Economics of the renewable gas transition
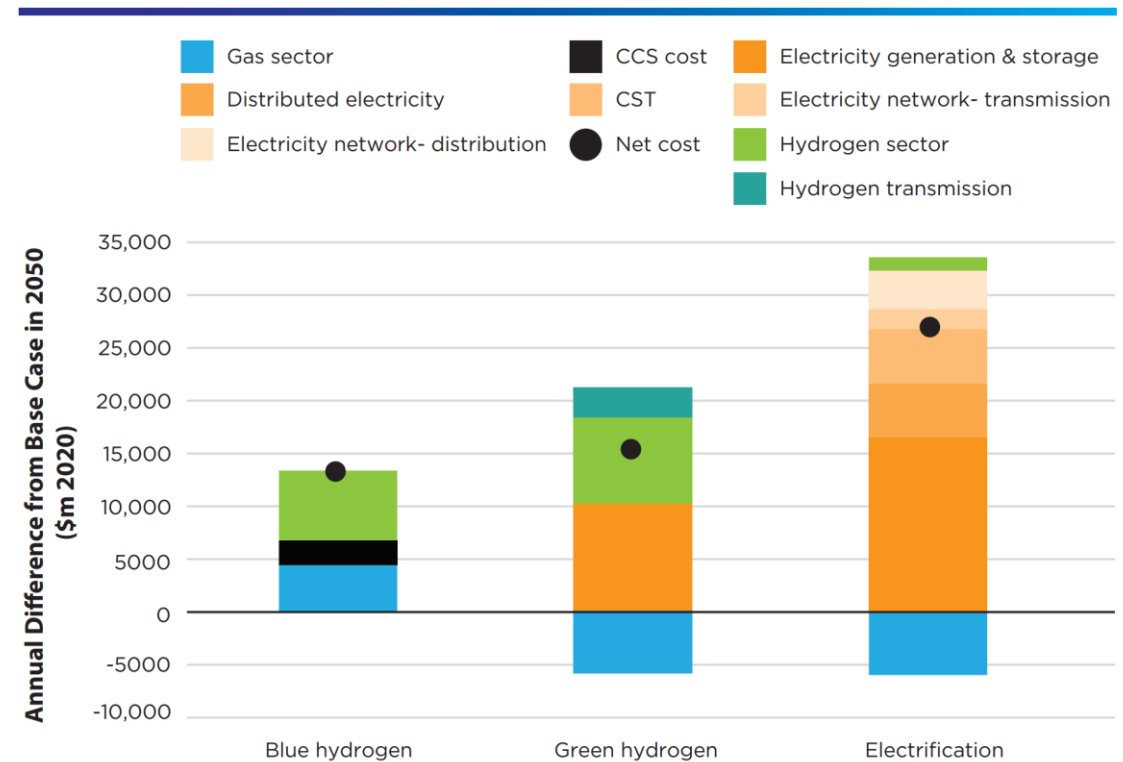## Total customer cost of heat amenity in the home

Australian Pipelines and Gas Association
November 2022

The importance of renewable gases

Foundation in Gas Vision 2050

Figure ES-3: Net cost of decarbonising gas by scenario

The importance of renewable gases

Headwinds within the renewable energy ecosystem

Will clean green hydrogen ever replace gas in Australian homes?

Ron Ben-David   29 April 2022

A clean future or merely greenwashing? Critics claim Coalition's hydrogen plans are a 'fig leaf' for fossil fuels

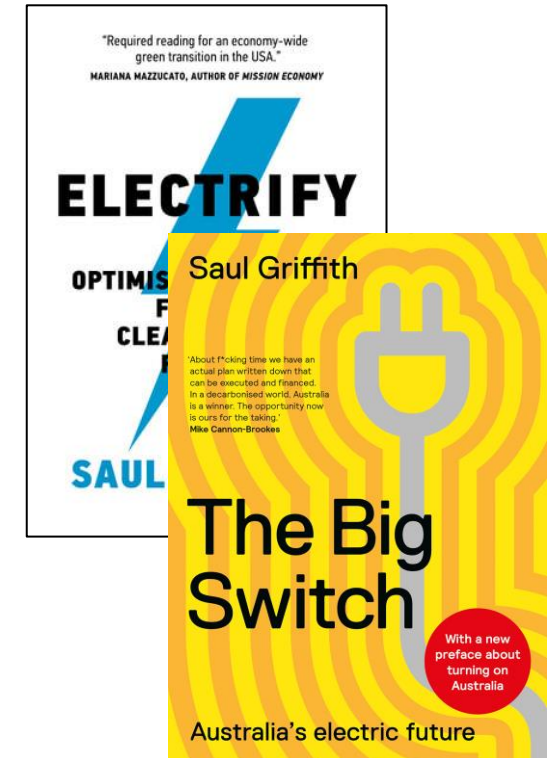By energy reporter Daniel Mercer

Posted Thu 12 May 2022 at 7:06am

Rewiring Australia

What about Hydrogen?

Hydrogen is a battery, not an energy source. To make hydrogen with truly zer[o]... with green electricity anyway, only it squanders more than half of that energy conversion. In short, hydrogen is electrification, but a roundabout and very in[efficient]... we do hydrogen for the majority of the energy economy, it doubles or triples [the]... energy we have to produce. It is an expensive sideshow to the main event: el[ectrification]... amount of hydrogen, but let's not get carried away. Beware! There are obvious reasons the gas industry likes to lobby for this idea. Australia is dangerously addicted to the Hydrogen narrative, and we should be more realistic about its role in Australia's future.
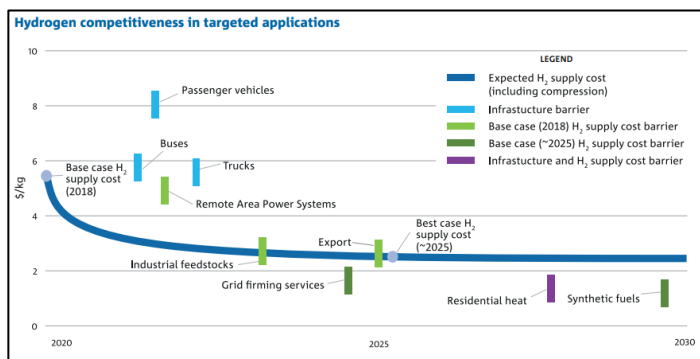
SEPTEMBER 9, 2022

AGN claims 'renewable gas' is climate-friendly could be greenwashing

"Required reading for an economy-wide green transition in the USA."
MARIANA MAZZUCATO, AUTHOR OF *MISSION ECONOMY*

ELECTRIFY

OPTIMIS[T]
F[OR A]
CLEA[N]

SAUL

Saul Griffith

'About f*cking time we have an actual plan written down that can be executed and financed. In a decarbonised world, Australia is a winner. The opportunity now is ours for the taking.'
Mike Cannon-Brookes

The Big Switch

With a new preface about turning on Australia

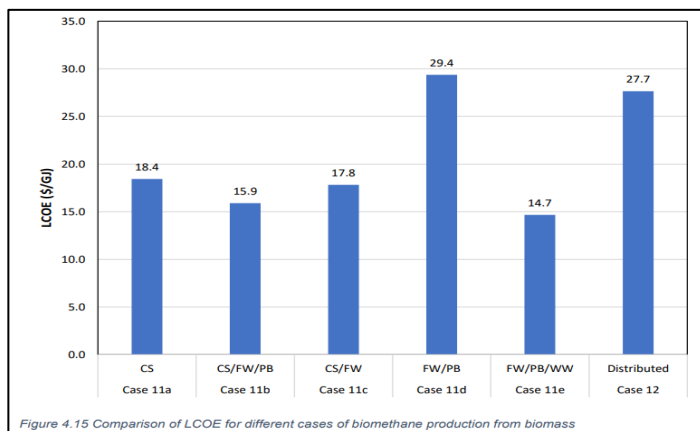Australia's electric future

Recent renewable gas research and analysis

Research and analysis of wholesale cost of net zero gas and electricity
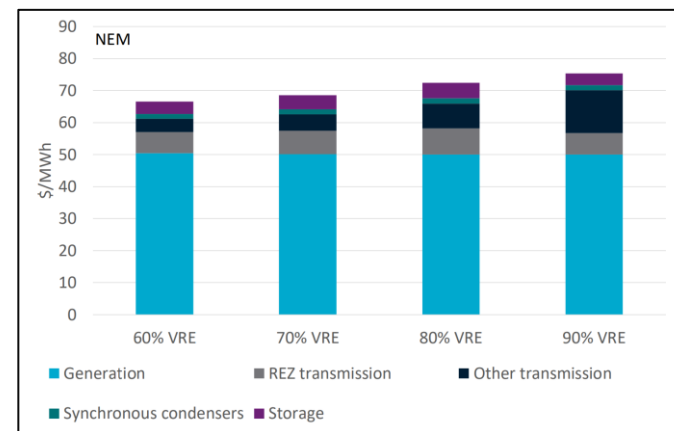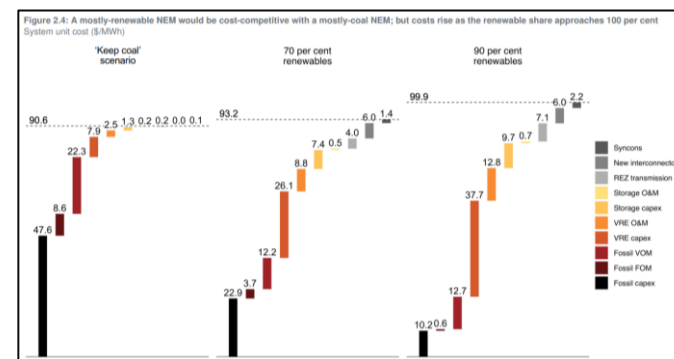
Wholesale Net Zero Gas Cost ($15 - $30 per Gigajoule)

CSIRO

Hydrogen competitiveness in targeted applications

Future Fuels CRC

Figure 4.15 Comparison of LCOE for different cases of biomethane production from biomass

Wholesale Net Zero Electricity Cost ($75 - $90 per Megawatt Hour)

The Grattan Institute

Figure 2.4: A mostly-renewable NEM would be cost-competitive with a mostly-coal NEM; but costs rise as the renewable share approaches 100 per cent

CSIRO

Recent renewable gas research and analysis

Research and analysis of wholesale cost of net zero gas and electricity

Wholesale cost of net zero gas
is often cheaper than
wholesale cost of net zero electricity

