The Big Switch – Home Electrification

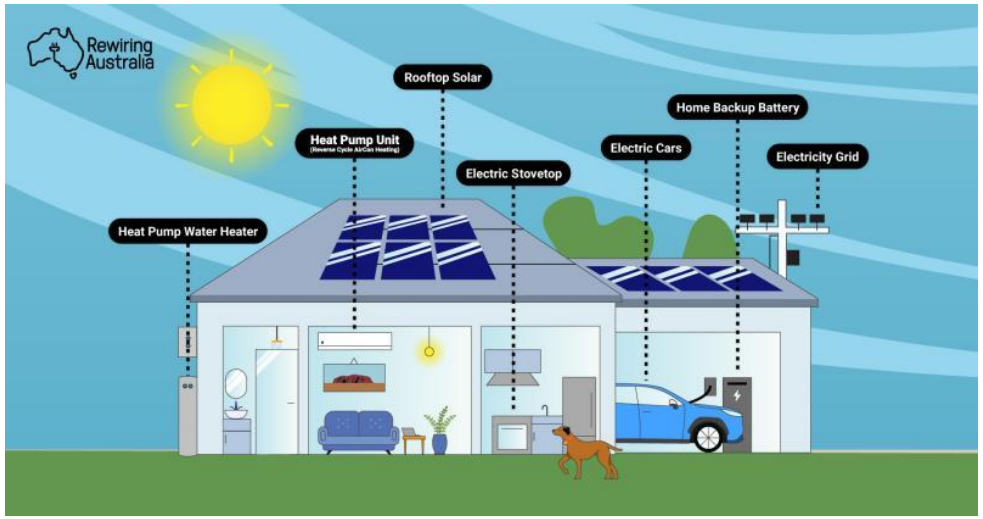
Fraser Maywood

Big thanks for permissions to use images and information

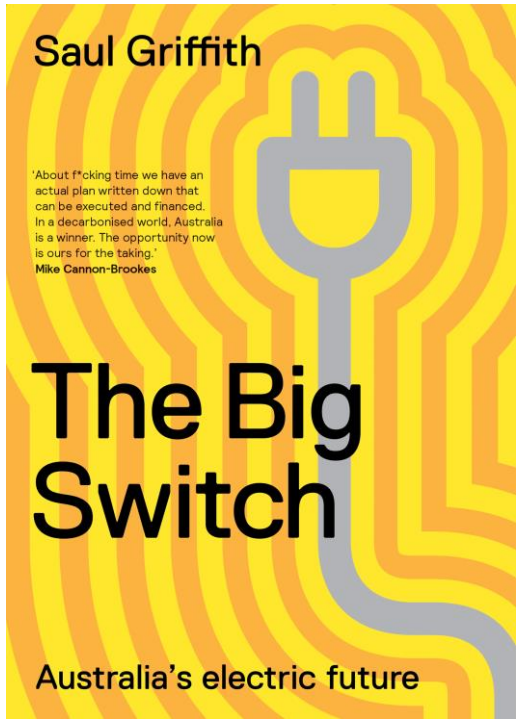
Rewiring Australia

Sustainable Energy Now !

https://www.sen.asn.au/



Saul's Introduction

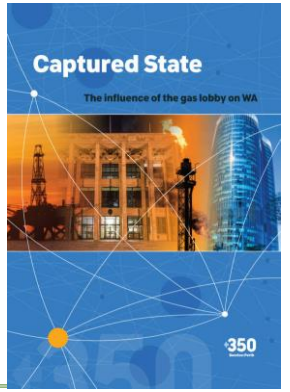


About SEN

- We are a grassroots not-for-profit member based advocacy group promoting Sustainable Energy Now!
- We model the WA electricity grids and advocate on how we can make a swift and orderly transition to clean renewable electricity safely, reliably, and affordably with commercially proven technologies. **WE HAVE NO COMMERCIAL INTERESTS**.
- Our 2030 vision is to phase out the majority of fossil fuel-based energy sources in WA and transition towards 100% renewables.
- Our mission is to model and promote practical, affordable strategies for the adoption of renewable energy toward a sustainable global future.
- We provide presentations, submissions and briefings to government agencies, corporations, media, schools, community groups, politicians and hold public events.

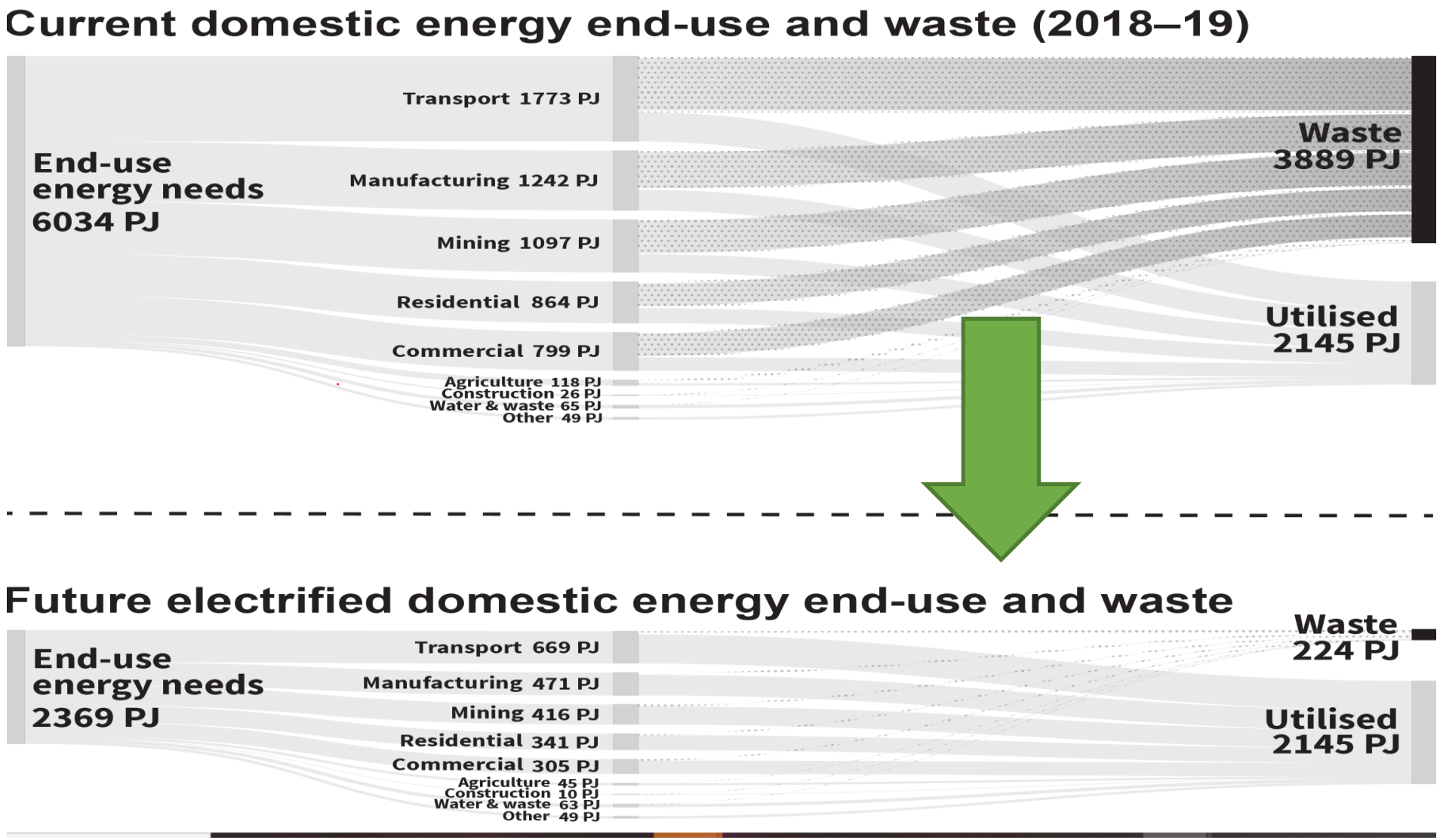
Why The Big Switch Is So Important
Home Electrification

- Emissions reduction – greatest moral challenge of our times
- Systemic change from Federal and State governments is slow coming (especially with state capture[4])
- Local government and cities (go! ToEF) declaring climate emergencies and taking action https://citiespowerpartnership.org.au/
- Individual households can have a significant impact - Australia's **10 million households** (personal vehicles, cooktops, water heaters, space heating / cooling) are responsible for **~42% of Australia's domestic emissions**
- Small businesses, offices, and workplaces when combined with households represents **70% of domestic emissions**
- Ten million houses in Australia – three million with rooftop solar PV enjoying the lowest cost of delivered electricity in the world
- Rewiring Australia 2021 Report[1] shows that Australian families could **save $5,000 per year** by replacing their current cars with electric vehicles, switching from natural gas to electric and fitting rooftop solar and a battery.



