



Public Works



# BZE's Zero Carbon Australia Buildings Plan

Newcastle – 14/11/13

Sponsored by





# **ZERO CARBON AUSTRALIA BUILDINGS PLAN**



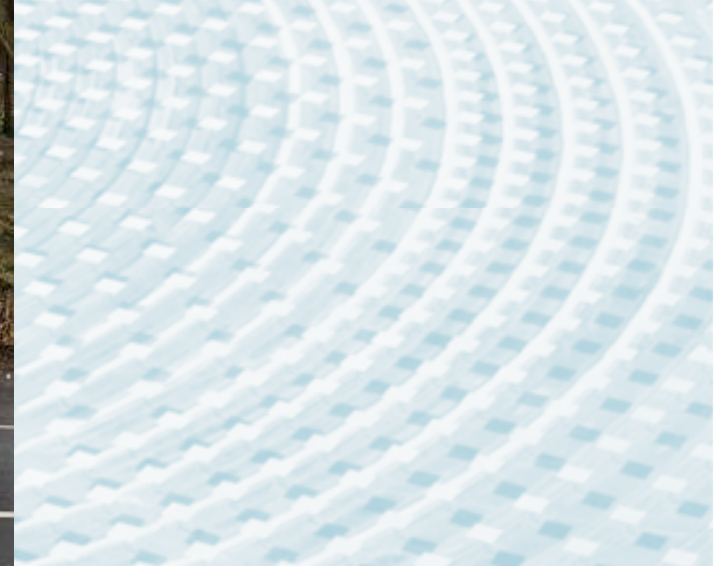


# The ZCA Buildings Plan

- Re-engineered Australia's building sector on a shoestring budget
- Over 100 volunteer contributors
- In-kind contributions from over 30 companies



# Dangerous climate change already here?





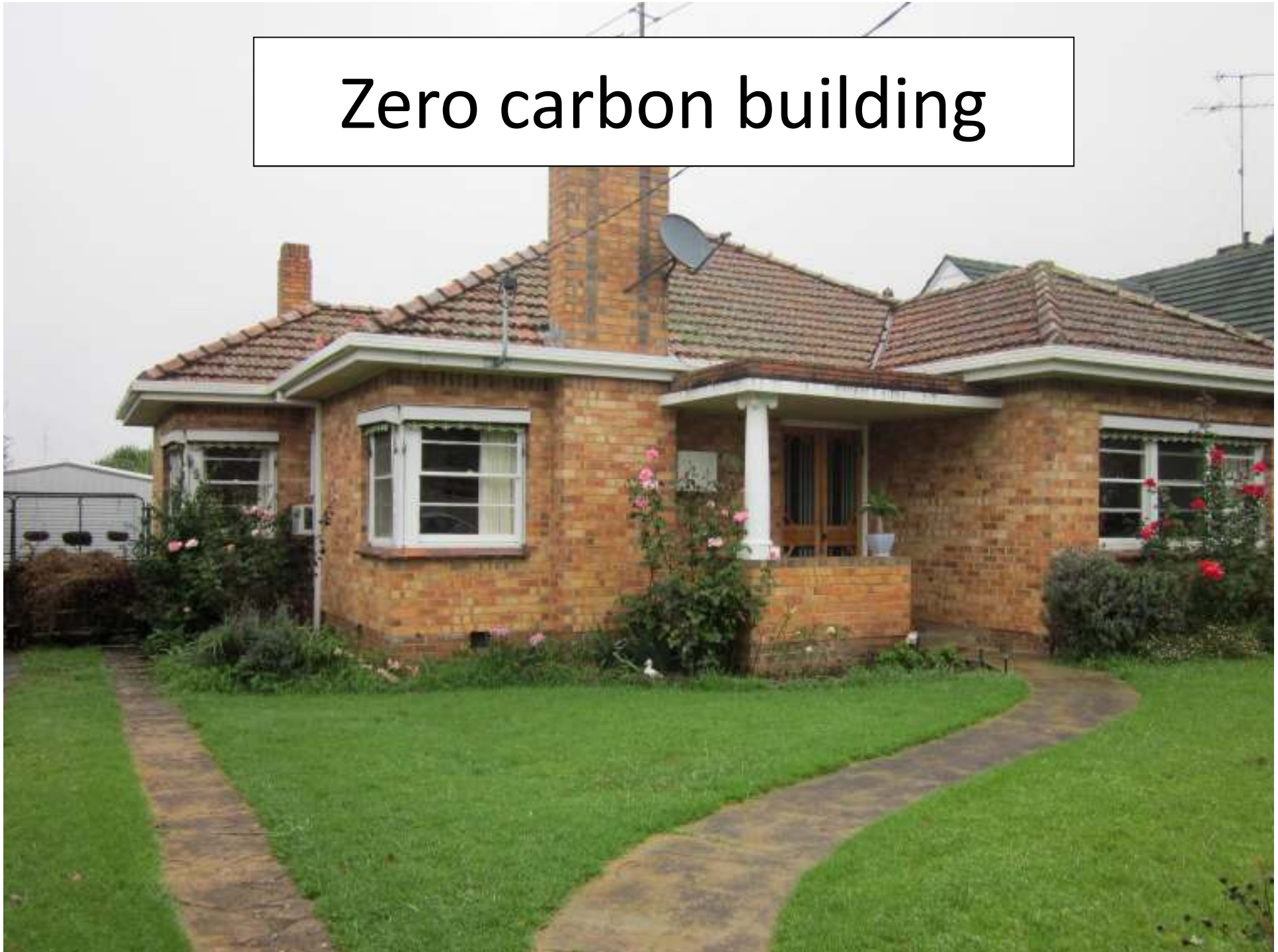
# What did we find out?



