves chemically combining green hydrogen with carbon dioxide to produce liquid hydrocarbons. This is at an earlier state of technological development, and so is a longer-term option.

There are many potential pathways to decarbonising LPG

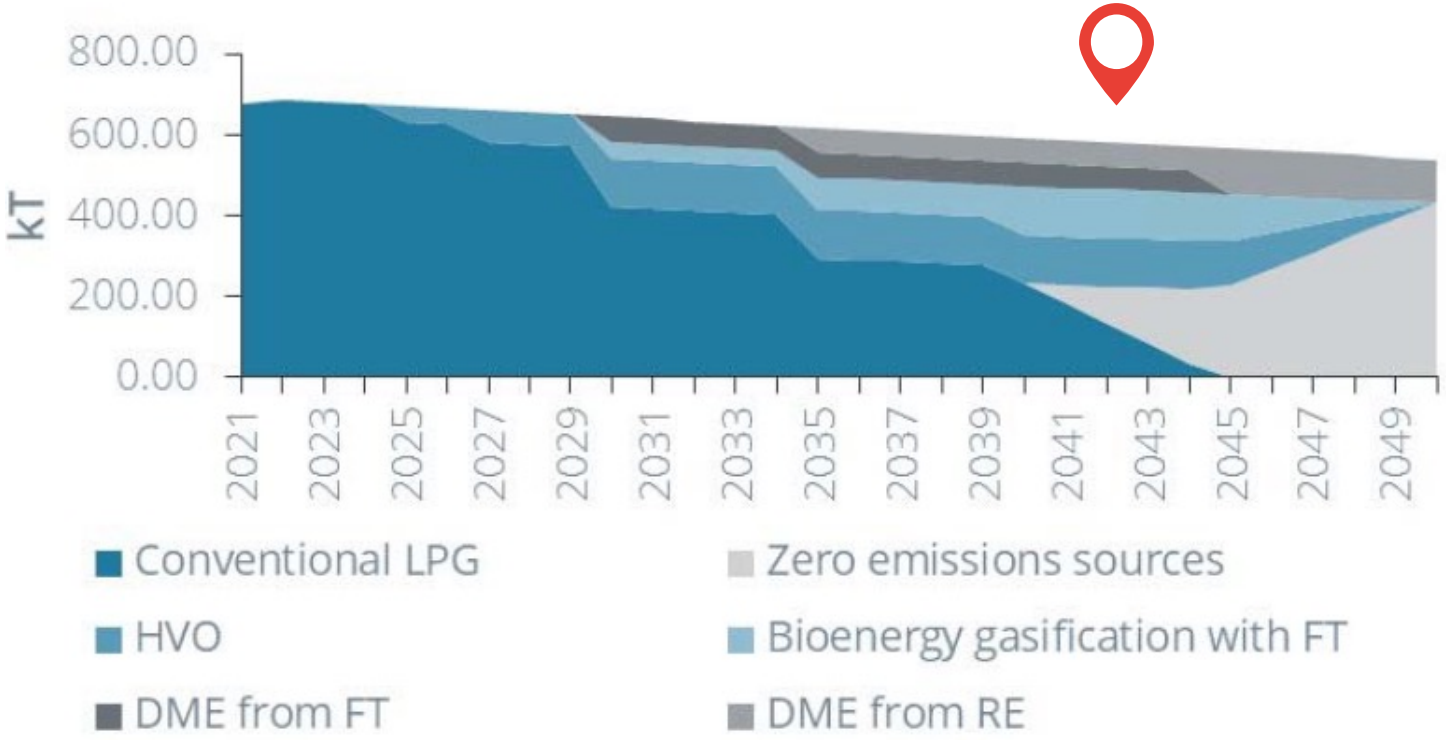
Renewable Dimethyl Ether (RDME)

rDME is often described as synthetic LPG. It can be blended with LPG, but it is not a drop-in replacement at 100% volumes.