Ref 1 Household Electrification: Savings in the Suburbs - Saul Griffith, PhD, Josh Ellison, Sam Calisch, PhD, Dan Cass, October 1, 2021
Ref 4 - https://350perth.org.au/captured-state/

Domestic Energy Use - Sankey Diagram



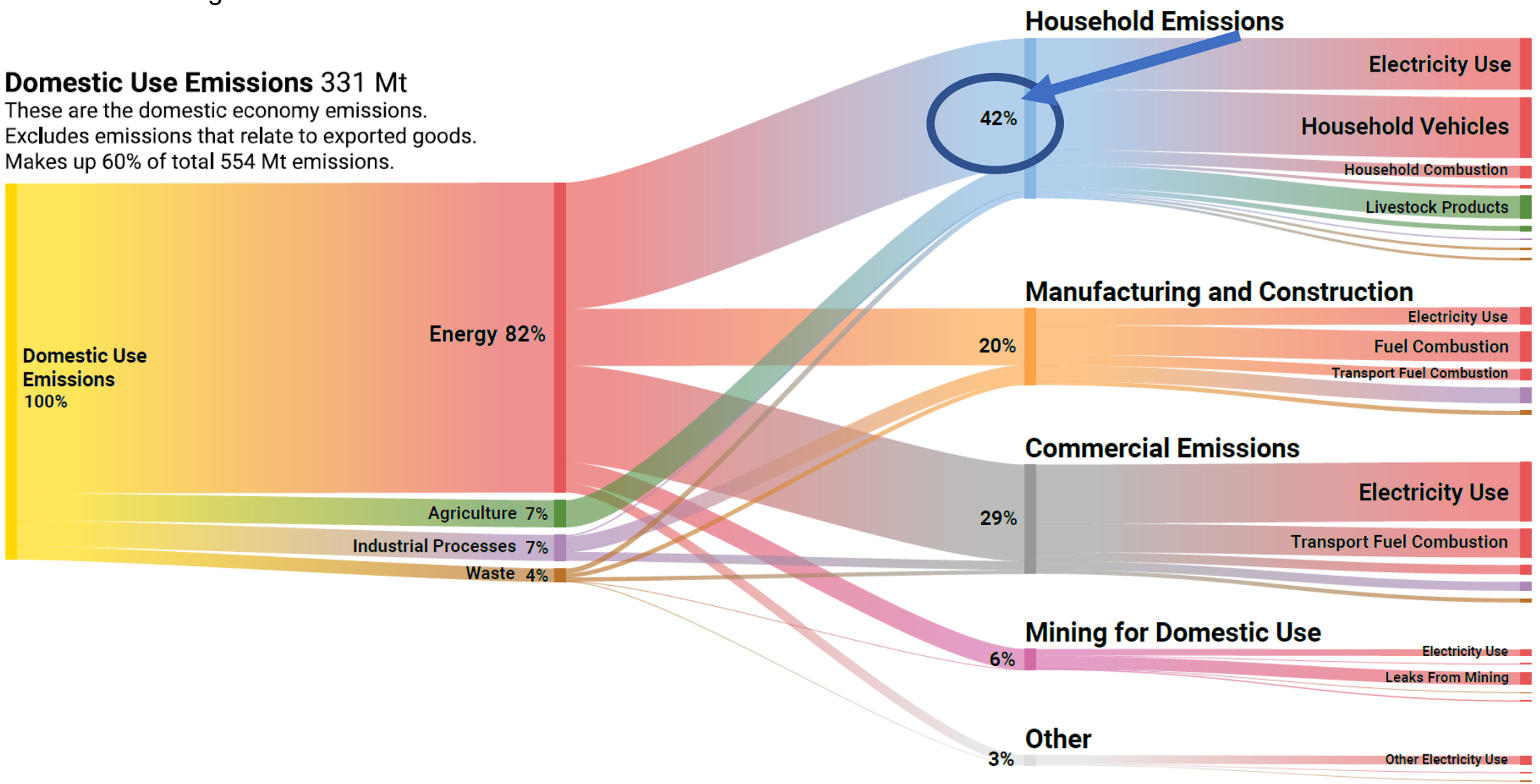
64% of primary energy wasted
Fossil Fuel Home

92% of primary energy used
Fully Electric Home

"Domestic Energy" is national 'running the country' energy use.

Domestic Emissions - Sankey Diagram

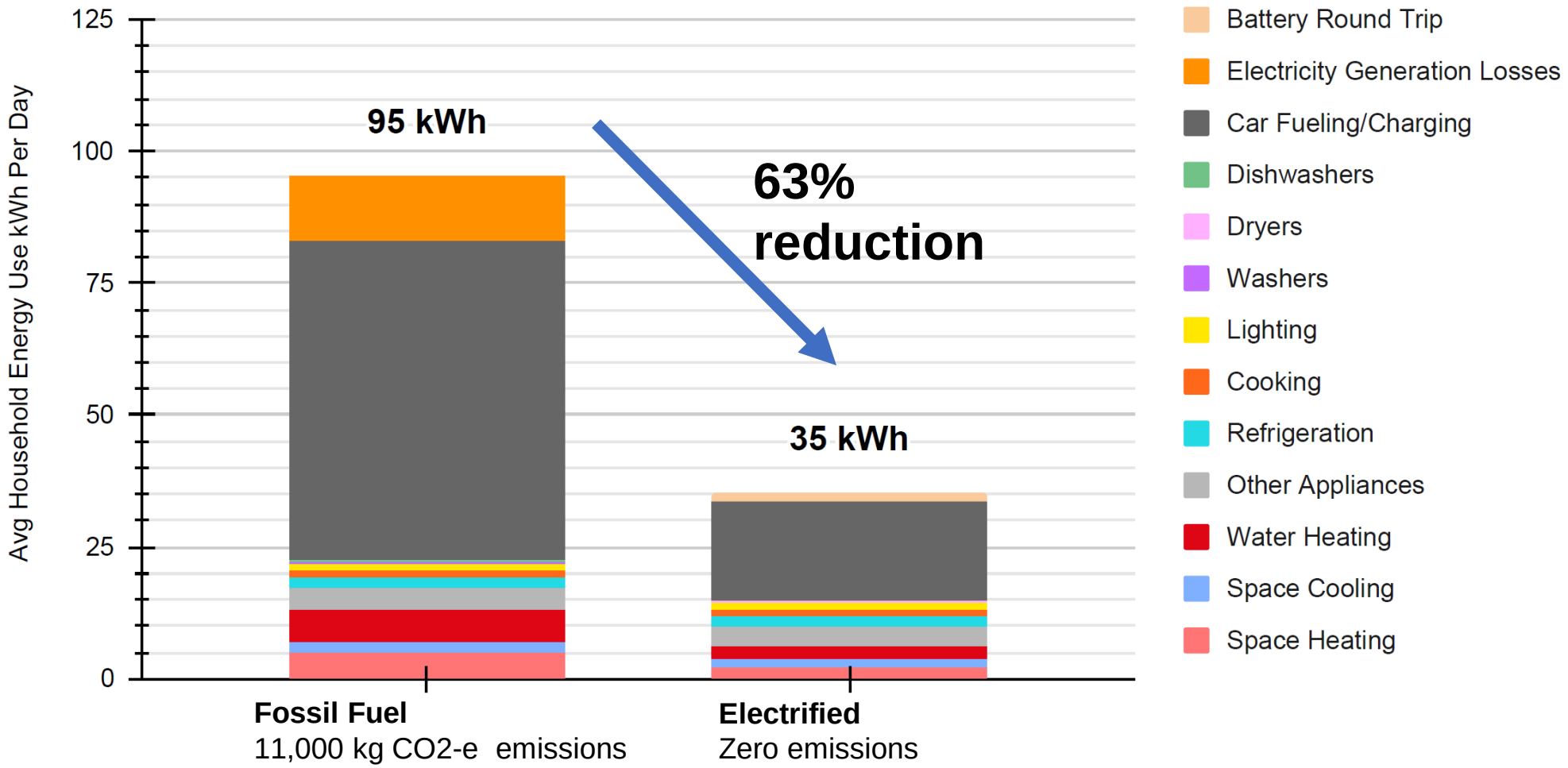
"Domestic emissions" 331Mt CO2-e are national 'running the country' emissions. Trade emissions are another 224 Mt – this includes agriculture exports, iron ore coal, LNG etc … but not the burning of those fossil fuels



Household Energy Usage

WA - Household Energy Use - Current Mix versus Electrified Solar and Battery Household.

Average household energy use including vehicles compared to electrified household with solar, battery, and electric vehicles.