- 53% reduction in residential energy use
- 44% non-residential energy use
- 33,000MW of rooftop solar
- Initial investment offset by savings on energy bills



# Zero carbon building





# Why fix Australia's buildings?

- Uninsulated, leaky, uncomfortable buildings
- Gas guzzling appliances for heating and cooking
- Inefficient and outdated halogen lighting
- Substandard electrical appliances
- Households and businesses driving blind on energy use
- Households and businesses at the behest of big energy companies

Going gas-free





# Gas is not a clean fuel

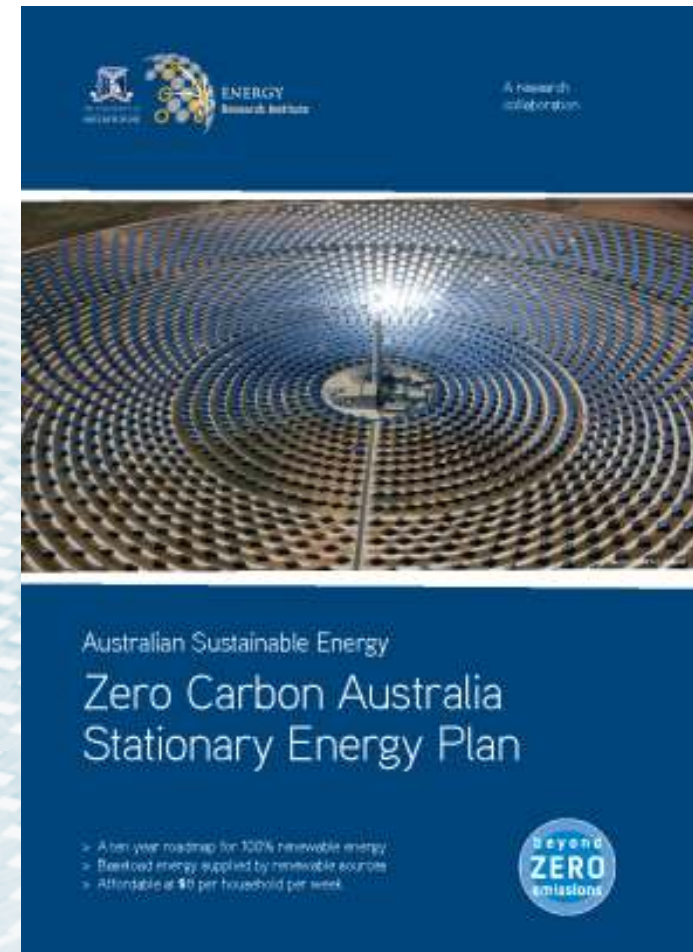
<b>Assumed Leakage Rate</b>	<b>Combustion emissions [kg CO<sub>2</sub>]</b>	<b>Leakage emissions [kg CO<sub>2</sub>(e)]</b>	<b>Total emissions<sup>(a)</sup> [kg CO<sub>2</sub>(e)]</b>	<b>Emissions multiplier [ = (a)/(b) ]</b>
0%	2.74	0	2.74 <sup>(b)</sup>	1.00
3.3%	2.65	2.83	5.49	2.00
5.0%	2.61	4.35	6.96	2.54
7.5%	2.54	6.54	9.06	3.30