Recent renewable gas research and analysis

Research and analysis of cost of net zero energy transport and storage

Levelised Cost of Energy Transport
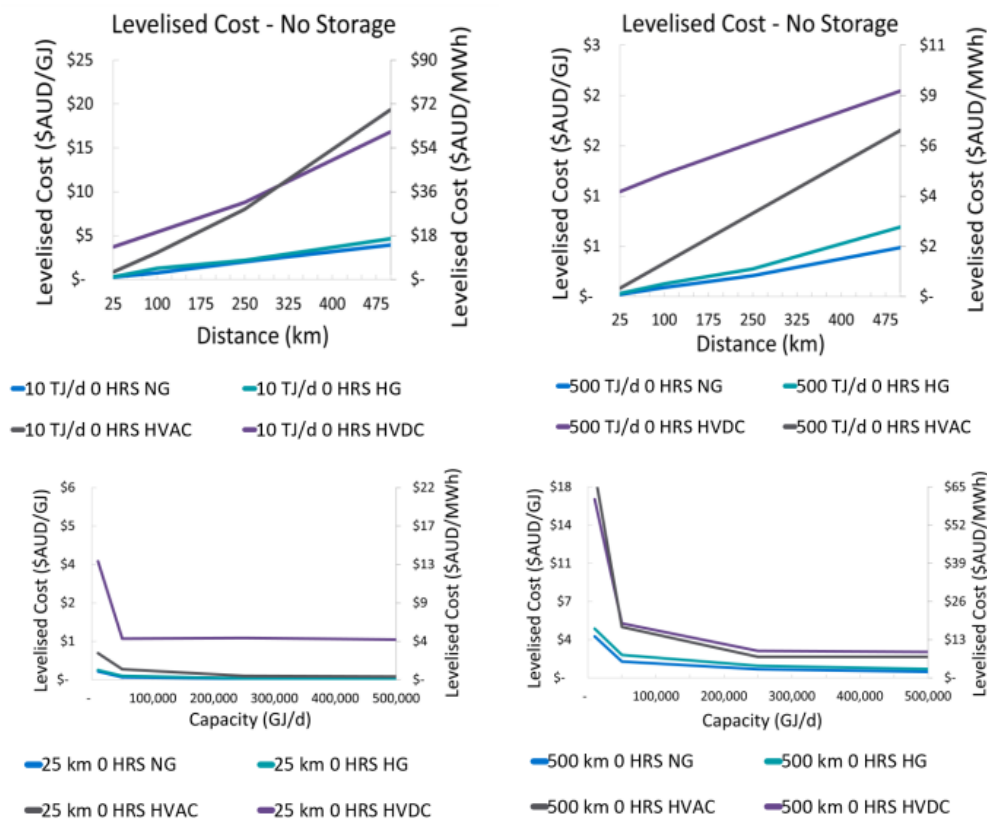
Levelised Cost of Energy Storage

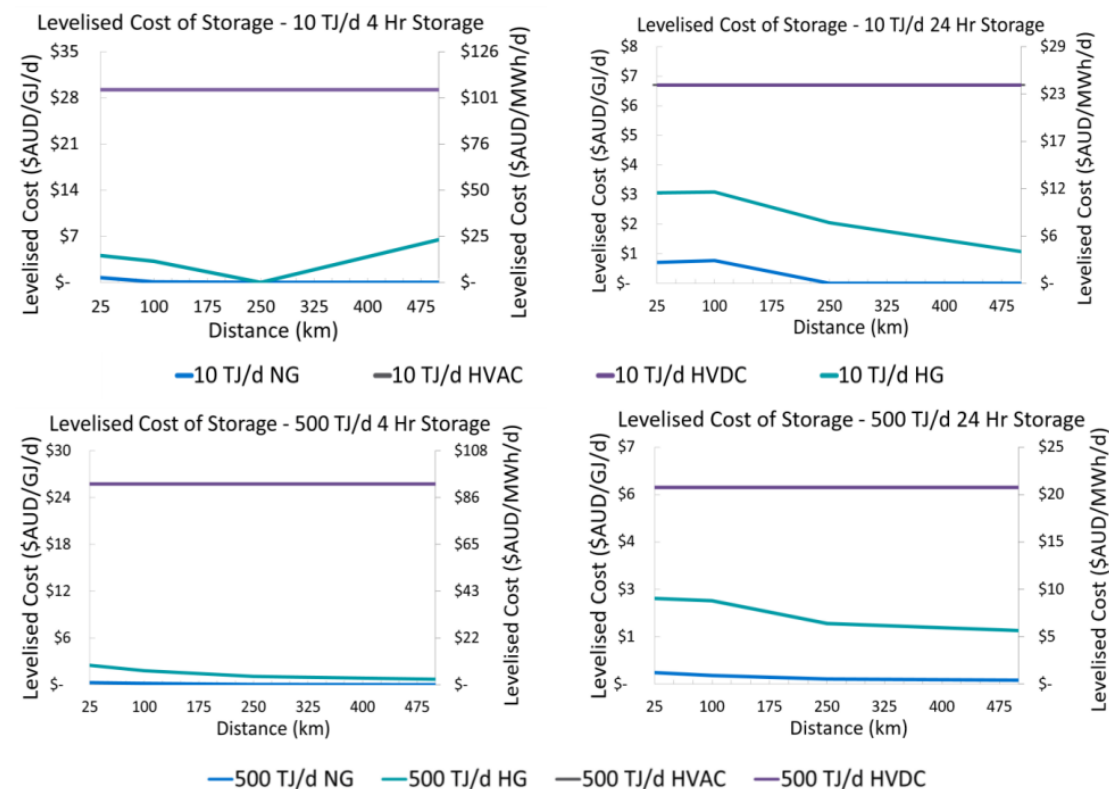Figure 1: Levelised cost of transport (zeros storage) at throughput and distance extremes

Figure 2: Levelised cost of storage (varying storage) for 10 and 500 TJ/d
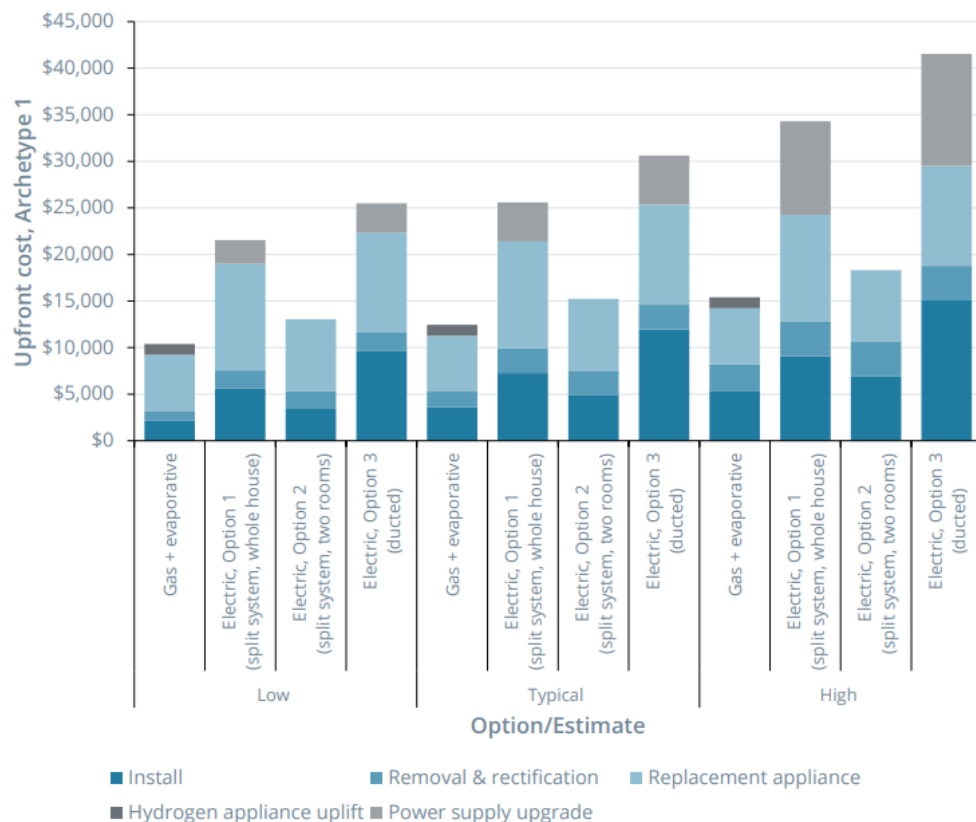
Recent renewable gas research and analysis

Research and analysis of cost of net zero energy transport and storage

Net zero gas infrastructure cost
is less than
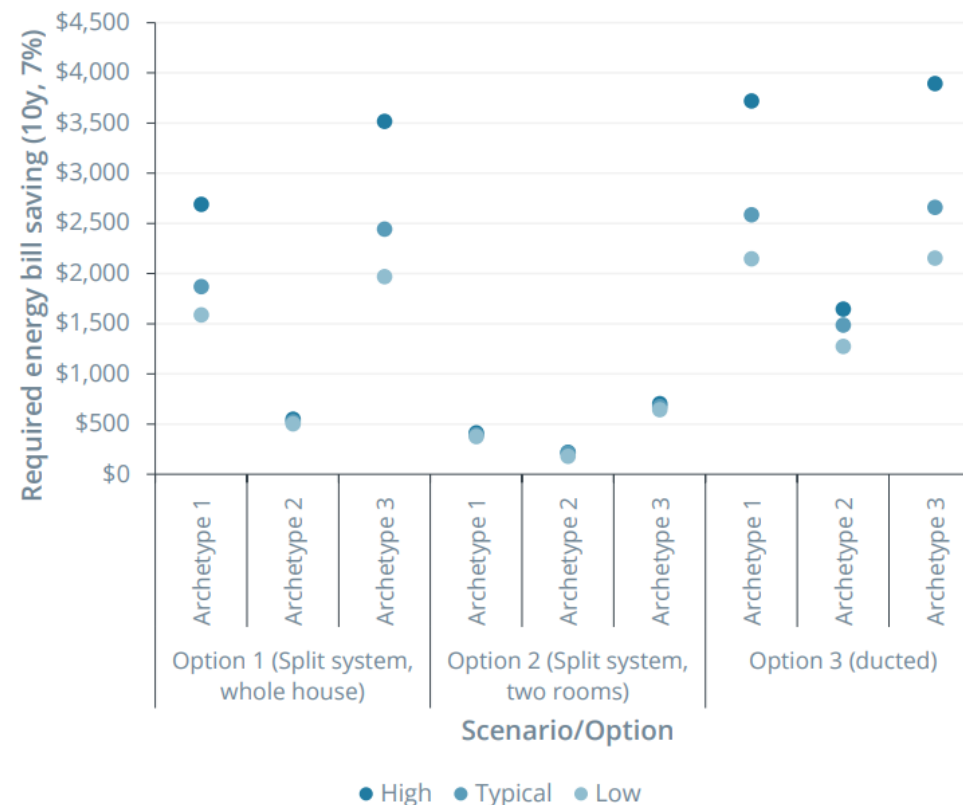# equivalent net zero electricity infrastructure cost

Recent renewable gas research and analysis

Research and analysis of net zero gas and electricity appliances in the home

Upfront Net Zero Appliance Costs

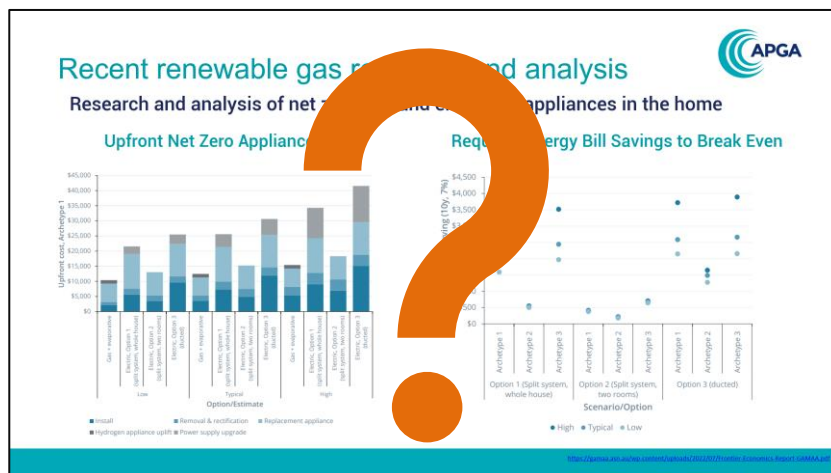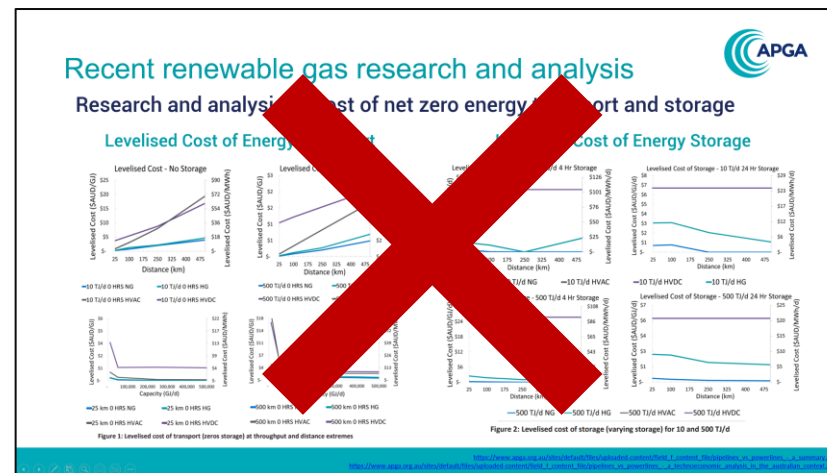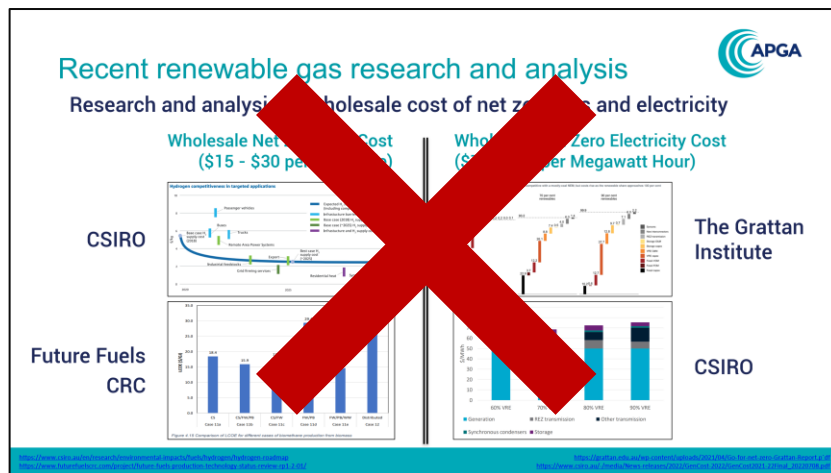### Required Energy Bill Savings to Break Even