International and National Home Electrification

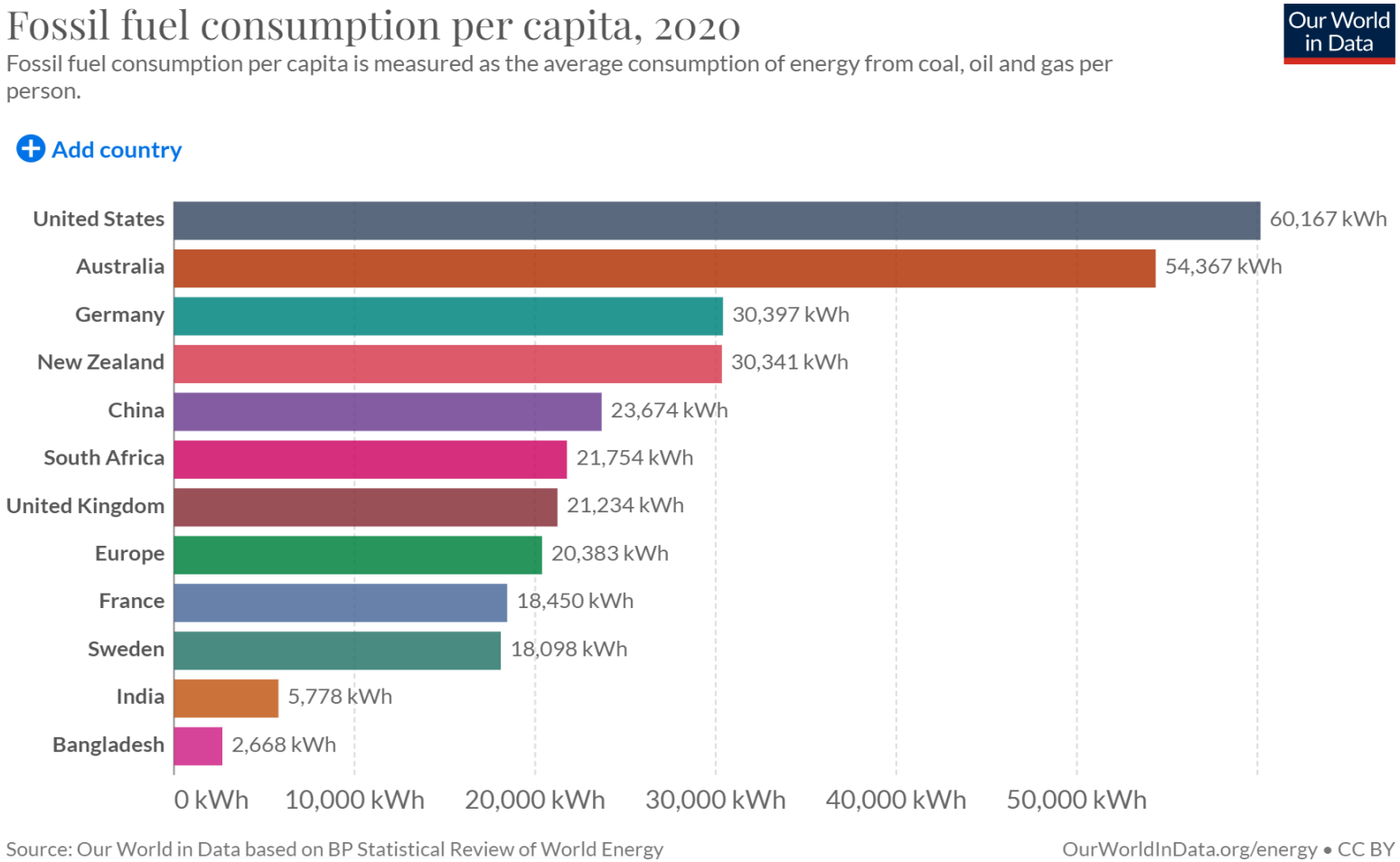
1. Just 9% of Australian household consumers seriously considering electrification. 77% either had not thought about it or had decided not to.

2. Small business consumers : 27% said they were seriously considering electrification. 30% report they are considering it but not seriously

https://energyconsumersaustralia.com.au/

28th April 2022 - Esperance is in the process of quitting gas, as part of a state government-backed transition to full electrification prompted by the closure of the area's privately-owned gas network.[6]

December 15th 2021, New York City Council passed a motion 40 to 7 vote banning new fossil fuel hook-ups in buildings for heat, hot water, and kitchen stoves starting as early as 2024.



Per capita energy by source: calculated as primary energy consumption by source, divided by population.

Ref 6 https://onestepoffthegrid.com.au/why-this-state-government-is-kicking-gas-out-of-big-coastal-community/

Home Electrification Drivers

- Government objectives: energy security; energy costs; emissions reduction / environmental impacts
- WA state net zero 2050 policy (Nov'21), Sectoral Emission Reduction Strategies – low hanging fruit is the electricity sector.
- Individual householders – carbon footprint / emissions reduction (average household 11,000 kg CO_2-e)
- Individual householders – economic
- Individual householders – health reasons - cooking with gas responsible for up to 12% of childhood asthma in Australia = living with household cigarette smoke[2,3]
- Individual householders – socio-political – undermines the social licence for gas companies to operate

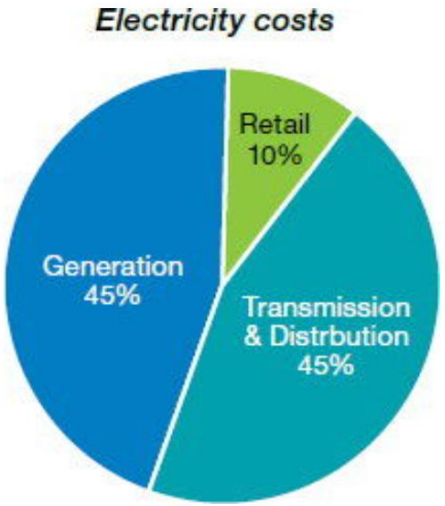
Ref 2 Climate Council of Australia Ltd 2021 Kicking the Gas Habit How Gas is Harming our Health
Ref 3 https://rmi.org/insight/gas-stoves-pollution-health

Home Electrification – WA Grid

SWIS – South West Interconnected System
NWIS – North West Interconnected System

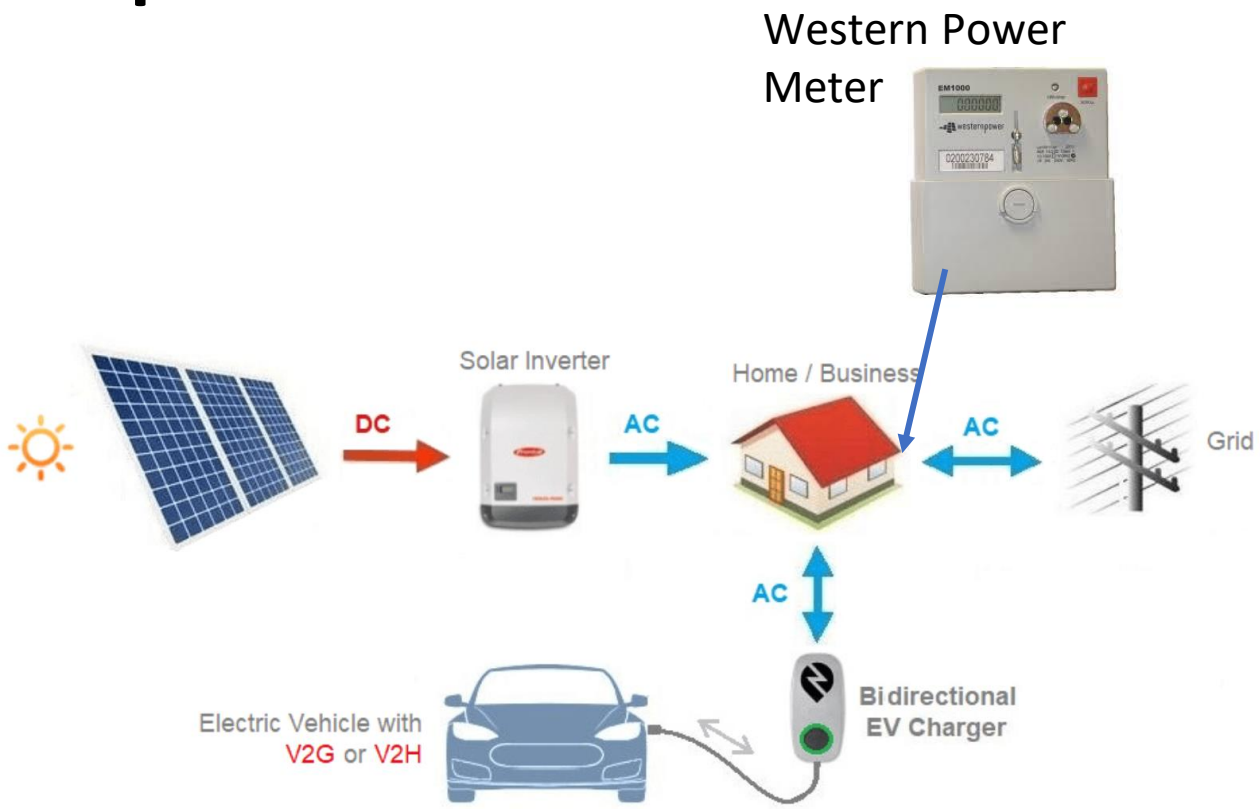
Collie Power Station

SWIS Fuel	SWIS Generation Capacity (MW)	Capacity %
Coal	1,569	28
Gas or Gas / Distillate	1,027	18
Wind	1,018	18
Rooftop Solar estimate	1,900	32
Large scale Solar	215	4
Total (approx.)	5,726	