*Table 2. Net emissions from 1kg of methane, for different leakage rates<sup>2</sup>*



# The Future is Renewable Energy

- Building Industry can plan for zero emissions grid
- AEMO 100% Renewables Study





# So how do we do it?

## Lighting

- Replace all linear fluorescents and halogen downlights with LED alternatives
- Assumed efficacy of LEDs = 150 lm/W



## Fabric Upgrades

- Insulate roof to R6, insulate walls to R2.5
- Replace windows with thermally broken double glazed units
- Install curtains and pelmets on all windows
- Ventilated downlights to be eliminated; install self sealing exhaust fans
- Full weather sealing on external windows and doors
- External awnings on east and west windows



## Space Conditioning

- Best on the market split system reverse cycle air-conditioners to replace all gas heaters and old air-conditioners. COP >4.6
- 2-3kW for bedroom, 4-5kW for living room
- Wood heating maintained on downward trend



## Hot Water

- Heat pump to replace all gas instantaneous, gas tank, and electric tank units
- Heat Pump: COP 4
- Water efficiency measures, e.g. low flow shower head



## Cooking

- Replace gas cooktops with induction electric
- Replace small amount of gas ovens with electric. (Electric is dominant type on market.)



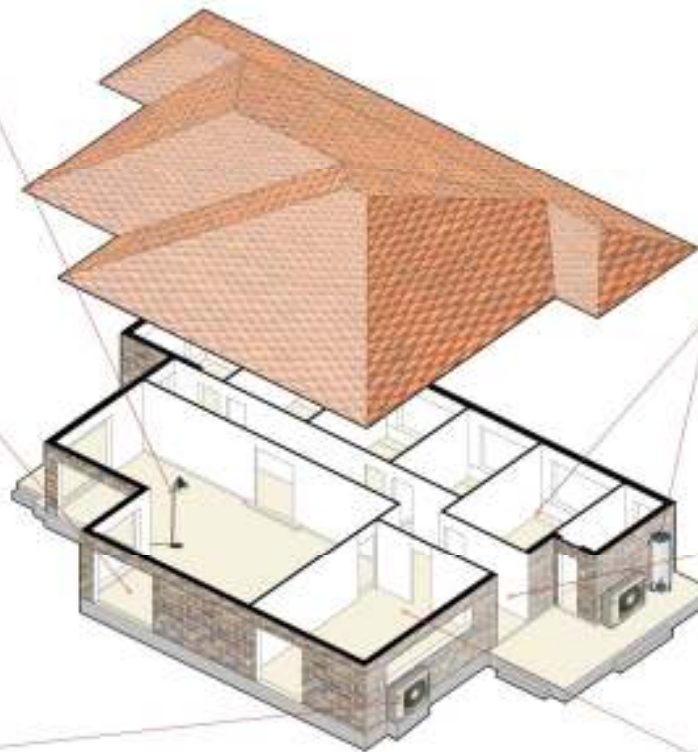
## Energy Monitoring

- Installation of Smart Meter
- Installation of In Home Display or web portal for real time monitoring of energy consumption
- Meters/switches on individual appliances



## Appliances

- New replacement appliances must meet best practice energy performance e.g. LED displays, best available fridge, washer, etc.



Retrofit measures



**LIGHTING**



- 35W halogen light replaced with 7W LED.  
80% saving
- LED is a 21st century technology,
  - better performance
  - lasts 20 years.