Recent renewable gas research and analysis

Research and analysis of net zero gas and electricity appliances in the home

Net zero gas appliance cost
is less than
equivalent net zero electricity appliance cost

What do energy customers care about?

Individual Supply Chain Costs? Unlikely…

What do energy customers care about?

Reliable, affordable, sustainable energy
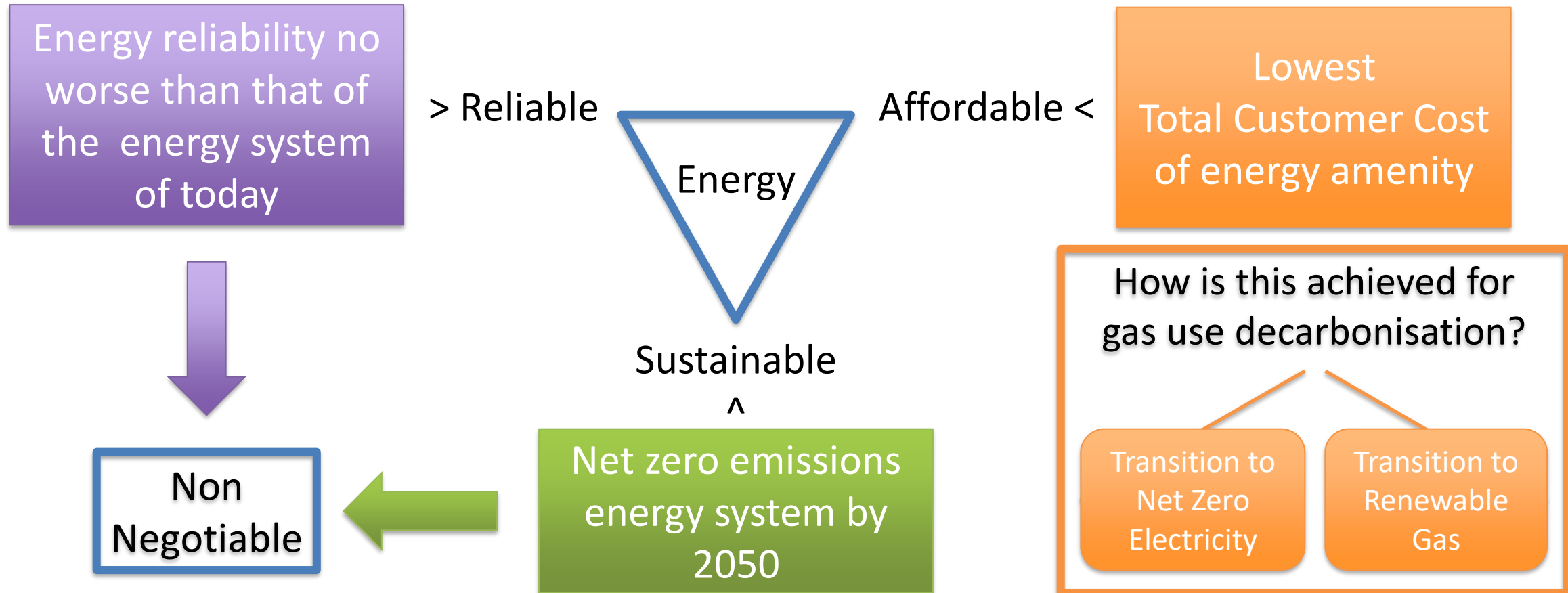
Energy reliability no worse than that of the energy system of today

> Reliable

Energy

Affordable <

Lowest
Total Customer Cost
of energy amenity

Sustainable
^

Net zero emissions energy system by 2050

Non Negotiable

How is this achieved for gas use decarbonisation?

Transition to Net Zero Electricity

Transition to Renewable Gas

APGA

Total Customer Cost of Amenity

Constituent components of Total Customer Cost
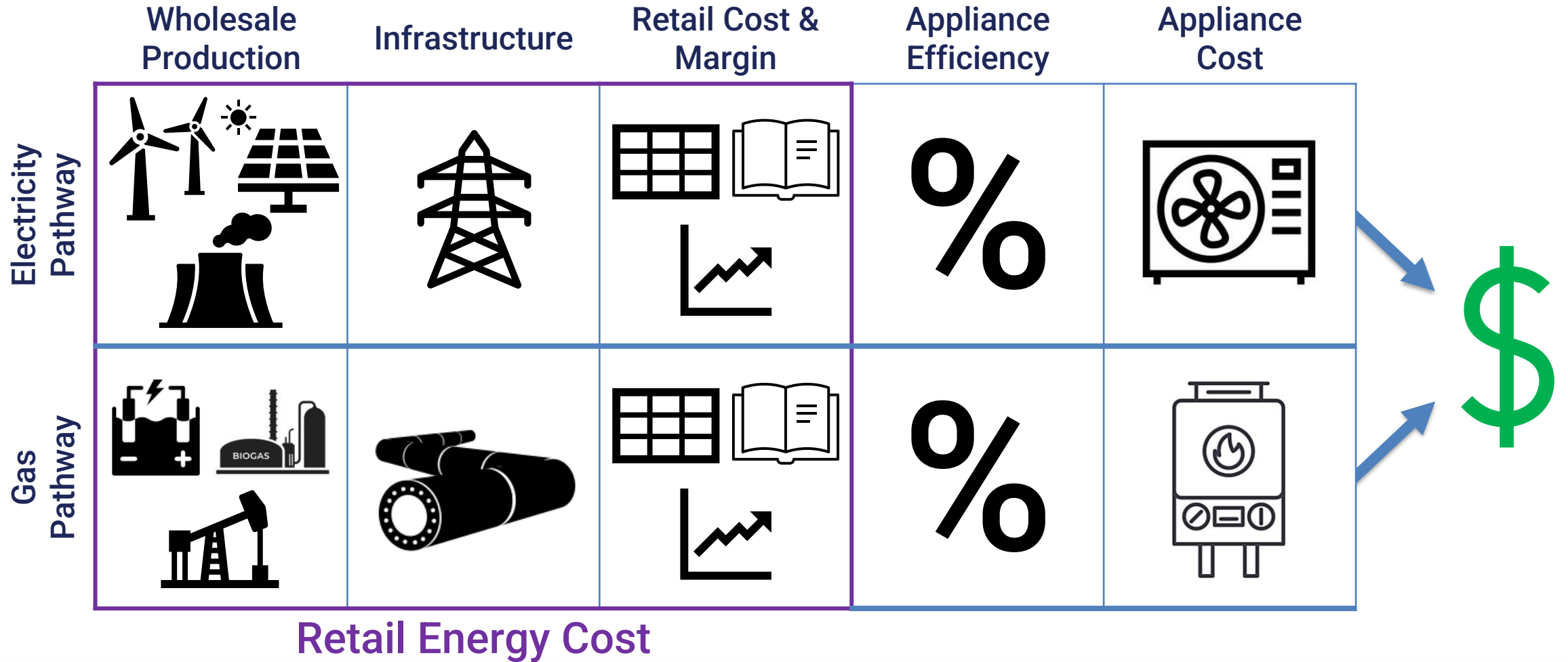
Total Customer Cost of Amenity

Constituent components of Total Customer Cost

Total Customer Cost of Amenity

Macroeconomic Analysis Methodology

The macroeconomic analysis methodology combines real or modelled retail energy price ranges with ranges for appliance cost and efficiency.
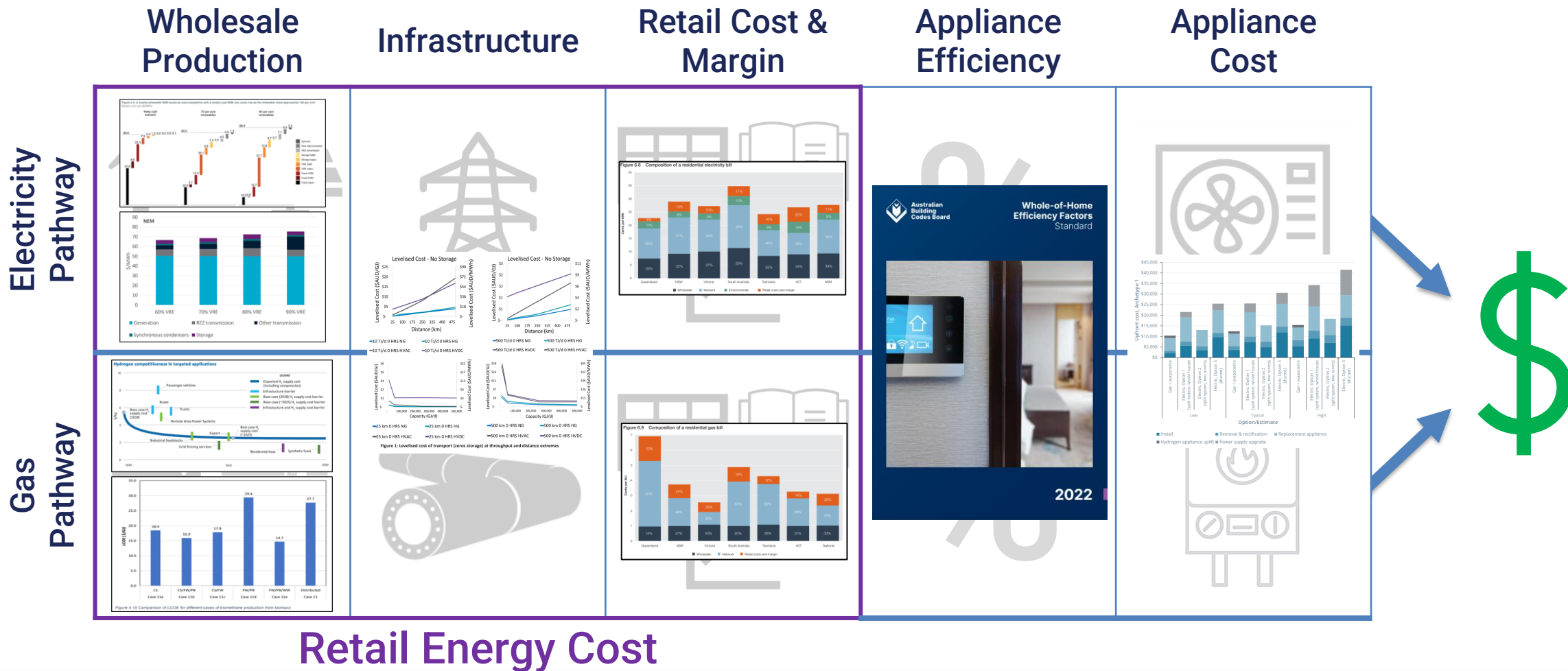
Total Customer Cost =
(Energy Cost x Appliance Efficiency) + (Annualised Appliance Cost / Annual Energy Use)

[Put simply, bill cost per unit of energy amenity plus appliance cost per unit of energy amenity]

Energy cost could either be a reported figure, derived through a bottom-up Whole of System Cost approach as proposed by Frontier Economics, or by a top-down approach of modelling anticipated changes to the breakdown of retail energy costs.