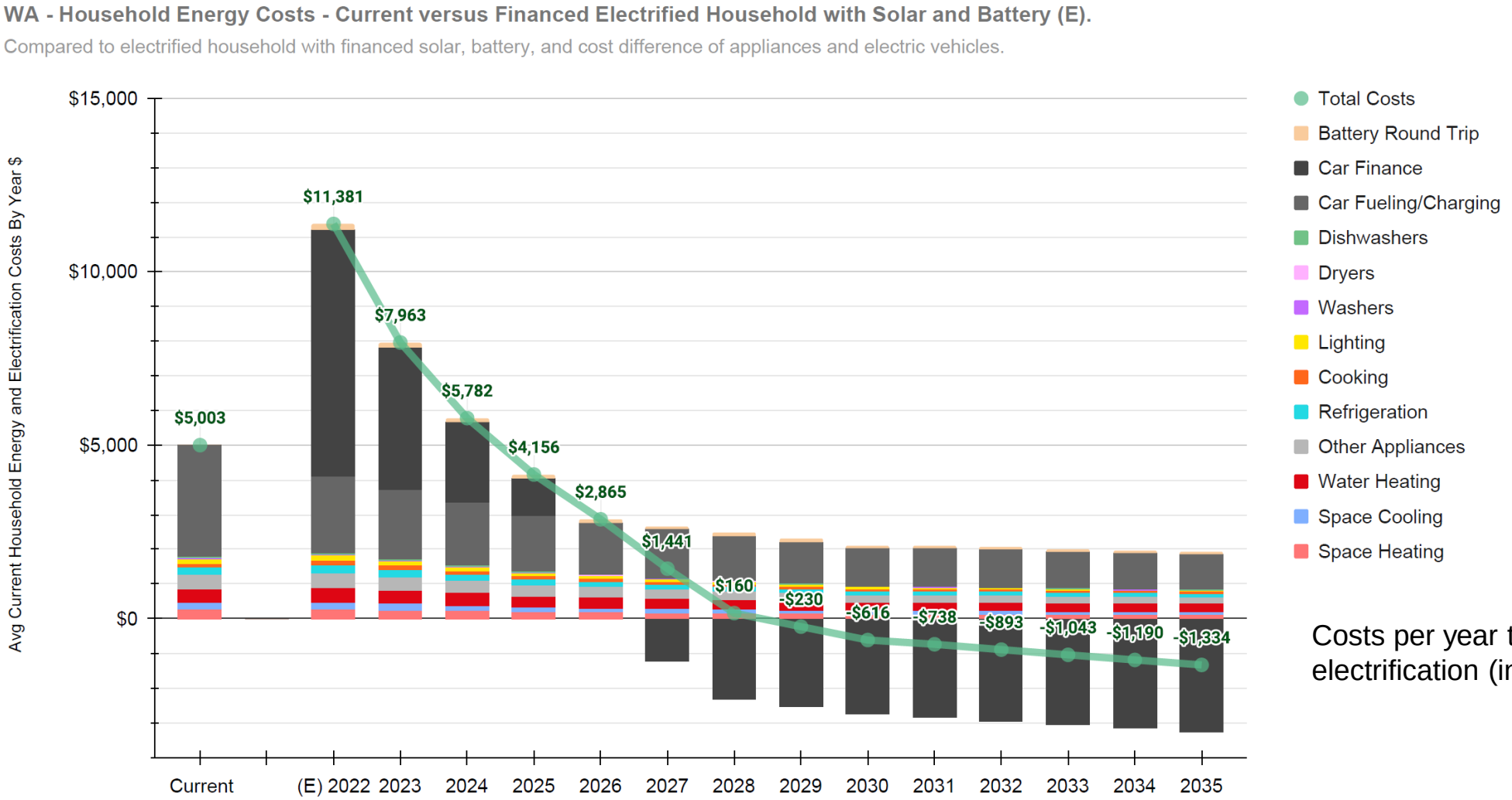
Economic Regulation Authority

Rooftop Solar Basics



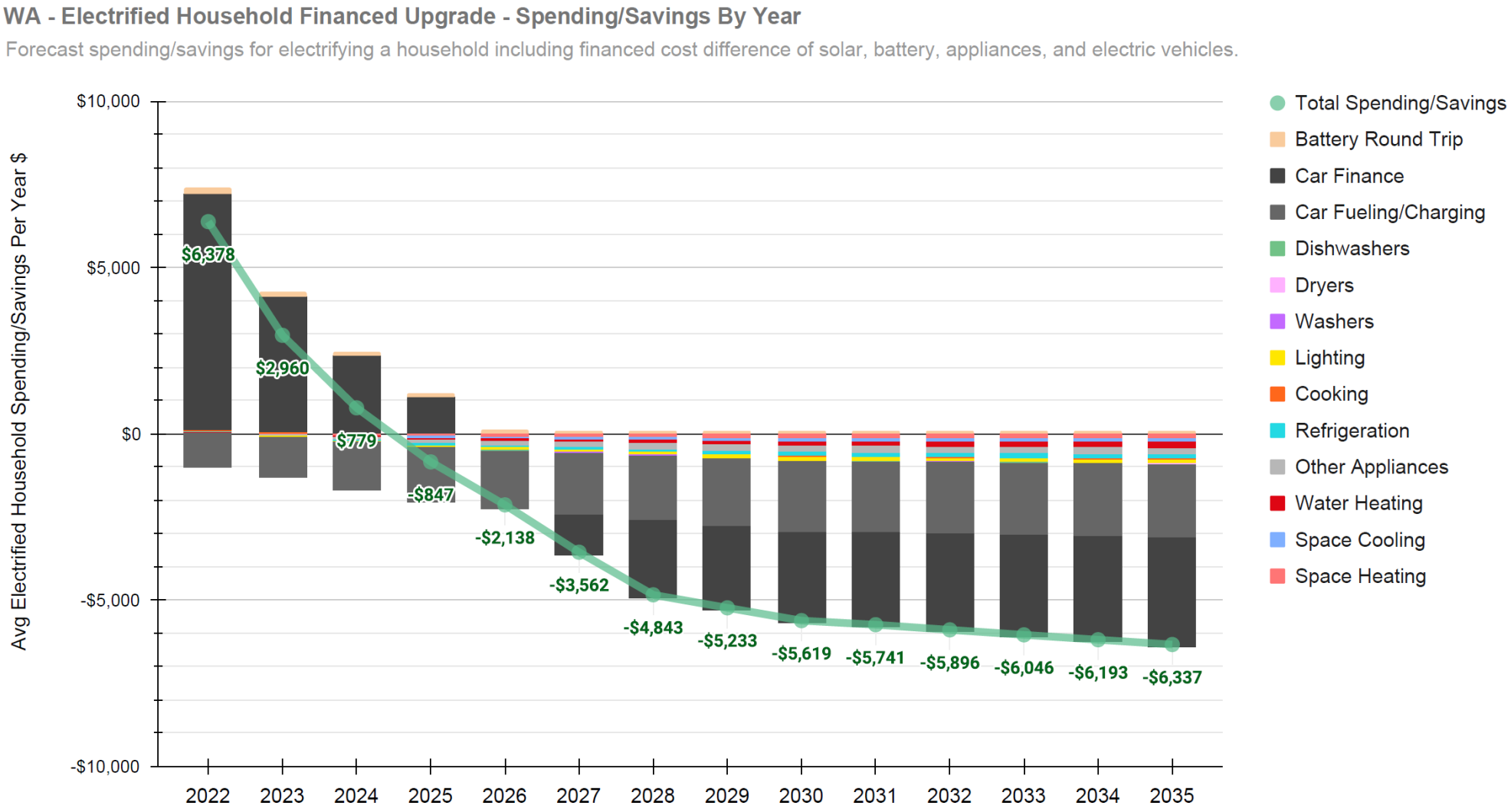
- Systems are sized according to their power output (kW)
- Electricity is purchased on energy units (kWh) - If you use one kilowatt of power for an hour you've used 1 kWh and Synergy will bill you accordingly (Synergy is the state owned regulated monopoly for residential electrical power in most parts of WA … East Coast electrical market is deregulated)
- Western Power looks after the transmission and distribution ('poles and wires')
- Solar panels are also called Photovoltaic (PV) module
- You don't need a home battery … discuss this later

Home Electrification Economics 1/2

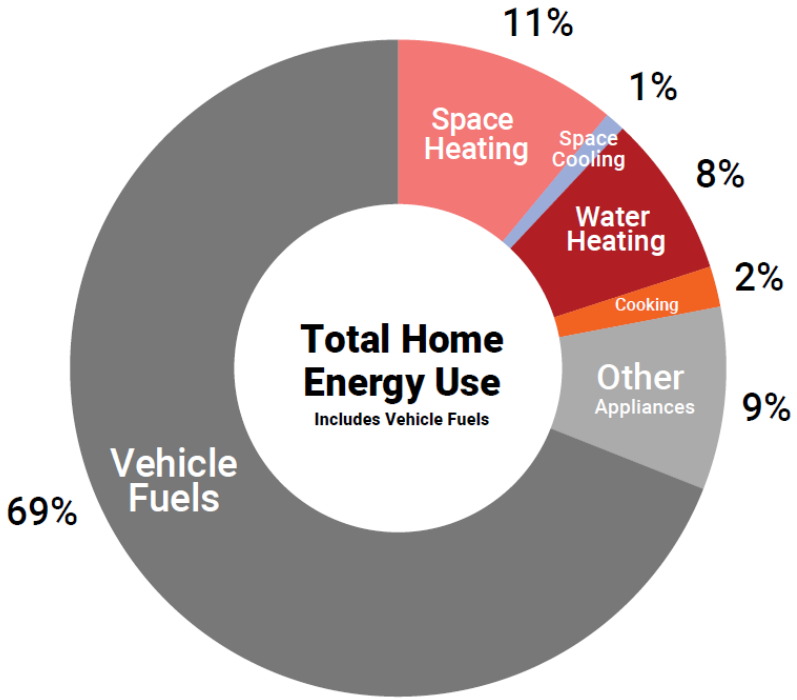


Costs per year to finance full electrification (including 1.8 cars)