## LIGHTING

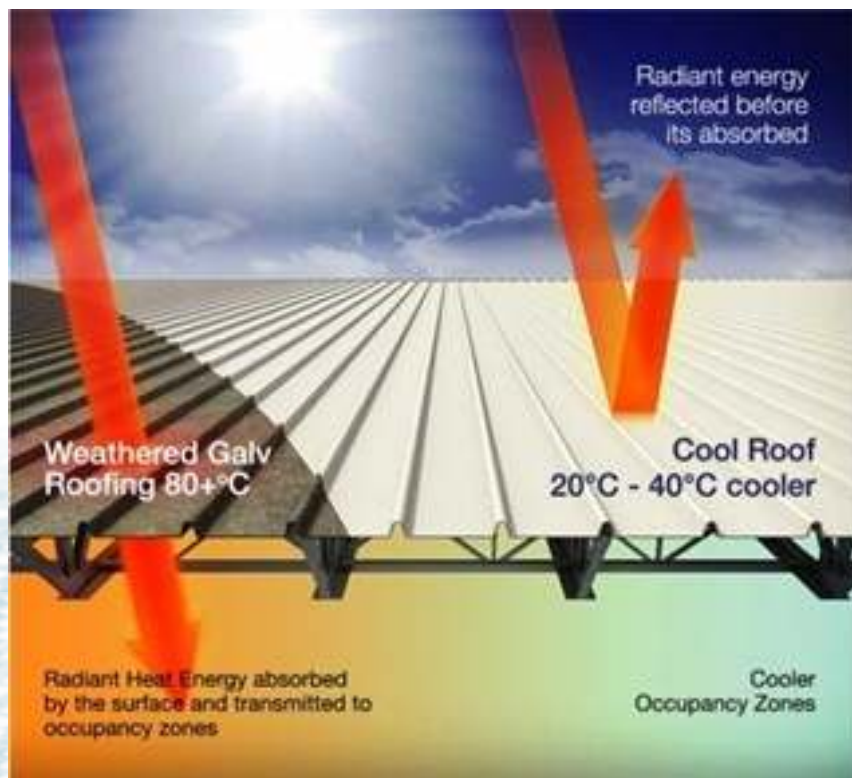


Retrofit measures

# **BUILDING ENVELOPE**







**FULLY  
INSULATE**





**OPTIMISE  
GLAZING**







**AIR INFILTRATION**



Retrofit Measures

# SPACE CONDITIONING

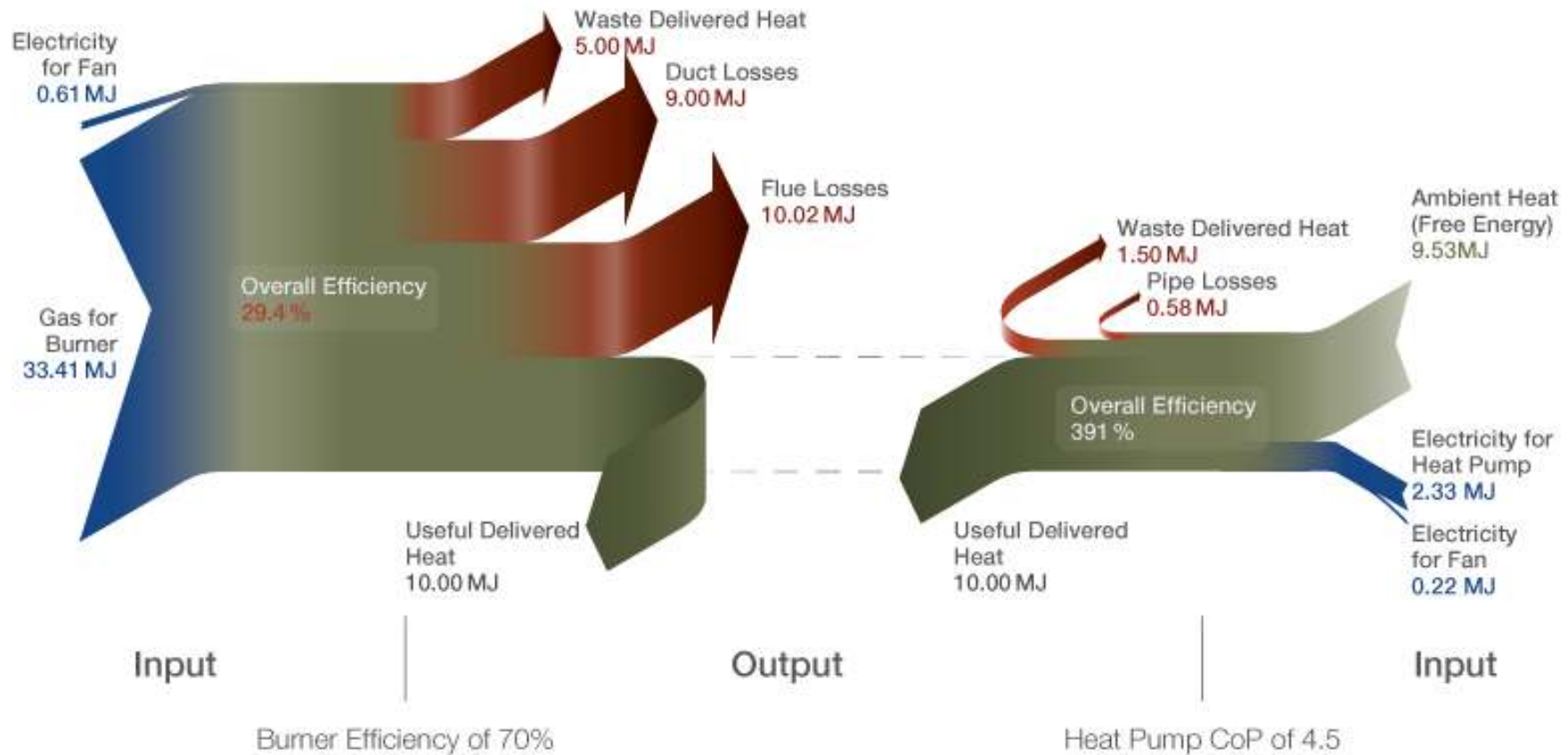