Within the modelling displayed within this presentation, reported retail energy prices for FY2020-21 are considered alongside a top-down model of retail energy price breakdown based upon data from the Australian Energy Regulator (AER) via the formula:

Retail Energy Cost $_{net\ zero}$
*= ∑(Retail Energy Component Cost $_{FY2020-21}$ * Net Zero Energy Scalar)*

[Put simply, how much net zero energy and infrastructure costs relative to historic costs]

Macroeconomic analysis of Total Customer Cost

Heat amenity in the home FY2020-21

	Wholesale Production	Infrastructure	Retail Cost & Margin	Appliance Efficiency	Appliance Cost
Electricity Pathway					
Gas Pathway					

Retail Energy Cost

Macroeconomic analysis of Total Customer Cost

Heat amenity in the home FY2020-21

Victorian Customer Cost of Heat Amenity in the Home FY2020-21 including Sensitivity Analysis Scenario D & E
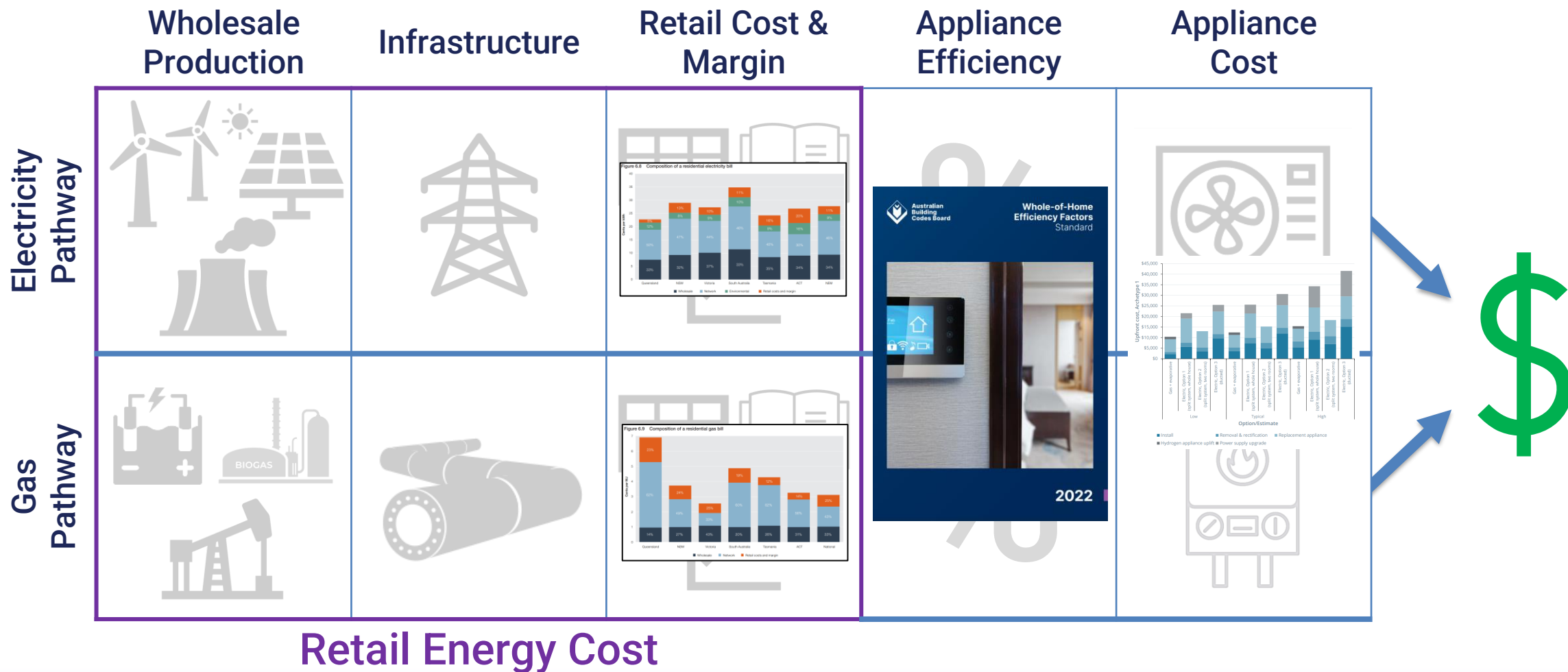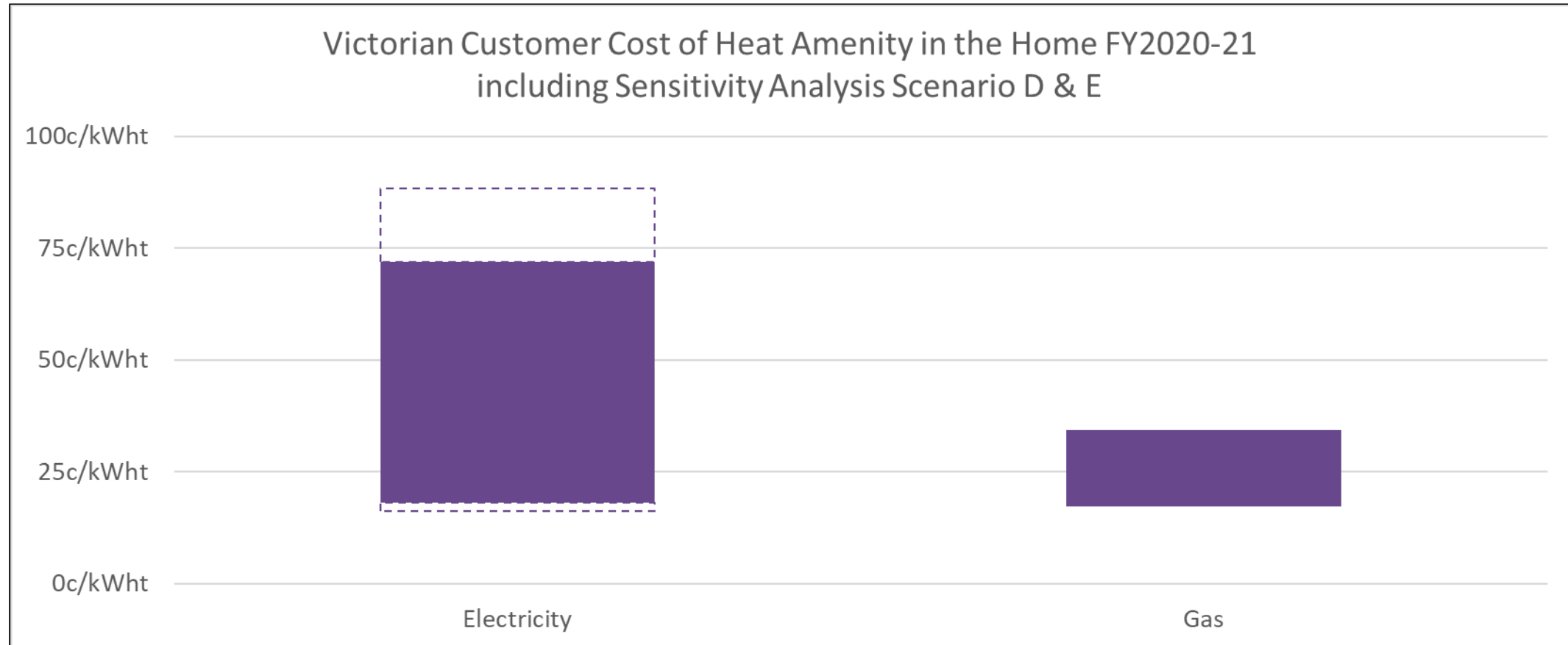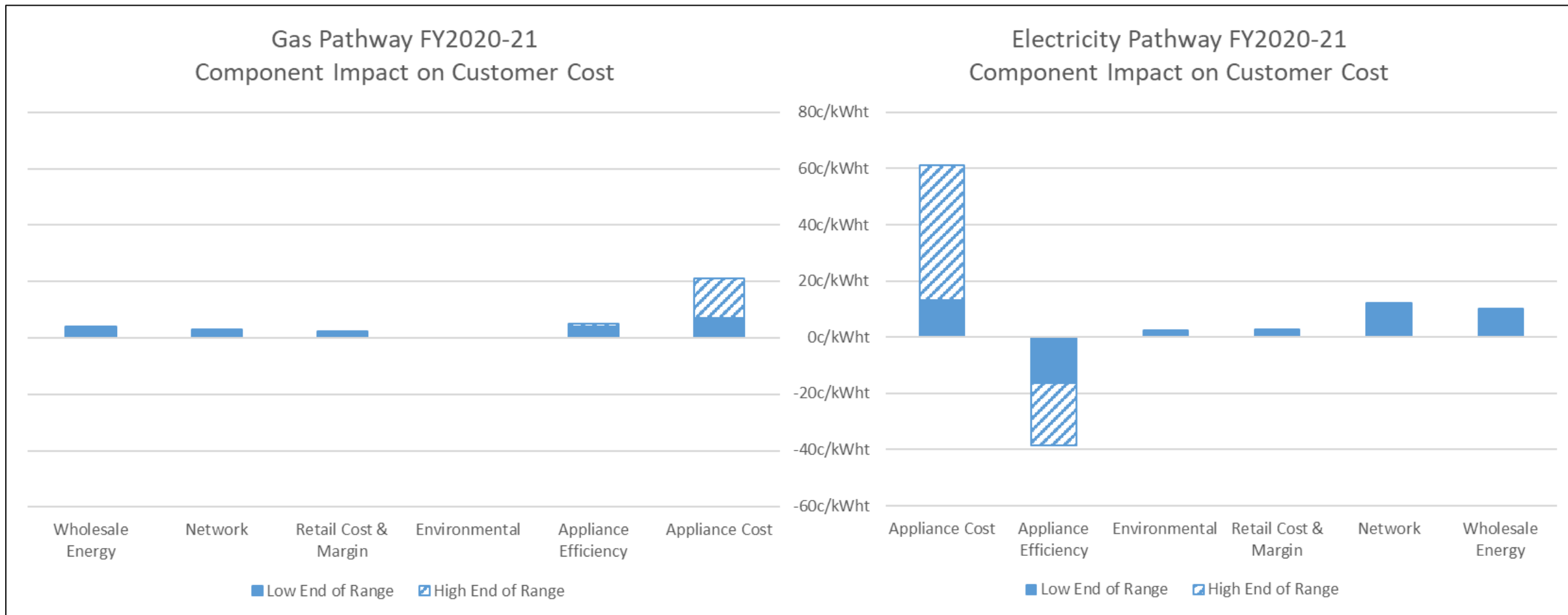
Macroeconomic analysis of Total Customer Cost