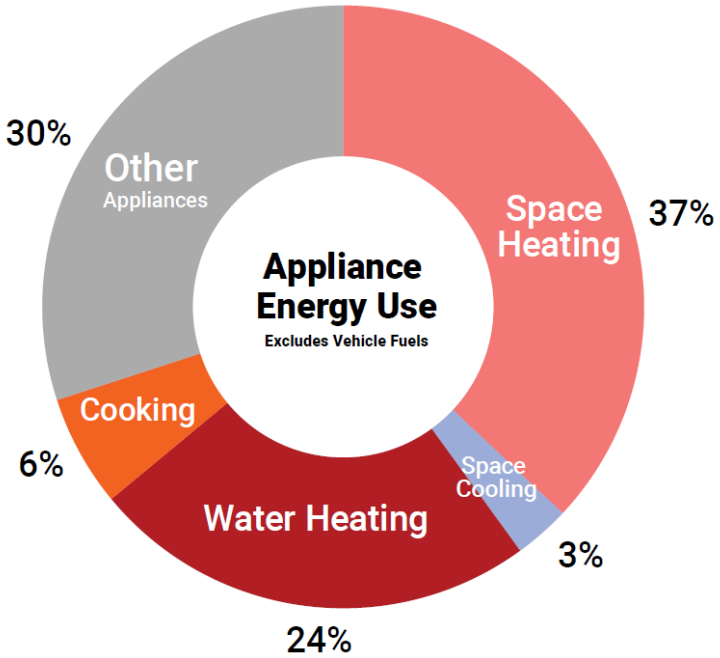
Home Electrification Economics 2/2



Home Electrification Priorities



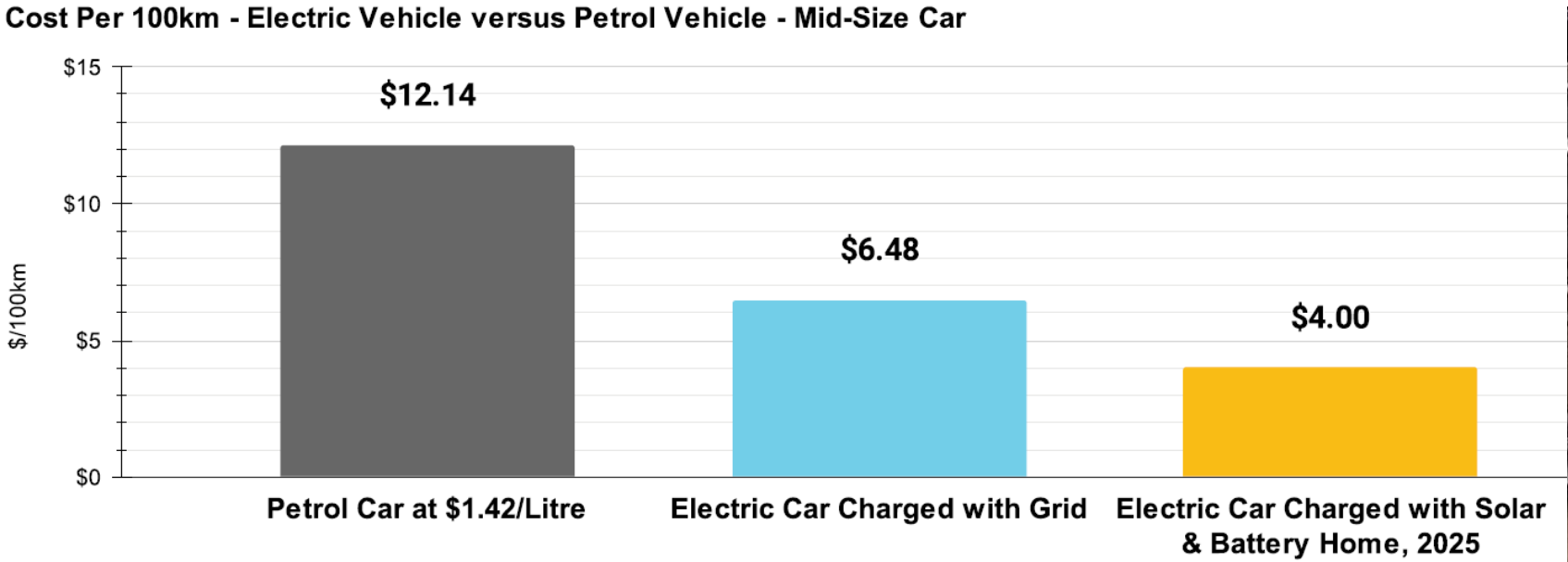
Including Vehicles



Excluding Vehicles

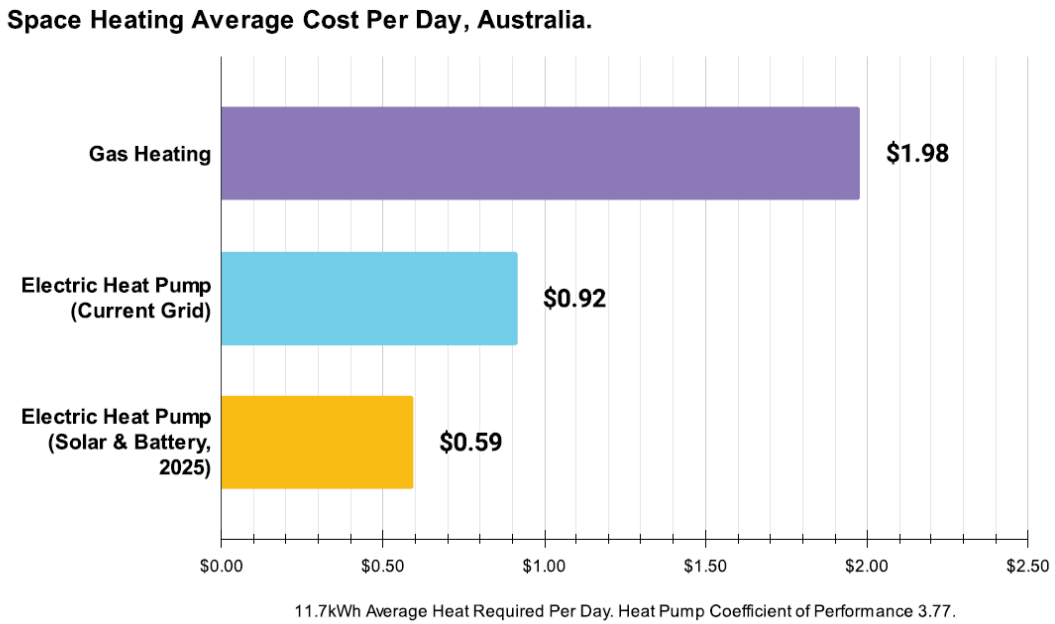
Other appliances include: fridges, dishwashers, dryers, lighting, pool pumps etc

Home Electrification - EVs



EVs have drastically lower running costs – due to their simpler maintenance and cheaper refueling –on average, EV owners save from $810 to $1,400 per year. NRMA

Home Electrification – Space Heating or Cooling

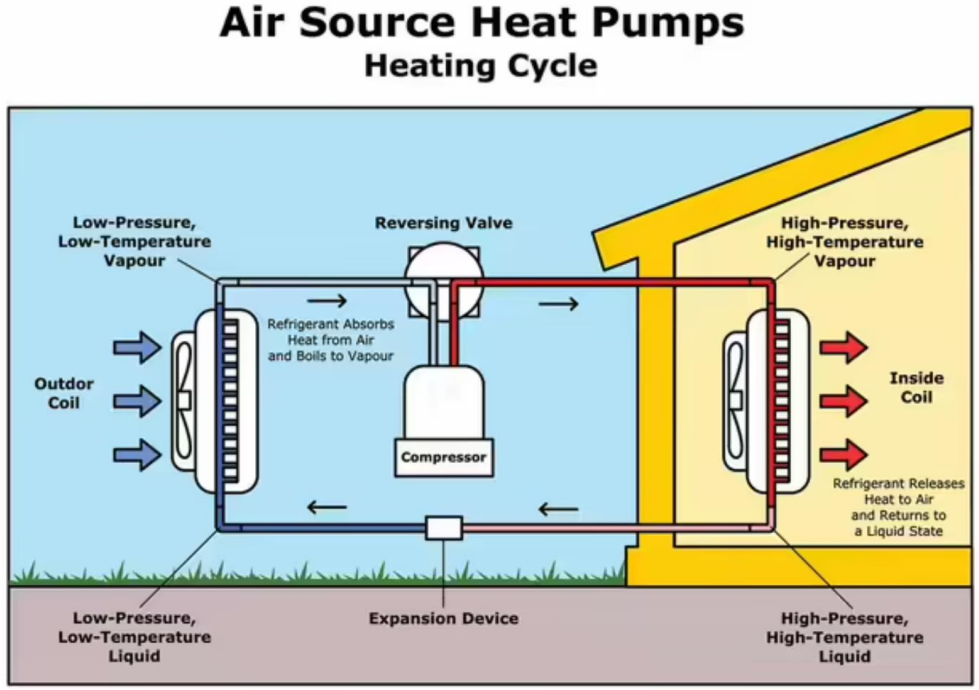


Heat pumps or reverse cycle air-conditioners extract heat from the air (or ground or water) and provide space heating for rooms – individual rooms or ducted air conditioning.

In summer the cycle operates in reverse and extracts heat from the room to outside.