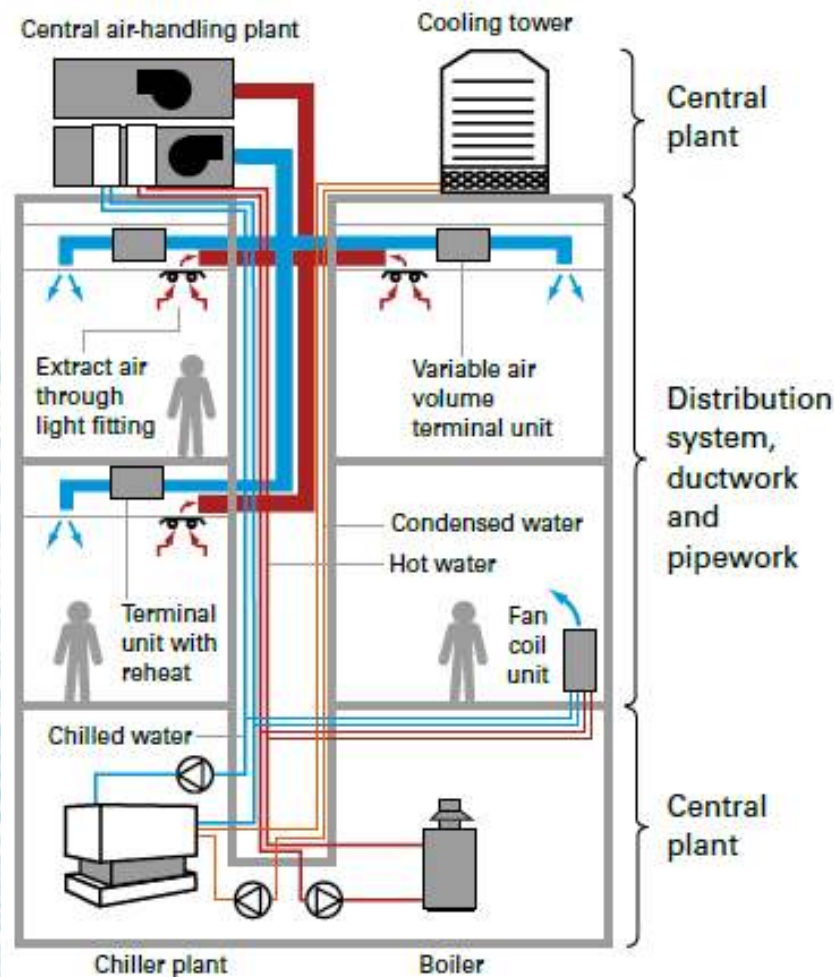
VS







# Replacing chillers and boilers



1. New chillers
2. Heat Pump Boiler
3. Air handling improvements
  - Variable Air Volume
  - Economy Cycles
  - Variable Speed Drives