Heat amenity in the home FY2020-21

Macroeconomic analysis of Total Customer Cost

Heat amenity in the home FY2020-21

Victorian Customer Cost of Heat Amenity in the Home FY2020-21 including Sensitivity Analysis Scenario D & E

Macroeconomic analysis of Total Customer Cost

Heat amenity in the home FY2020-21 (Plus Fed. Budget projected price increase)

Victorian Customer Cost of Heat Amenity in the Home FY2020-21
including Sensitivity Analysis Scenario D & E + Budget Increases (E:^56%, G:^44%)

Macroeconomic analysis of Total Customer Cost

Net zero heat amenity in the home

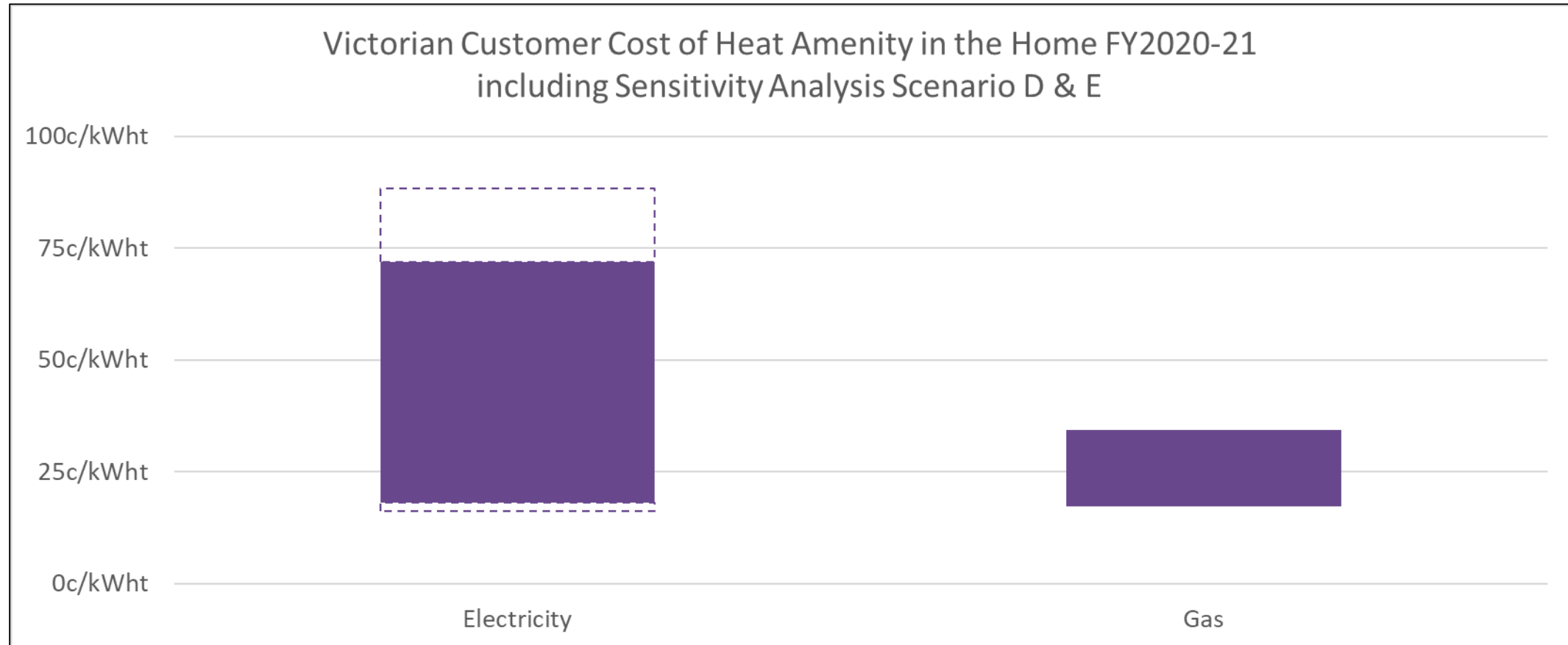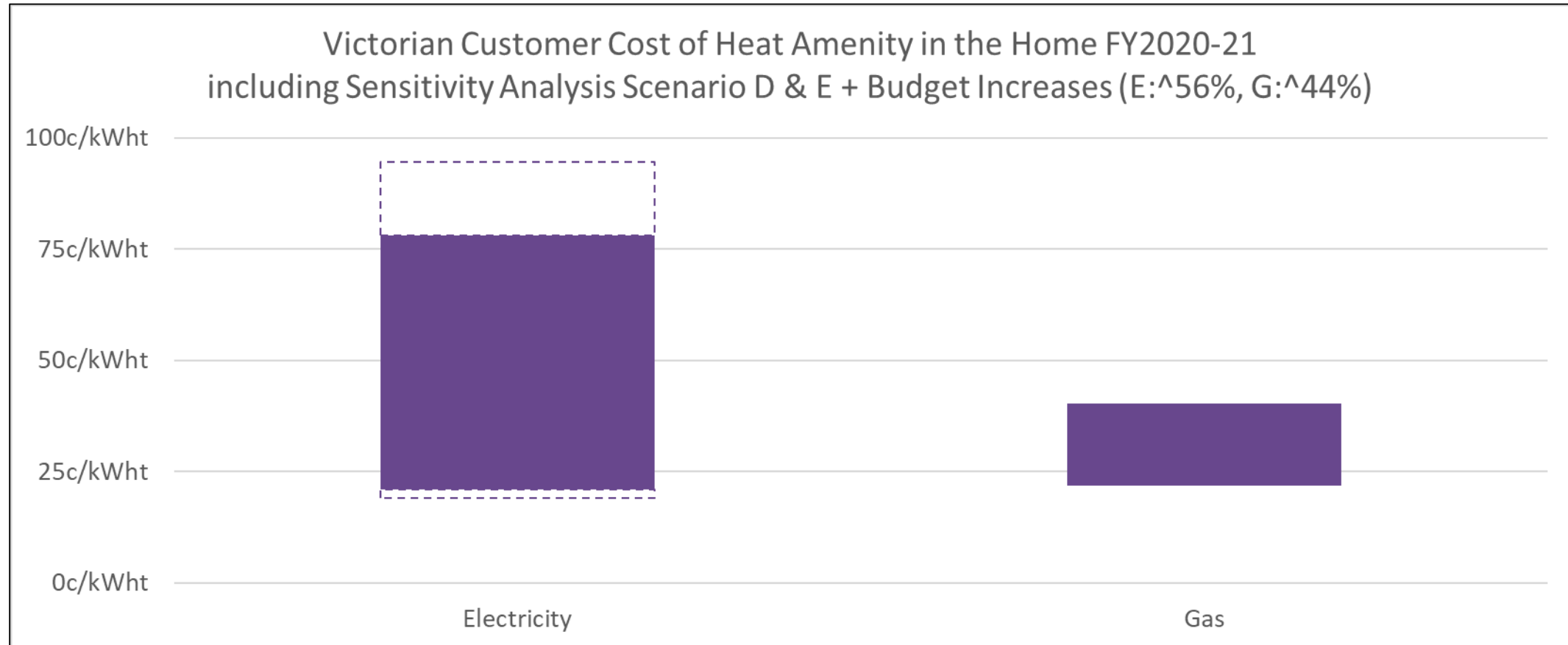|	Wholesale Production	Infrastructure	Retail Cost & Margin	Appliance Efficiency	Appliance Cost
Electricity Pathway					
Gas Pathway					

Retail Energy Cost

Macroeconomic analysis of Total Customer Cost

Net zero heat amenity in the home

Macroeconomic analysis of Total Customer Cost

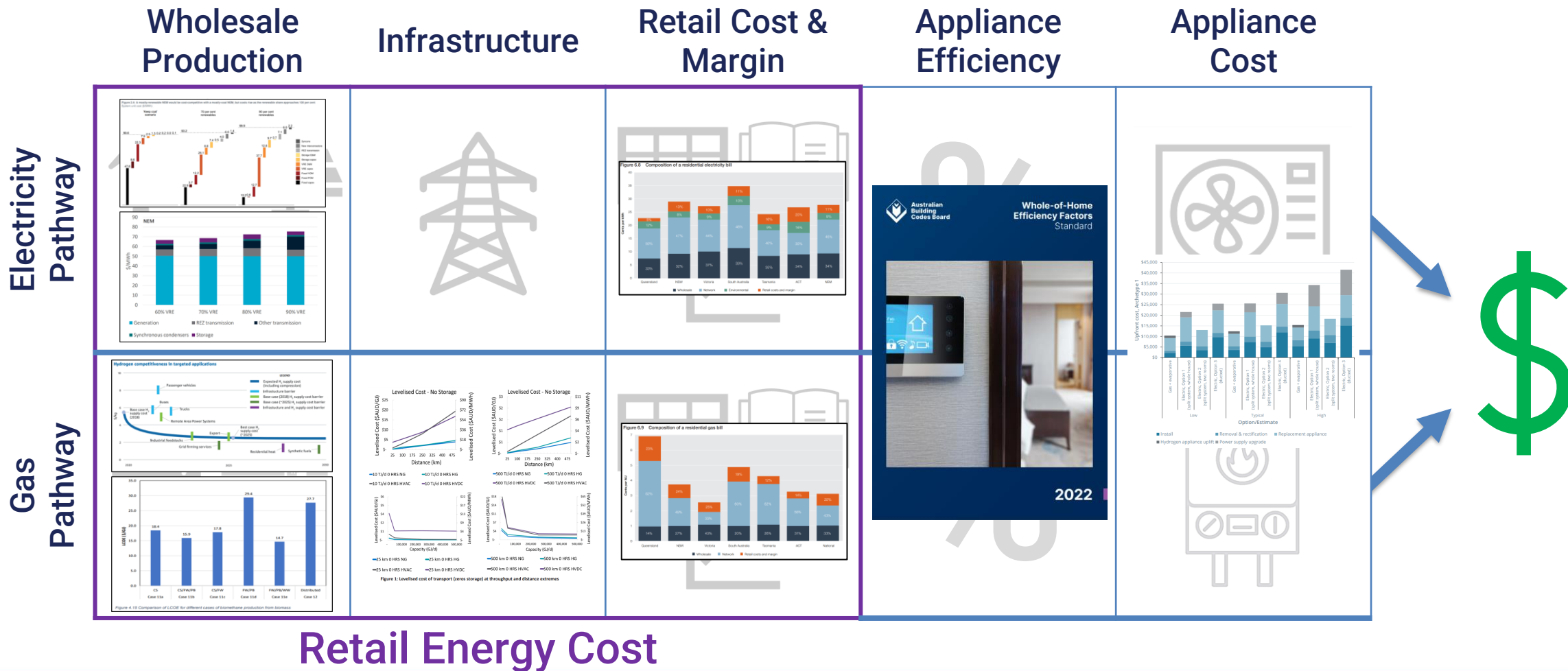## Net zero heat amenity in the home (Modelled net zero retail energy costs)

Modelled retail net zero energy prices Victoria

Modelled retail net zero energy price (c/kWh)

Net Zero Electricity Low
- Net Zero Wholesale Low, -1.2
- FY20-21 Retail Cost & Margin, 2.78c
- FY20-21 Environmental, 2.37c
- FY20-21 Network, 12.01c
- FY20-21 Wholesale, 10.12c

Net Zero Electricity High
- Net Zero Wholesale High, +1.82c
- FY20-21 Retail Cost & Margin, 2.78c
- FY20-21 Environmental, 2.37c
- FY20-21 Network, 12.01c
- FY20-21 Wholesale, 10.12c

Net Zero Gas Low
- Low Net Zero Wholesale, +5.89c
- FY20-21 Wholesale, 3.99c
- Net Zero Network, +0.58c
- FY20-21 Network, 3.07c
- FY20-21 Retail Cost & Margin, 2.30c