STATE	Heating (%)	Cooling (%)
NSW	66%	34%
ACT	86%	14%
NT	3%	97%
QLD	38%	62%
SA	77%	23%
TAS	98%	2%
VIC	95%	5%
WA	43%	57%

Home Electrification – Space Heating / Cooling



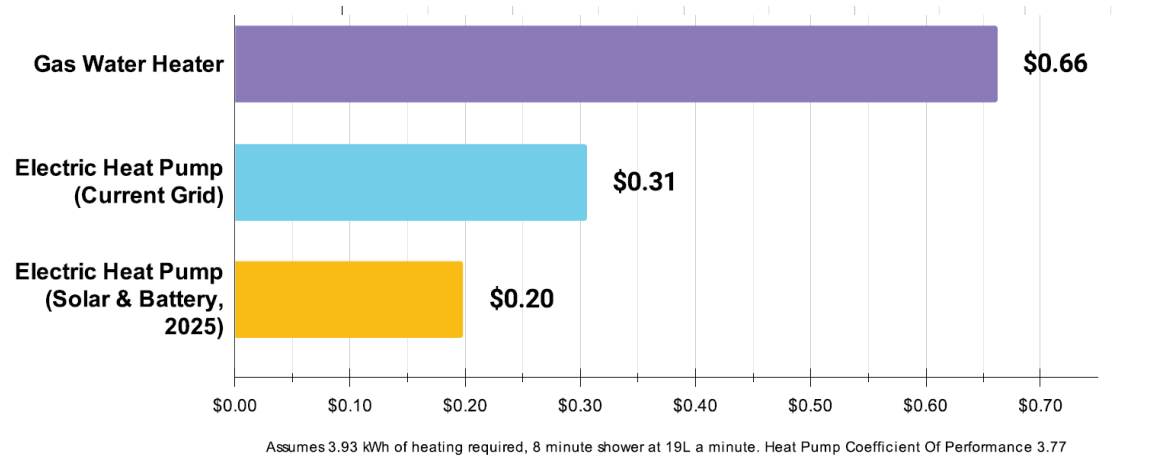
- Due to the laws of thermodynamics, a heat pump converts 1kW of electricity (work) into around 3kW of heating or cooling (called the coefficient of performance or COP)
- This COP factor of around 2.5-3.5 depending on the efficiency of the heat pump helps off-set the higher cost of electricity compared to gas

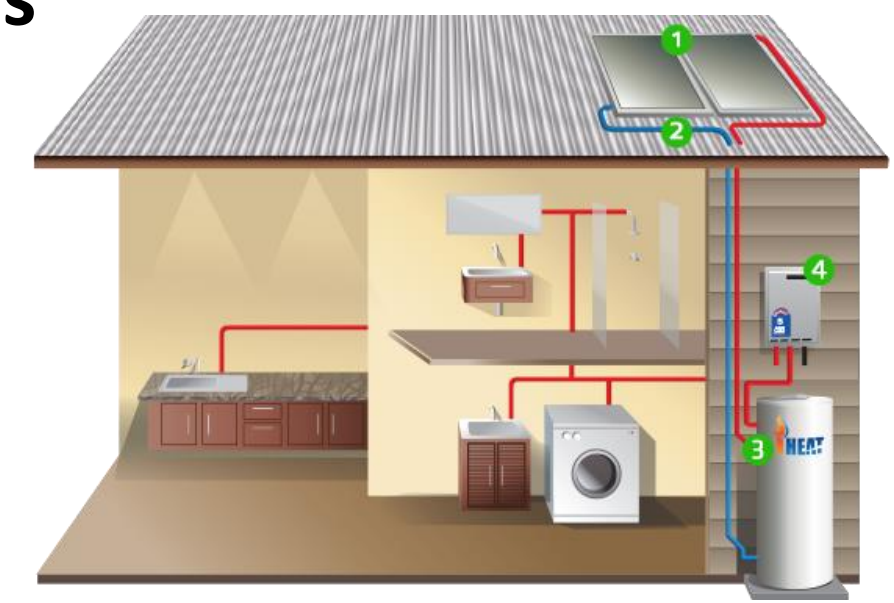
heat: The energy transferred from one system to another by thermal interaction.
work: The transfer of energy by any process other than heat.

Energy $/kWh	Australia
Electricity	$0.29
Natural Gas	$0.15
LPG	$0.13
Wood	$0.07
Petrol	$0.15
Diesel	$0.14

Ref 1 - Table 6.5: Energy pricing by state in $/kWh

Home Electrification – Hot Water Options



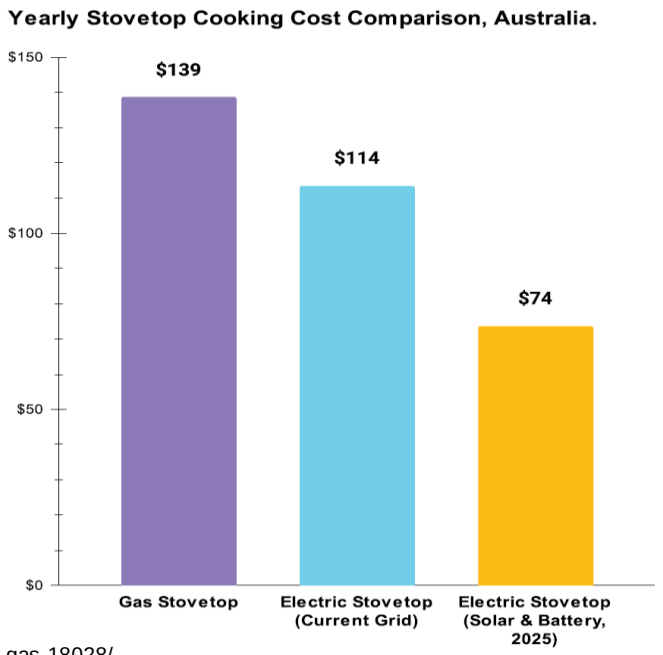


1. Solar hot water with gas booster or electric heating resistance element booster (HW storage or instantaneous)
2. Gas heating only
3. Electric heating only (HW storage or instantaneous)
4. Heat pump (lower image HW storage)
5. Combo PV&T system – WA Sunovate Systems

Home Electrification – Cooktop Options 1/2

“Cooking with gas”
#GoNaturalGas[4]

Source: Instagram/The Dearest Days.



Resistance element – yikes !

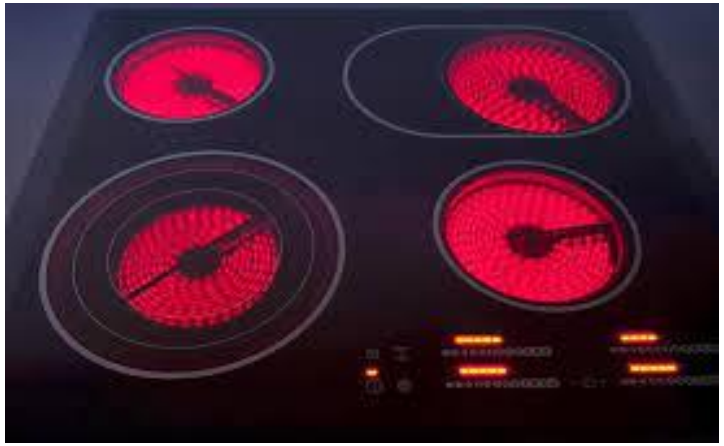
Ref 4 https://reneweconomy.com.au/the-australian-instagram-influencers-being-paid-to-promote-gas-18028/

Home Electrification – Cooktop Options 2/2

Induction cooktop

Induction cooktops use copper coils to create a magnetic current in the contact surface of the pot or pan to give an even heat with much less heat energy lost.

Cast iron, steel, some enamelled steel, and stainless steel pans with an iron base or core are suitable, but glass, aluminium and copper generally are not.
Look for the induction-compatible symbol or try the magnet test.



Ceramic cooktop

Beneath the glass-ceramic surface, electrical current flows through a metal coil - electrical resistance generates a hot glowing metal coil that transfers its heat via infrared energy and convective heat.

The pot or pan on the cooking zone is warmed evenly by the energy transmitted through the glass-ceramic. The surrounding surface of the glass-ceramic remains relatively cool.

The glass-ceramic cooktop continues to emit heat after electricity stops flowing - residual heat can be used to continue cooking or warming food.