Source: Carbon Trust UK

Retrofit Measures

# DOMESTIC HOT WATER





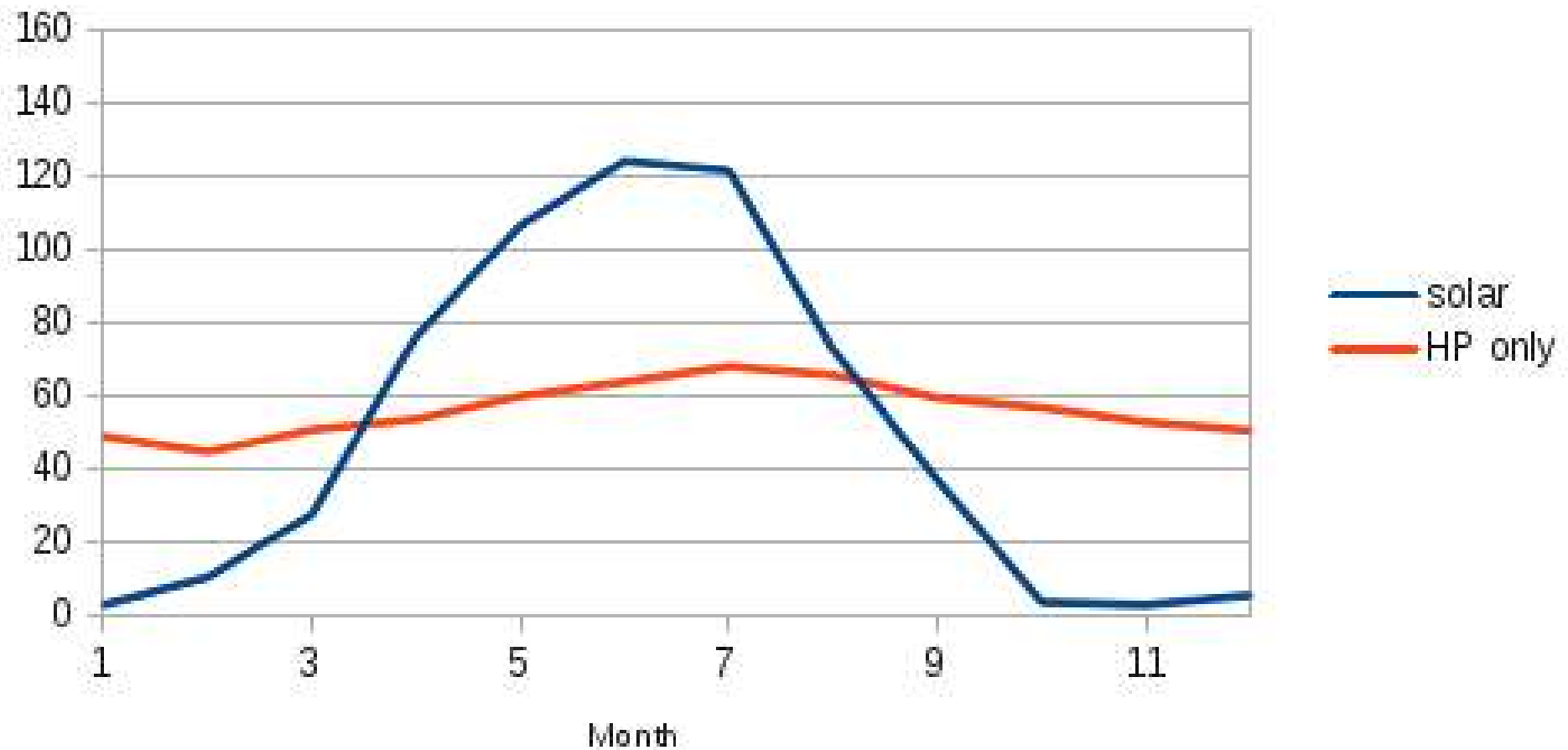


# HOT WATER SYSTEM



# Heat pump or solar hot water?

Sydney





Retrofit Measures

**COOKING**



COOKING



# Cooking



- Induction cooktop – same performance as gas, but half the energy consumption
- Electric kitchen replacements in commercial