The credible pathway we've developed involves:

- **rDME from biomass**. Organic waste is gasified, then converted to methanol, which is dehydrated to produce rDME. There are a number of small scale plant operating, or under development, internationally.
- **rDME from green hydrogen**. Involves the use of green hydrogen and renewable carbon dioxide to produce methanol, which is dehydrated to produce rDME. The Bell Bay Powerfuels Project plans to produce rDME, and is currently undergoing FEED.

Credible pathway – technology mix



A blend of technologies delivers a pathway to zero emissions

This is one pathway. Other pathways exist and may be preferred, depending on technology development, feedstock availability, emission reduction objectives, etc.

Credible pathway – emissions profile

How does the credible pathway compare with electrification?

Table 3: Summary of results – customers that choose **higher-efficiency** electrical appliances

	Upfront appliance cost *	Annualised appliance cost (10 years, 7%)	Average annual bill 2023 to 2032 (real dollars)	Average total annual cost (2023 - 2032)	Total emissions over 10 years
LPG and electricity case					
Cooking (LPG hub)	$1,200.00				
Space heating (LPG indoor flued heater)	$2,799.00				
Water heating (LPG instantaneous)	$1,900.00				
Total	$5,899.00	$839.88	$2,565.19 **	$3,405.08	35.38
Electricity only case					
Cooking (induction)	$2,346.67				
Space heating (heat pump)	$4,925.00				
Water heating (heat pump)	$4,600.00				
Total	$11,871.67	$1,690.26	$1,846.86	$3,537.12	30.71 ***

** Includes removal of existing appliance, new appliance purchase and installation) ** includes LPG costs and electricity bills *** Step Change scenario*

LPG delivers lower total annual cost than **efficient** electrical appliances

Accounting for appliance costs and bills, LPG customers in Victoria save around $130/annum. This is mostly due to cheaper LPG appliances.

Carbon emissions over next 10 years are higher with LPG

Our credible pathway has slower forecast reductions in emissions than electricity. Ultimately both are on a pathway to zero emissions. Implied carbon price of switching to electricity is high.

How does the credible pathway compare with electrification?

Table 4: Summary of results – customers that choose **lower-efficiency** electrical appliances

	Upfront appliance cost *	Annualised appliance cost (10 years, 7%)	Average annual bill 2023 to 2032 (real dollars)	Average total annual cost (2023 - 2032)	Total emissions over 10 years
LPG and electricity case					
Cooking (LPG hub)	$1,200.00				
Space heating (LPG indoor flued heater)	$2,799.00				
Water heating (LPG instantaneous)	$1,900.00				
Total	$5,899.00	$839.88	$2,565.19 **	$3,405.08	35.38
Electricity only case					
Cooking (electric oil cooktops)	$1,733.33				
Space heating (electric panel heaters)	$1,197.00				
Water heating (electrical storage water heating)	$3,590.00				
Total	$6,520.33	$928.35	$2,353.53	$3,281.88	44.98 ***

** Includes removal of existing appliance, new appliance purchase and installation) ** includes LPG costs and electricity bills *** Step Change scenario*

LPG delivers higher total annual cost than **inefficient** electrical appliances

Accounting for appliance costs and bills, LPG customers in Victoria pay around $125/annum extra. This is mostly due to higher energy costs.

Carbon emissions over next 10 years are lower with LPG

Implied carbon price of switching to LPG is lower.

Key lessons

1. There is a credible pathway to decarbonise LPG supply, and to do so at a competitive cost to customers.

2. Requiring customers to electrify may increase emissions, because much of the benefit of electrification is a result of efficient heat pumps which are expensive.

3. The decarbonisation pathway for both LPG and electricity is uncertain. Given this uncertainty, there is real benefit in preserving options for different decarbonisation pathways.

Contact Us

Brisbane | Melbourne | Singapore | Sydney

Ground Floor, 395 Collins Street
Melbourne VIC 3000 Australia
Tel: +61 3 9620 4488

contact@frontier-economics.com.au
www.frontier-economics.com.au

/frontier-economics-asia-pacific @FrontierEconomicsAsiaPacific