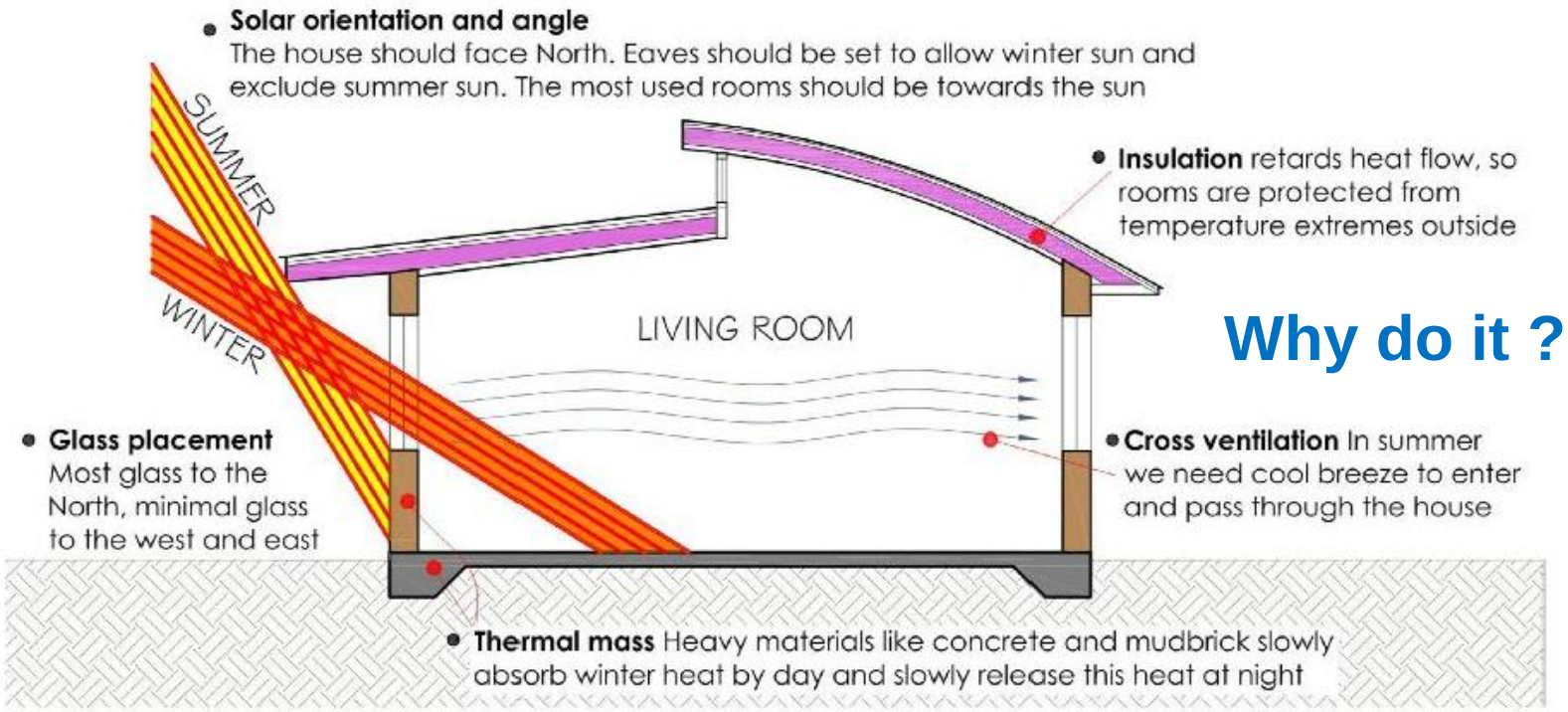
Lights on the cooktop indicate if the rings are still hot.

Stainless steel, titanium, aluminum and copper-bottomed pans are all acceptable

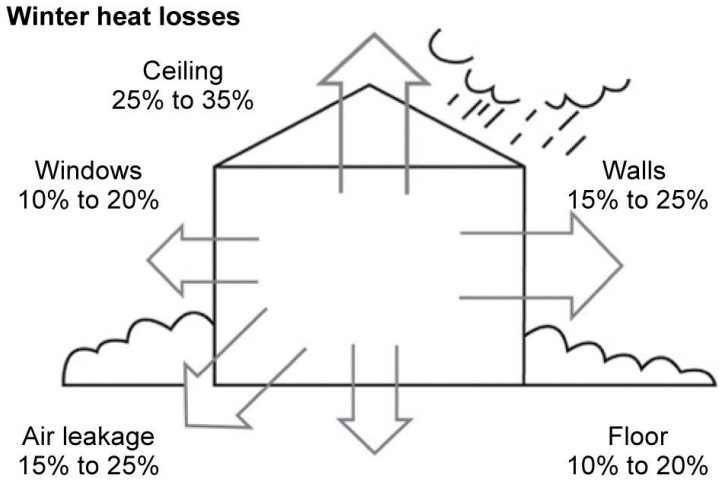
New Build East Fremantle – 9.3 Stars !

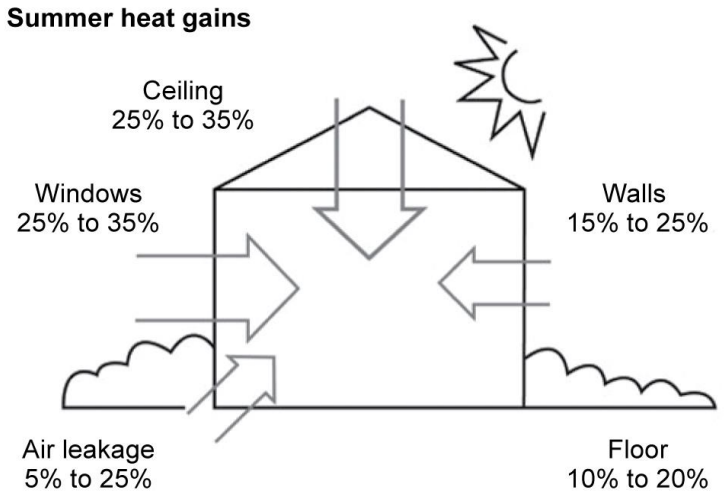
Solar Passive Design Principals

What is it ?



Why do it ?





Solar passive living to us means playing an active role in managing our living environment.

https://www.yourhome.gov.au/passive-design

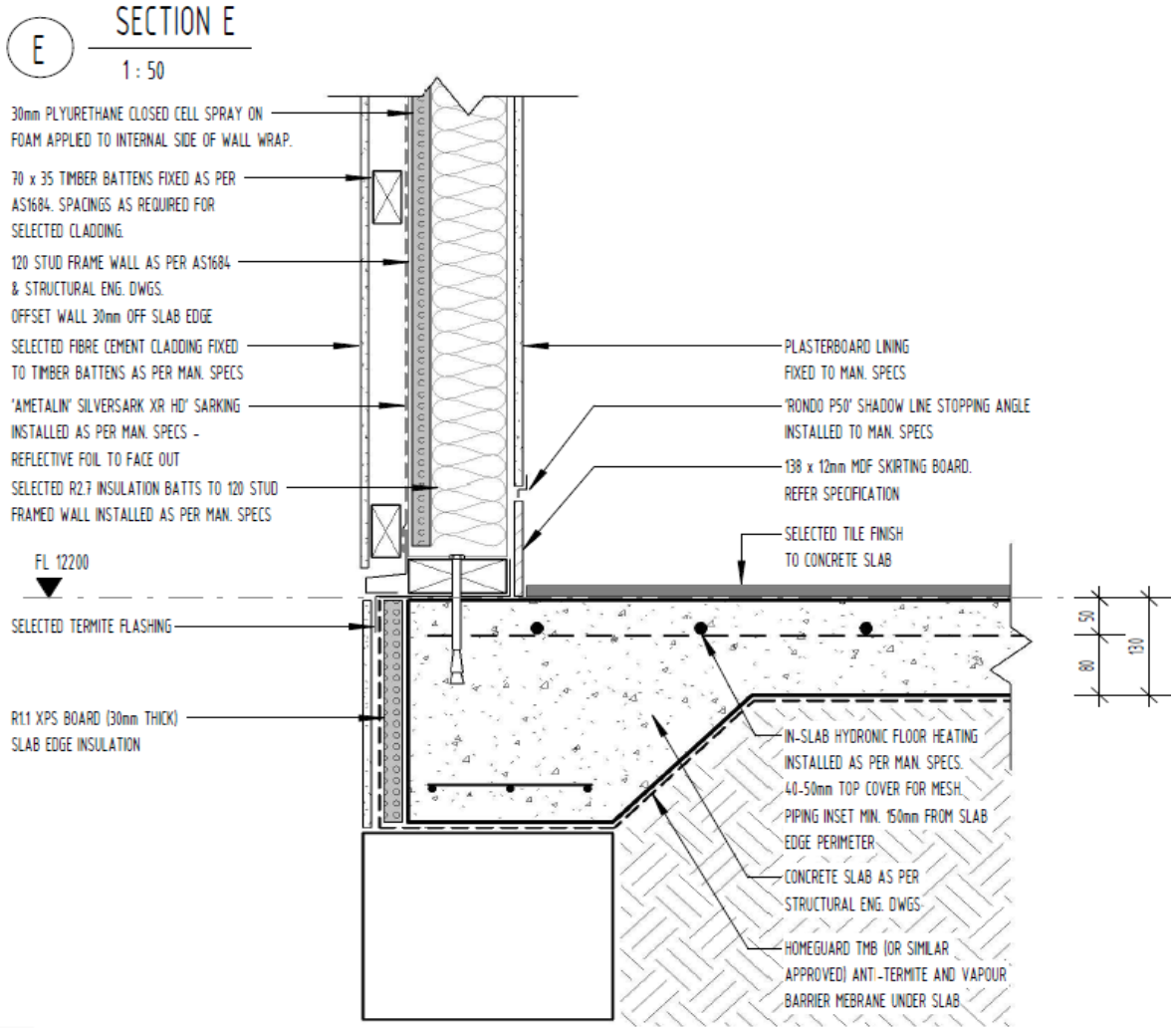
Our High Efficiency Solar Passive Design

- Design for your climate – **No Aircon**
- Reduce energy needs and living costs as much as possible – **NO GAS**
- Harvest and use as much **FREE** natural resources. Sun & Rain (26,000L storage)
- Hydronic In Slab Heating – Experiment with Circulating Water heated from Sun Only 1 year
- Cross Flow Ventilation with louvres and ceiling fans