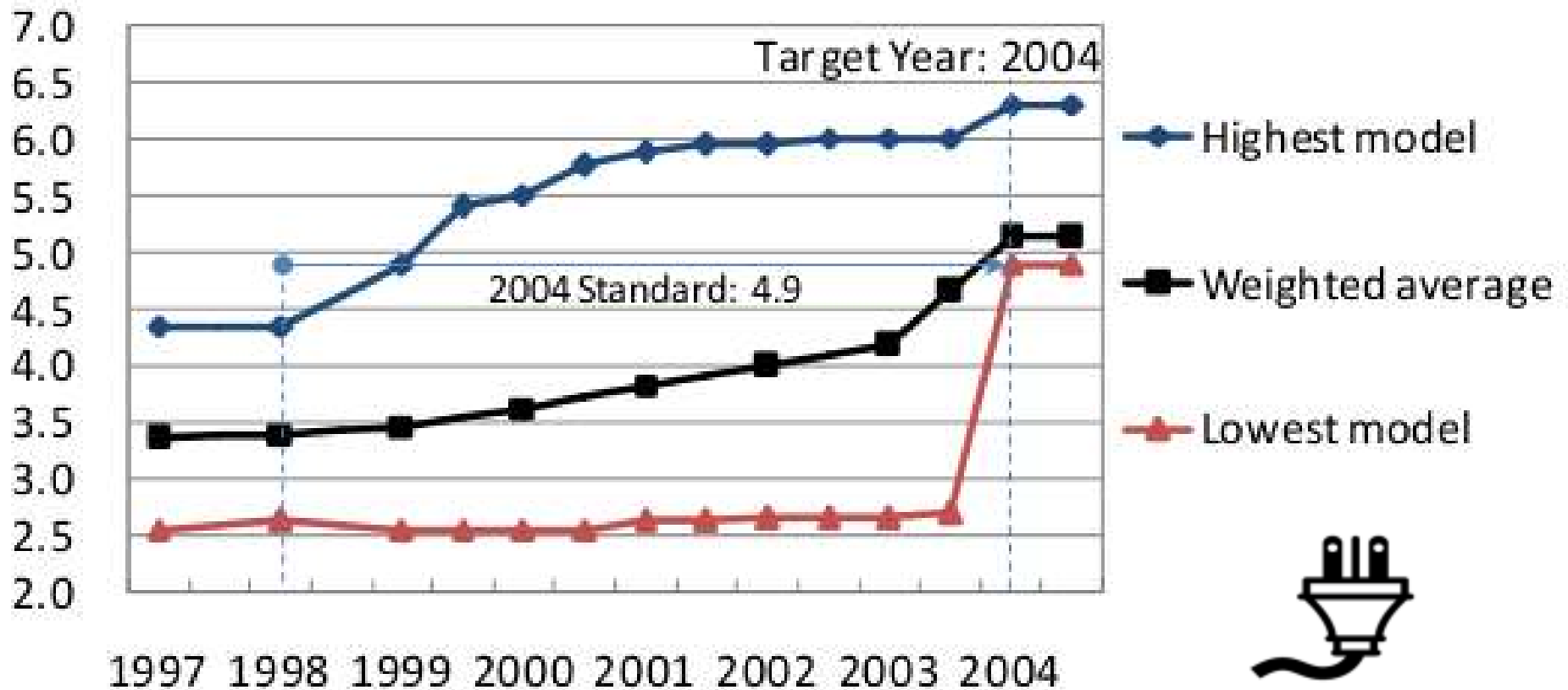
Retrofit Measures

# APPLIANCES



APPLIANCES

COP



APPLIANCES

**Top Runner Program – Today's best is tomorrow's benchmark**





# Feedback – EMS + FMs, In Home Display

The background of the slide features a series of concentric, semi-circular lines that create a ripple effect. Overlaid on these lines is a fine, light blue grid pattern. The overall color palette is a range of light blues, from very pale to a slightly darker shade, giving it a clean, modern, and technological feel.