Net Zero Gas High
- High Net Zero Wholesale, +15.77c
- FY20-21 Wholesale, 3.99c
- Net Zero Network, +2.08c
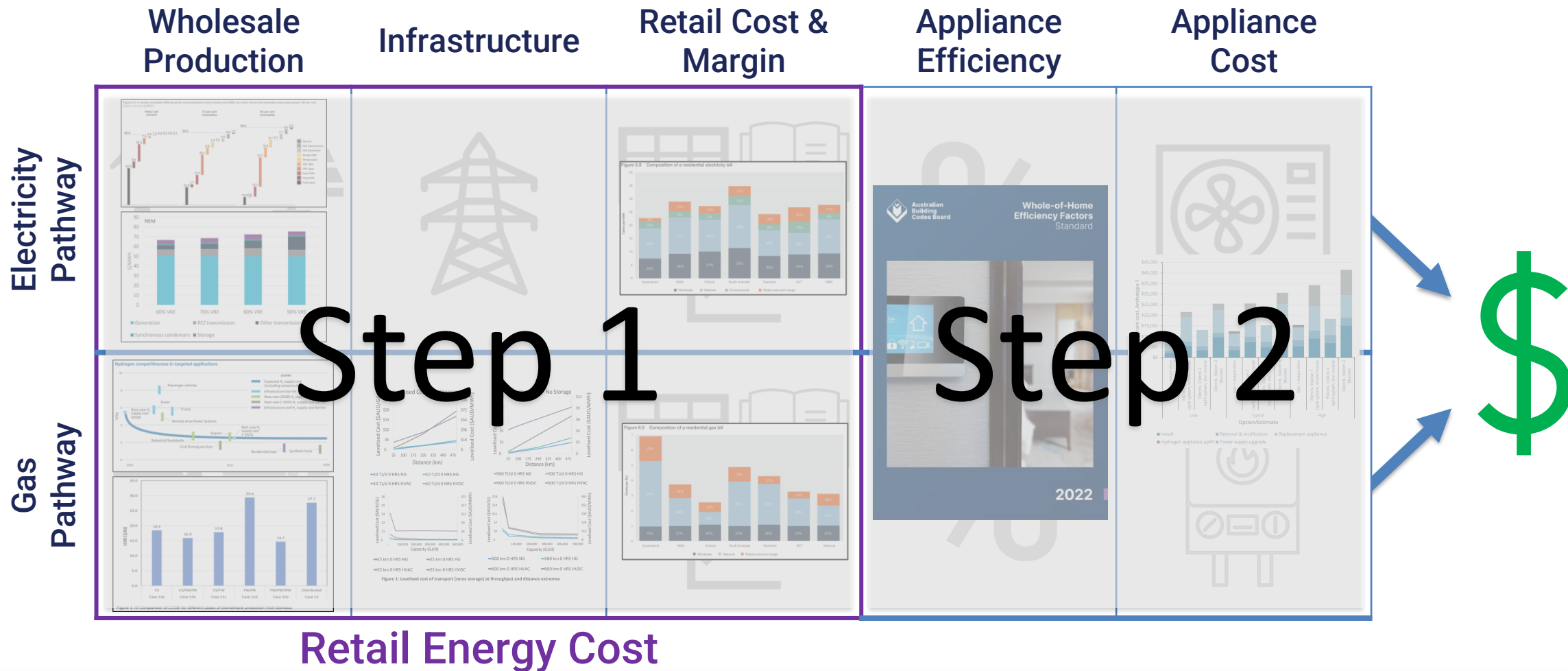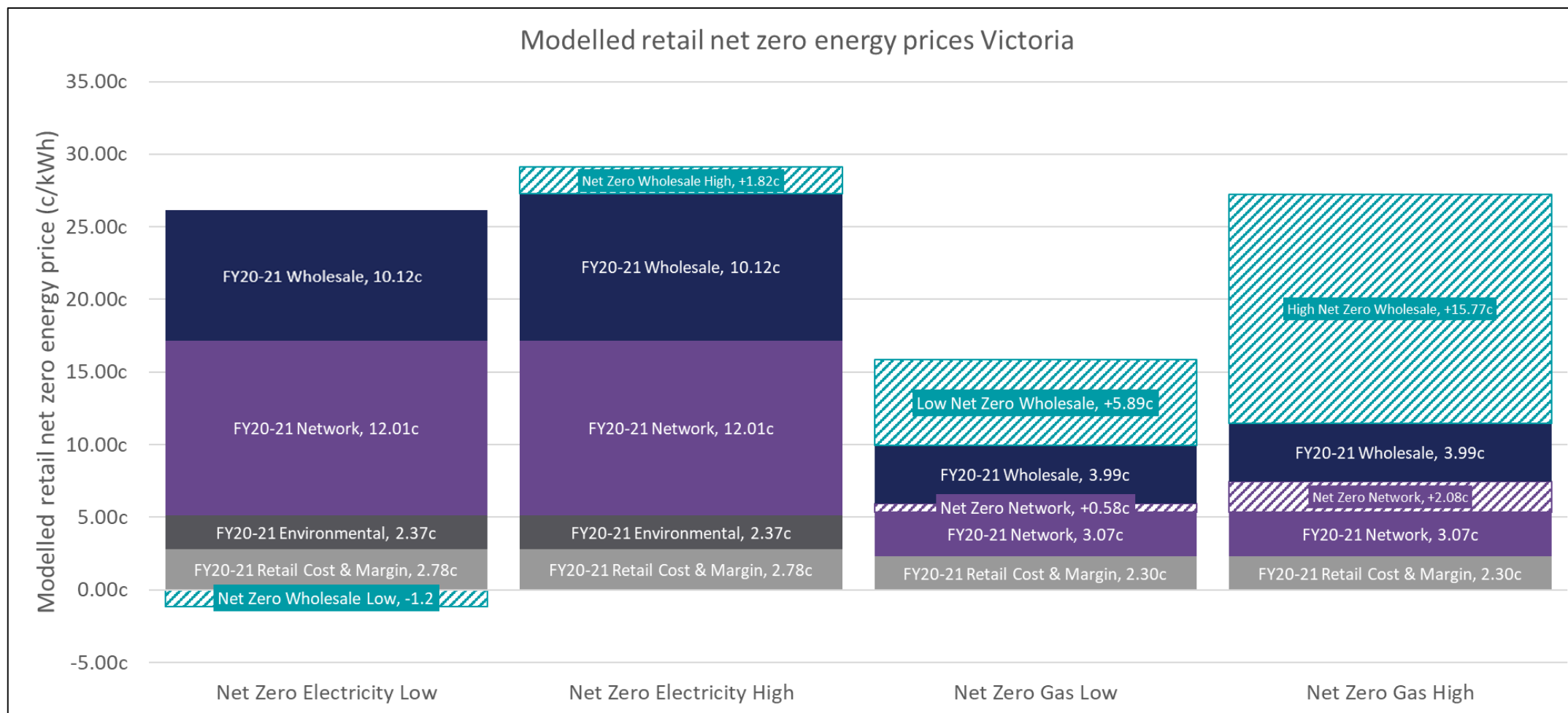- FY20-21 Network, 3.07c
- FY20-21 Retail Cost & Margin, 2.30c