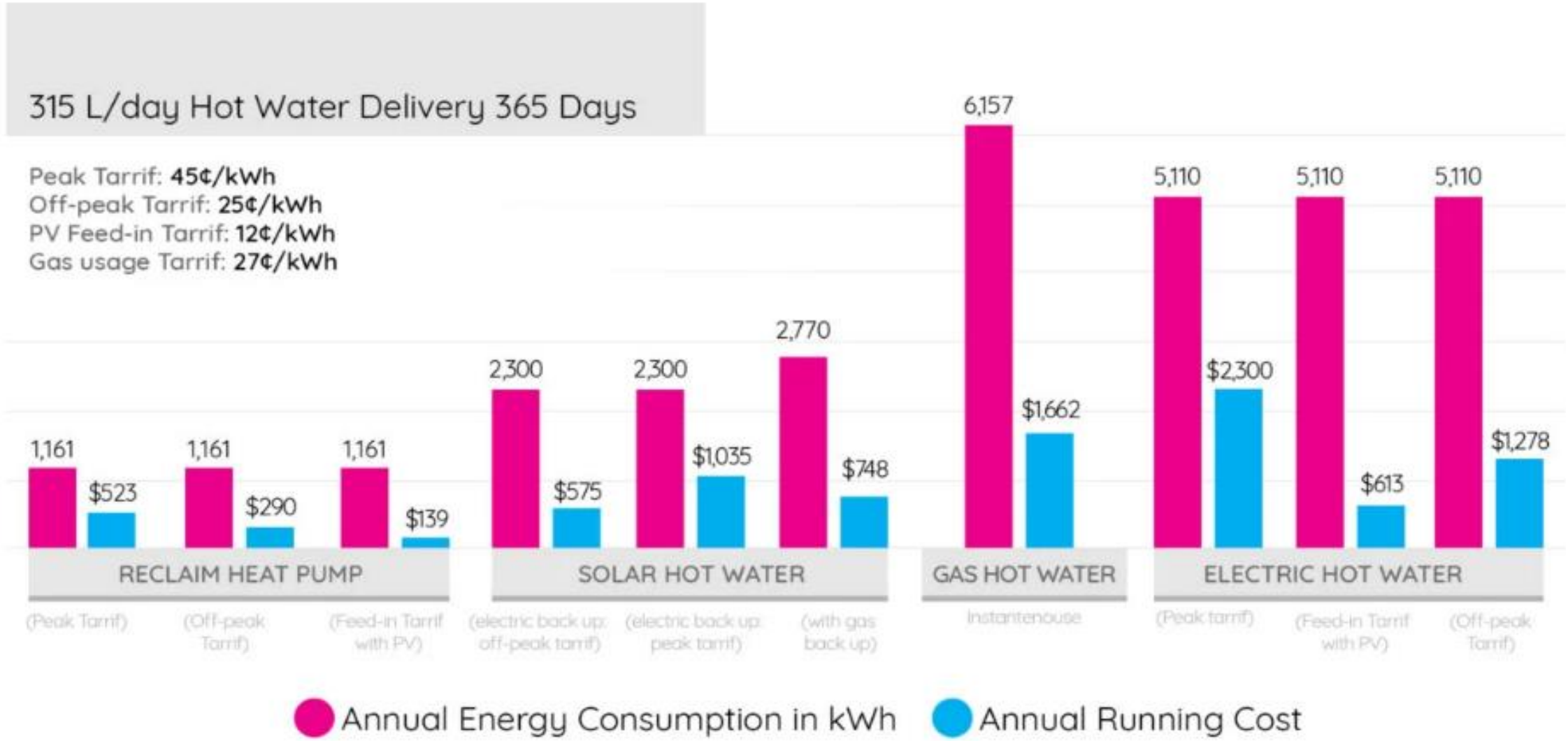
- Induction cooktop and electric ovens
- LED lighting
- Light Coloured Roof Reflects Heat in Summer
- CO2 Air Source Heat Pumps for heating water (Uses CO2 as refrigerant & controller to optimise solar use)
- Maximised rooftop solar 10kW - Battery and EV ready
- 3 phase power connection

- Use of North Facing Glazing, Low E Glass and uPVC Double Glazed Windows and Doors (thermal bridging)
- Dark Coloured Flooring optimises heat absorption into Thermal Mass (Concrete Slab on Ground – Edge Insulated, Earth Bonded)
- Maximise thermal mass to assist with passive cooling and heating (Masonry Blade Wall – North/South)
- Good airtightness can improve thermal comfort and energy efficiency – air leaks can cause 15−25% of winter heat loss in buildings (CSIRO 2015)
- Spray on insulation Flash and Batt System to help achieve air tightness – Novel in Australia Construction

Building Envelope Insulation – Reduce Thermal Bridging = Heat Loss / Gain



Reclaim Energy C02 Air Source Heat Pump
Victorian Household Case Study



Electrification Retrofit - Wendy

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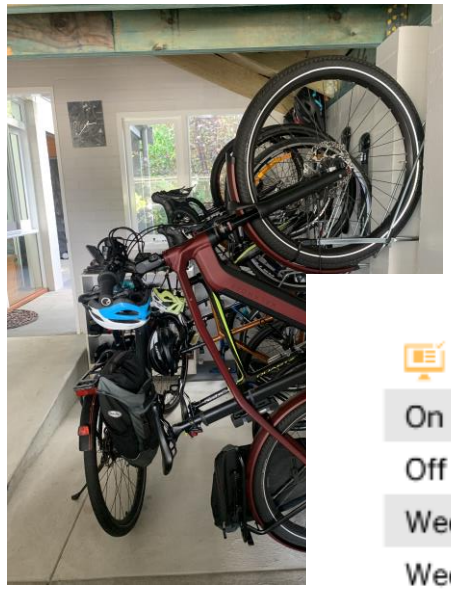

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BACK

79A View Tce

Overview

Plant Status

Your usage summary for meter number: 0520480975

Supply period: 24 Dec 2021 - 25 Feb 2022	**Units imported (kWh)**	**Units exported (kWh)**
Off-peak	92.1390	
On-peak	9.9030	
Weekday shoulder	4.7070	

20

50

eConnect

On peak	2.4910	kWh	50.7031	$1.26
Off peak	36.8520	kWh	13.9677	$5.15
Weekday shoulder	3.4290	kWh	26.5545	$0.91
Weekend shoulder	3.3440	kWh	26.5545	$0.89
Supply charge	66	days	95.5818	$63.08

Units (kWh)

Plus GST @ 10.00% $7.13

Total **$78.42**

*GST free

.6700

Today Yield
10.4 kWh

Net Export Off Peak 498.3810

†Your interval meter data is available online. Visit synergy.net.au/myaccount to login or register.

Self-consumption

Feed-in

Considerations

- Planning – new builds[7], how long in current house, what to do now and later
- Best use of solar hot water panels (WA different to VIC)
- Health risks and functionality, induction vs ceramic cooktops
- What appliances running off PV panels
- House battery or not
- EVs bi-directional charging (act as a home battery ..coming soon)
- Home Energy Management System
- Sufficient home supply capacity - single phase vs three phase
- Switchboard capacity
- Existing number of PV panels, inverter size, age
- What are essential off grid appliances
- Any real need to go totally off-grid

Ref 7 BZE Freedom Home https://bze.org.au/research_release/energy-efficient-buildings-plan/

EAST FREMANTLE CARG
CLIMATE ACTION REFERENCE GROUP

Sustainable Energy NOW

What can I do??

- Take individual action!!
- Buy The Big Switch – get informed, get educated- youtube[5] – understand needs and be able to communicate intelligently with electricians
- Climate Clever App
- Make a Big Switch plan ***– can be incremental***
- Talk to your electrician about the plan and what are logical and affordable bite sized steps
- Talk to friends and neighbours
- Join us at CARG to assist in delivering meaningful action within our great community!
- Contact local MP and state government to encourage the energy transition – Bill Johnston is the WA energy minister

Ref 5 Electricity Explained: Volts, Amps, Watts, Fuse Sizing, Wire Gauge, AC/DC, Solar Power and more!

https://www.facebook.com/EastFreoCARG

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Sustainable Energy NOW

Questions?

References

- Ref 1 Household Electrification: Savings in the Suburbs - Castles and Cars - Saul Griffith, PhD, Josh Ellison, Sam Calisch, PhD, Dan Cass, October 1, 2021
- Ref 2 Climate Council of Australia Ltd 2021 Kicking the Gas Habit How Gas is Harming our Health
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- Ref 6 https://onestepoffthegrid.com.au/why-this-state-government-is-kicking-gas-out-of-big-coastal-community
- Ref 7 BZE Freedom Home https://bze.org.au/research_release/energy-efficient-buildings-plan/
- https://renew.org.au/renew-magazine/buyers-guides/induction-cooktop-guide/
- https://www.motherjones.com/environment/2020/06/gas-industry-influencers-stoves/
- https://www.climateclever.org/
- https://www.eastfremantle.wa.gov.au/residents/sustainability-environment/action-on-climate-change.aspx
- https://podcasts.apple.com/ie/podcast/saul-griffith-bidens-renegade-climate-advisor-from/id1548626341?i=1000541229447
- Spray on insulation https://www.tatescoating.com.au/
- **CARG Presentation available:**