Macroeconomic analysis of Total Customer Cost

Net zero heat amenity in the home

Macroeconomic analysis of Total Customer Cost

Net zero heat amenity in the home
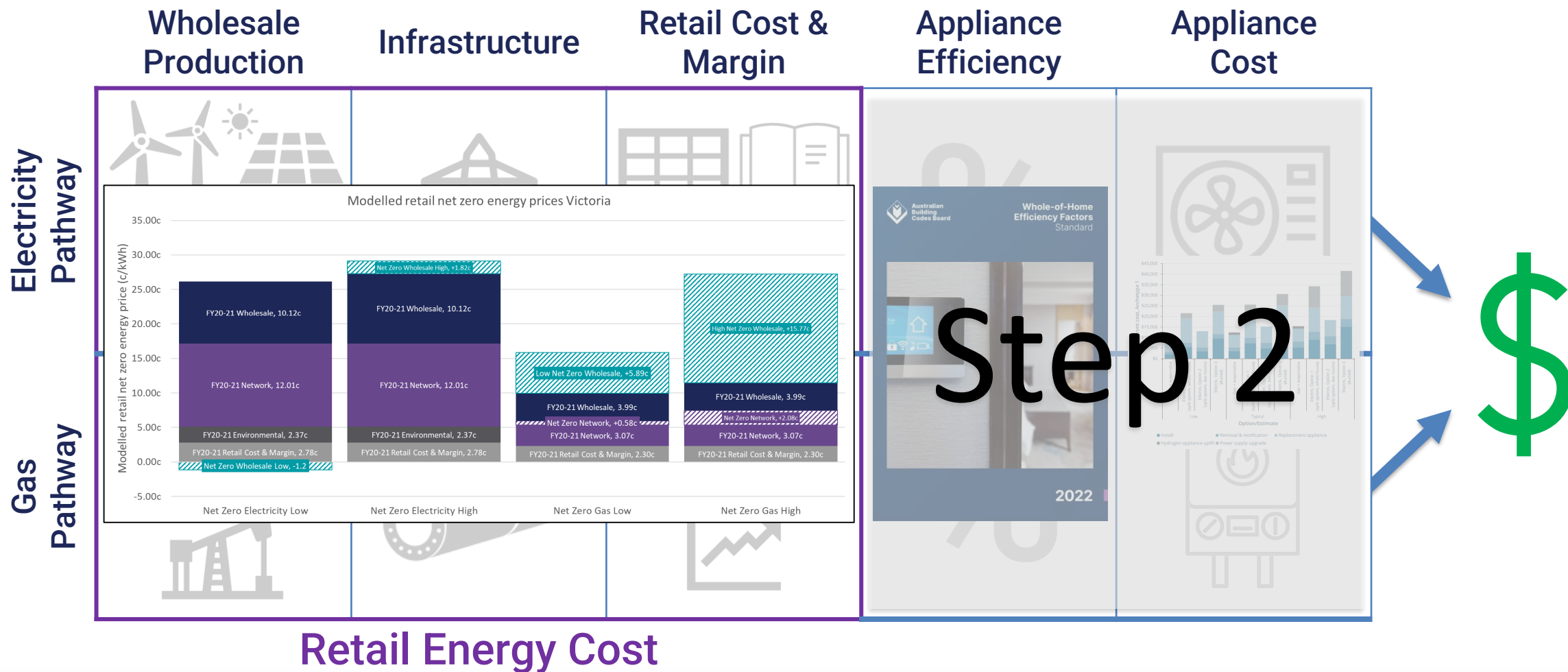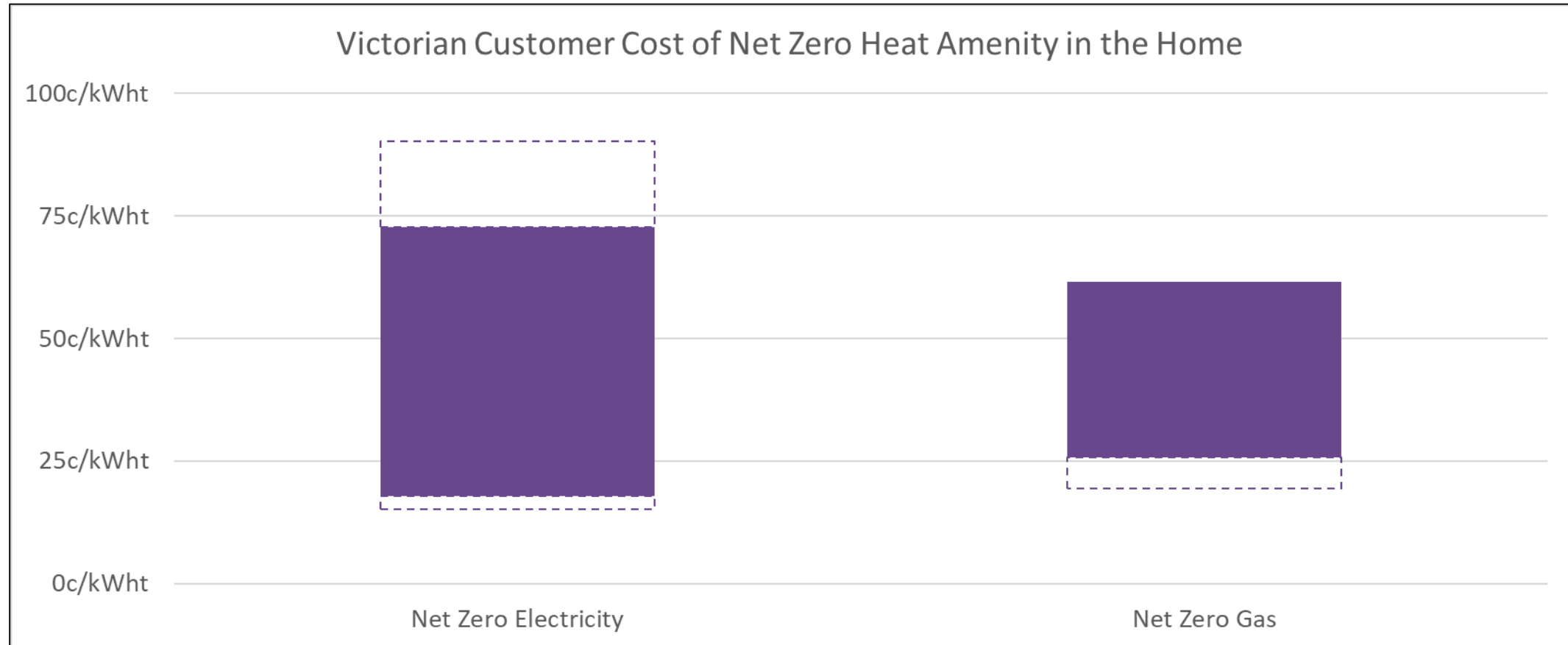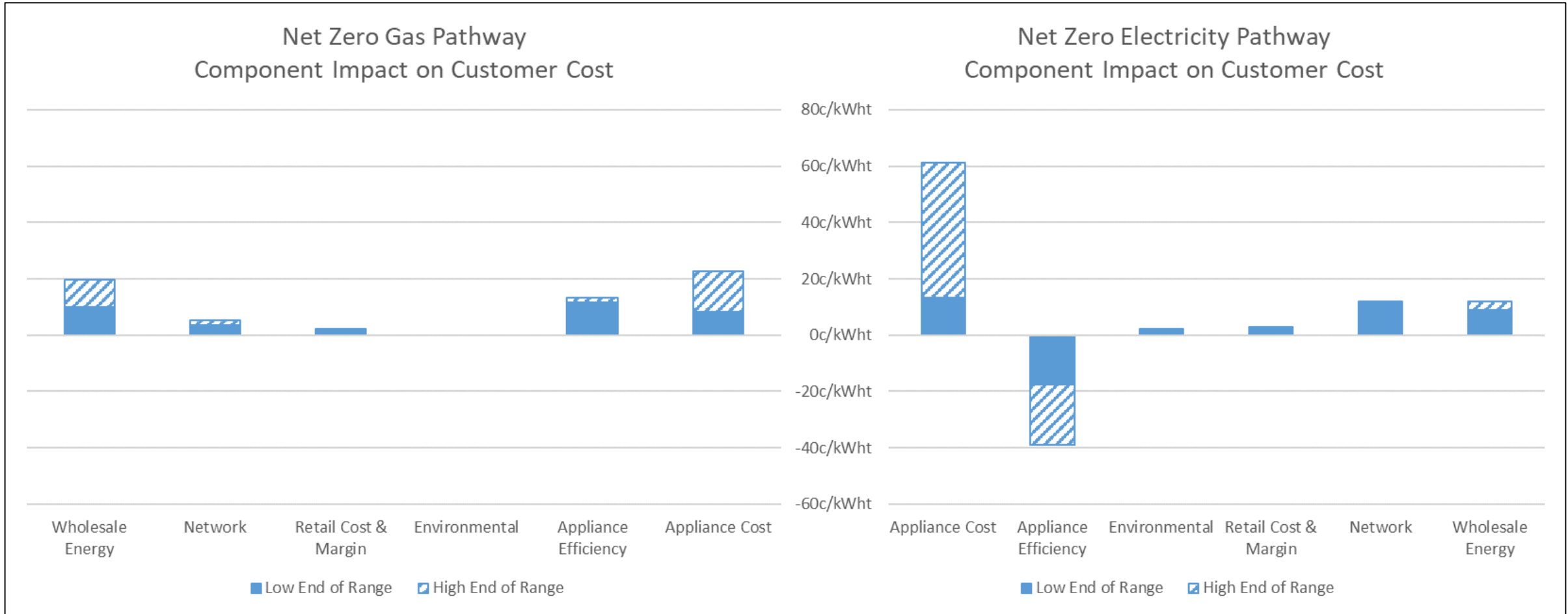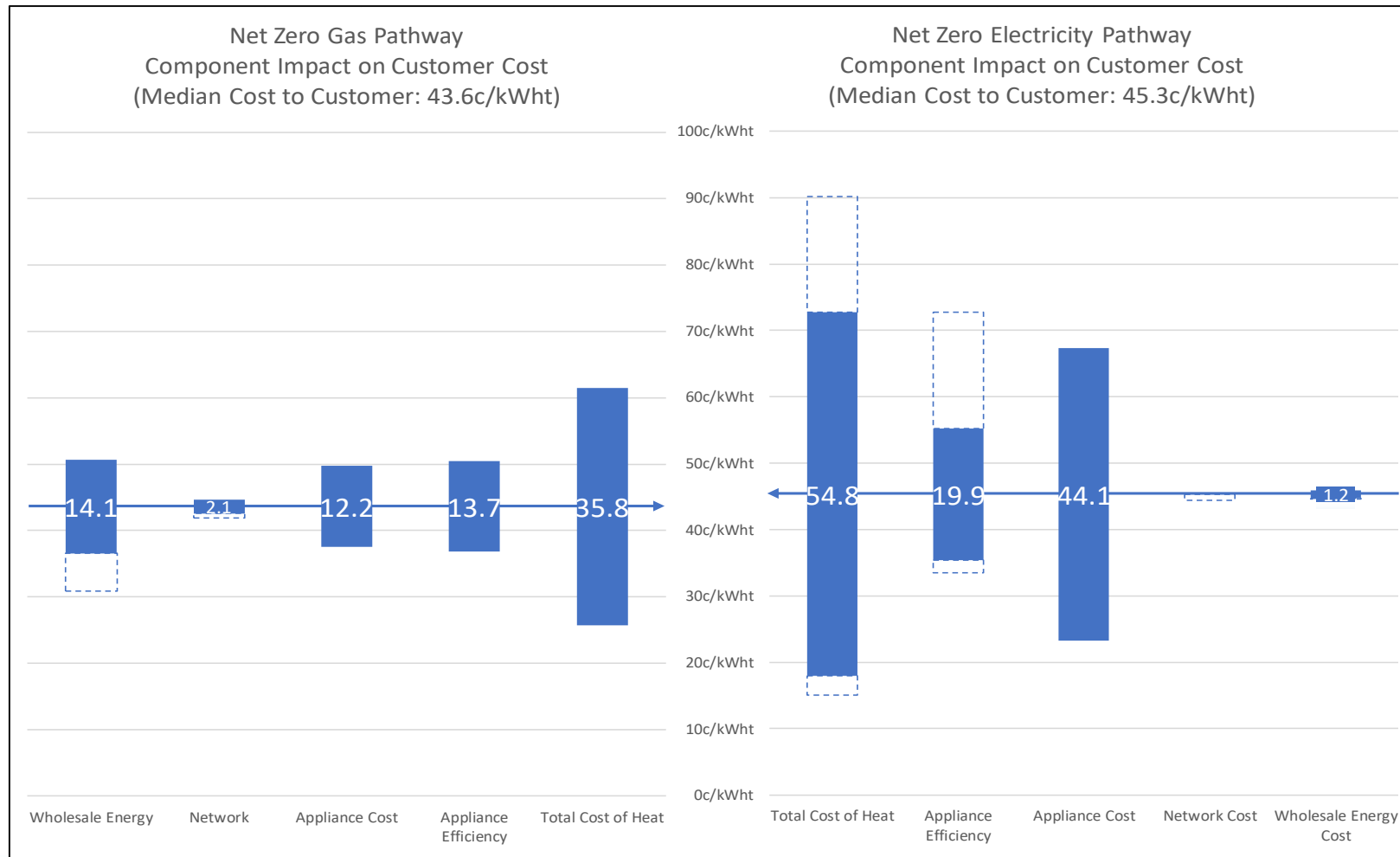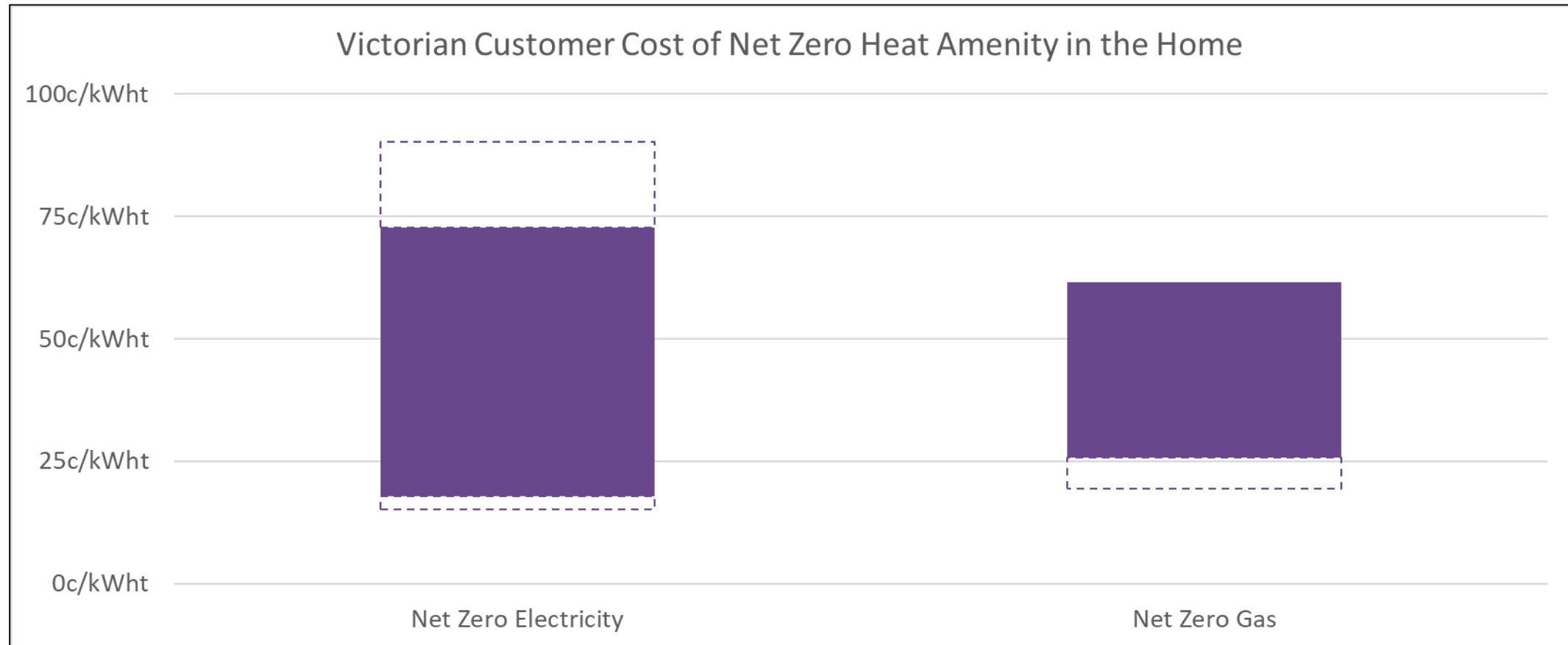
Macroeconomic analysis of Total Customer Cost

Net zero heat amenity in the home

Net Zero Gas Pathway
Component Impact on Customer Cost

Net Zero Electricity Pathway
Component Impact on Customer Cost

Macroeconomic analysis of Total Customer Cost

Net zero heat amenity in the home

Net Zero Gas Pathway
Component Impact on Customer Cost
(Median Cost to Customer: 43.6c/kWht)

Net Zero Electricity Pathway
Component Impact on Customer Cost
(Median Cost to Customer: 45.3c/kWht)

Gas Pathway values: Wholesale Energy 14.1, Network 2.1, Appliance Cost 12.2, Appliance Efficiency 13.7, Total Cost of Heat 35.8

Electricity Pathway values: Total Cost of Heat 54.8, Appliance Efficiency 19.9, Appliance Cost 44.1, Network Cost, Wholesale Energy Cost 1.2

Macroeconomic analysis of Total Customer Cost

Why focus on net zero heat amenity in the home?

Victorian Customer Cost of Net Zero Heat Amenity in the Home

Macroeconomic analysis of Total Customer Cost

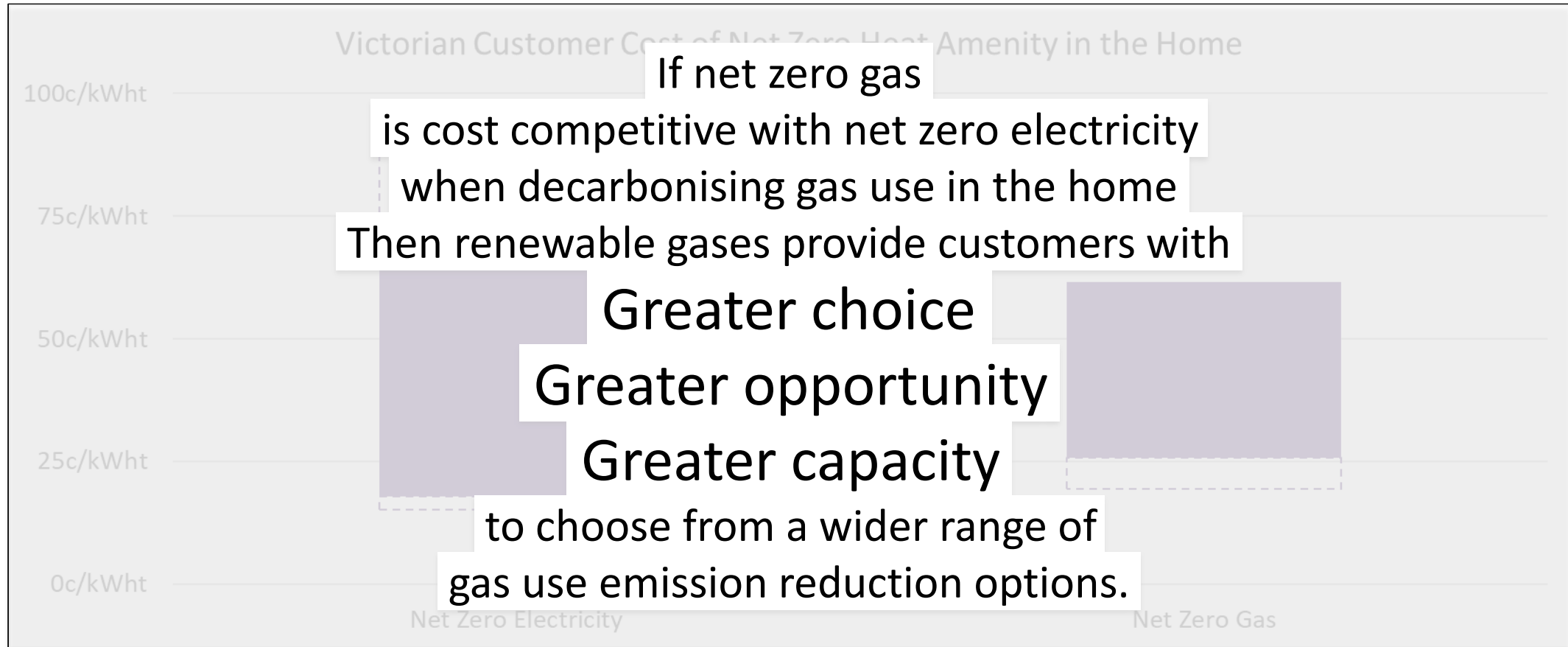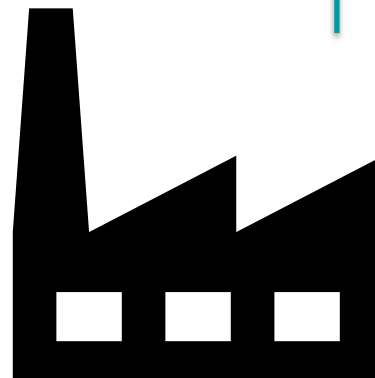**Why focus on net zero heat amenity in the home?**

Victorian Customer Cost of Net Zero Heat Amenity in the Home

100c/kWht

75c/kWht

50c/kWht

25c/kWht

0c/kWht

Net Zero Electricity

Net Zero Gas

If net zero gas
is cost competitive with net zero electricity
when decarbonising gas use in the home
Then renewable gases provide customers with

Greater choice

Greater opportunity

Greater capacity

to choose from a wider range of
gas use emission reduction options.

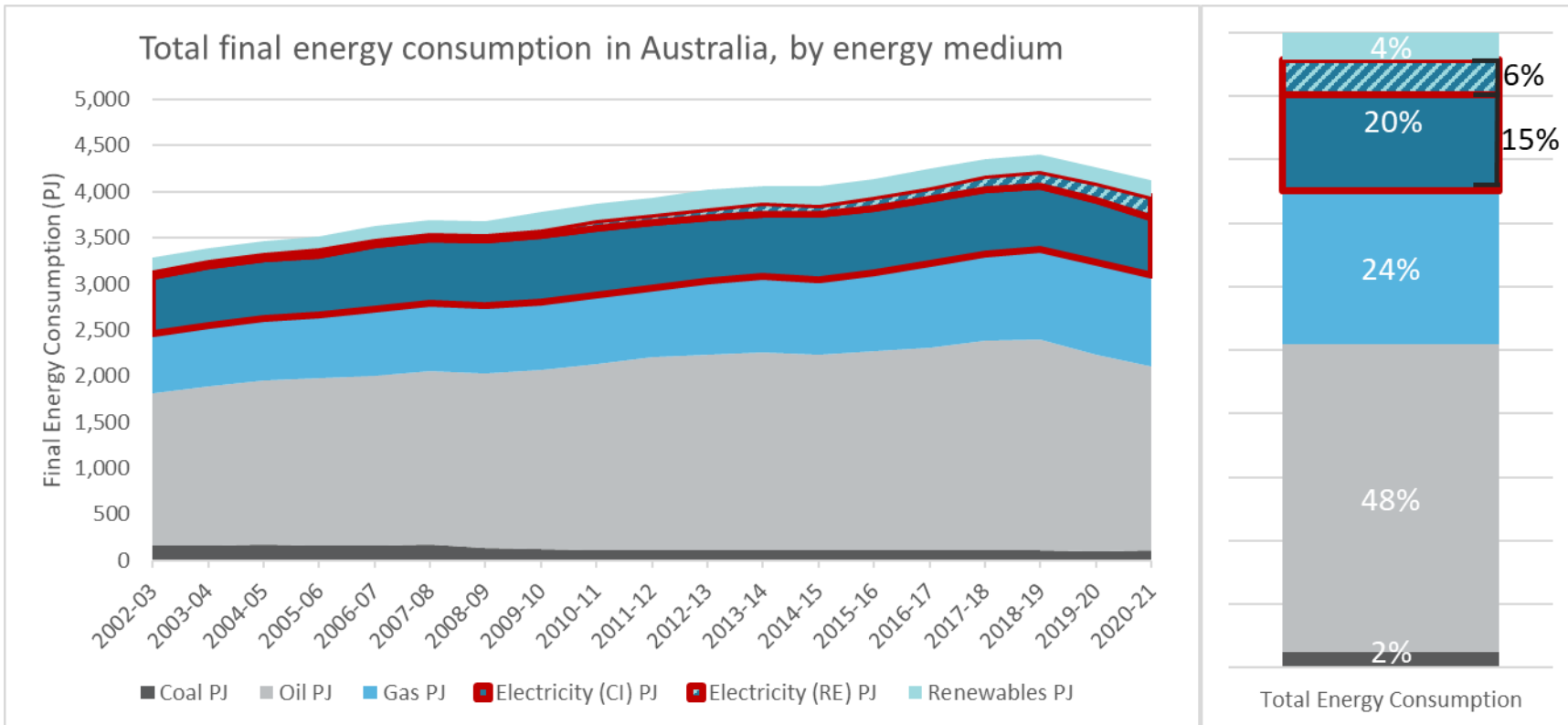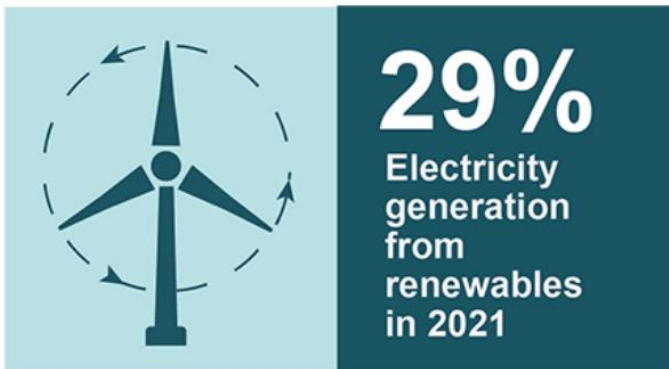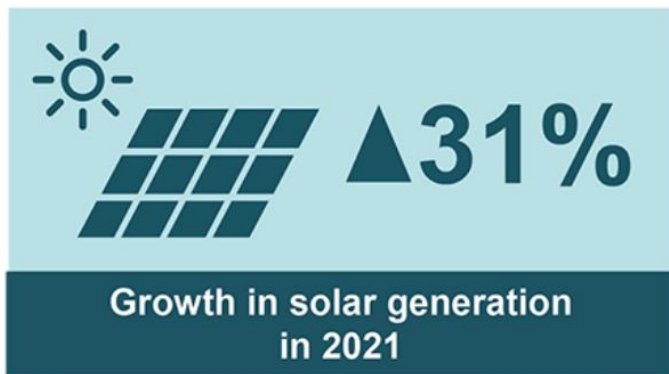# Macroeconomic analysis of Total Customer Cost

Why focus on net zero heat amenity in the home?

Why are Renewable Gases Important?

Question: What if Renewable Electricity didn't have to solve the entire problem alone <u>AND that made decarbonization easier to achieve?</u>

▲31%
Growth in solar generation in 2021

29% Electricity generation from renewables in 2021

Total final energy consumption in Australia, by energy medium

Final Energy Consumption (PJ)

■ Coal PJ   ■ Oil PJ   ■ Gas PJ   ■ Electricity (CI) PJ   ■ Electricity (RE) PJ   ■ Renewables PJ

4%
6%
20%
15%
24%
48%
2%

Total Energy Consumption

Thank You

Australian Pipelines and Gas Association