Retrofit Measures

# **ROOFTOP SOLAR**



# Rooftop solar – 33,000MW





Homes become solar power stations





# Distribution Network Upgrades

- Network upgrades investigated to accommodate changing energy flows
- Total only \$17 billion



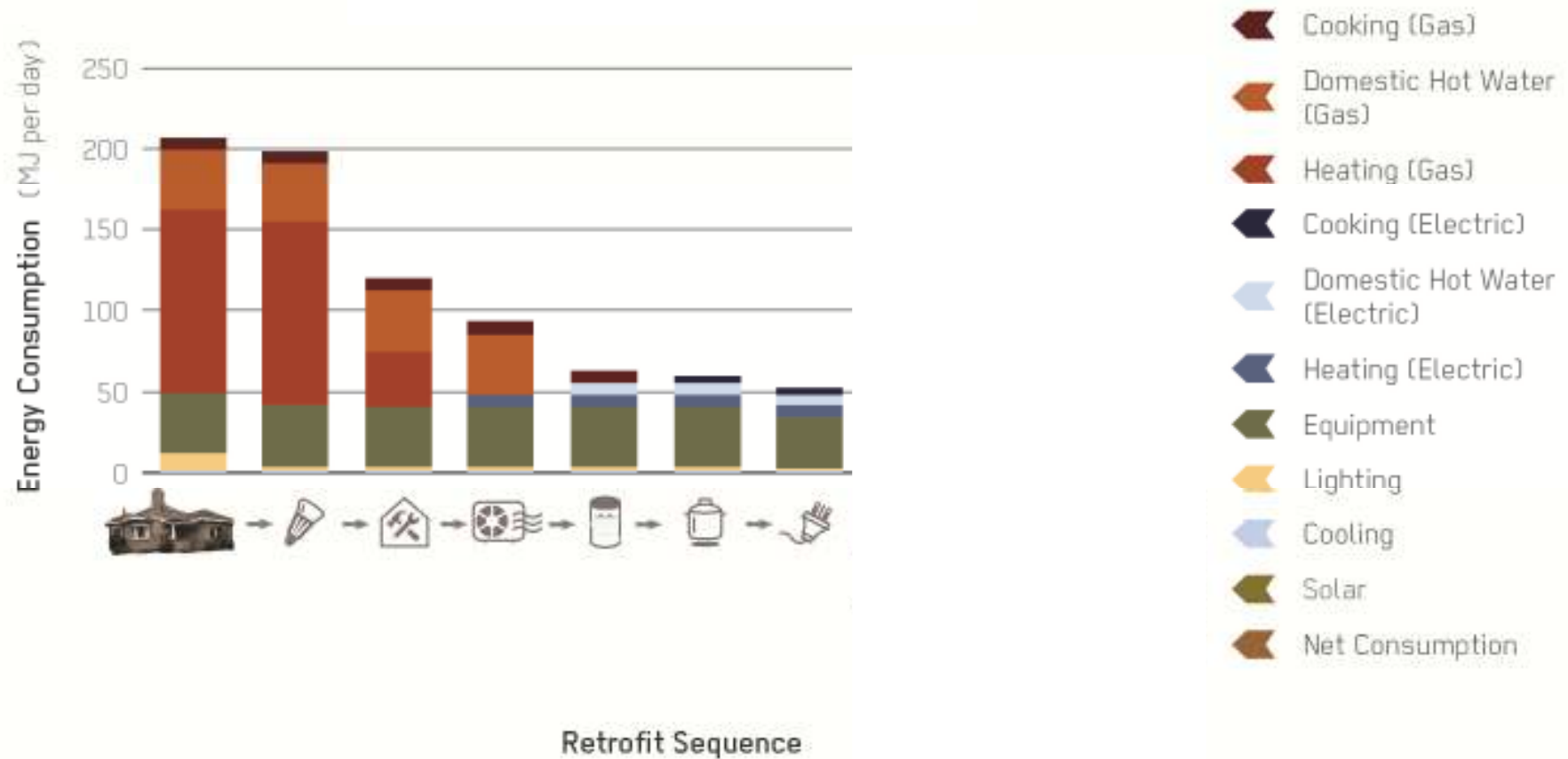
The background of the slide is a light blue and white abstract pattern. It features a series of concentric, slightly irregular circles that create a ripple effect, centered around a small, dark blue, cross-like shape. Overlaid on this pattern is a fine grid of small squares, alternating between light blue and white. The overall effect is a textured, wave-like surface.

Pulling it all together



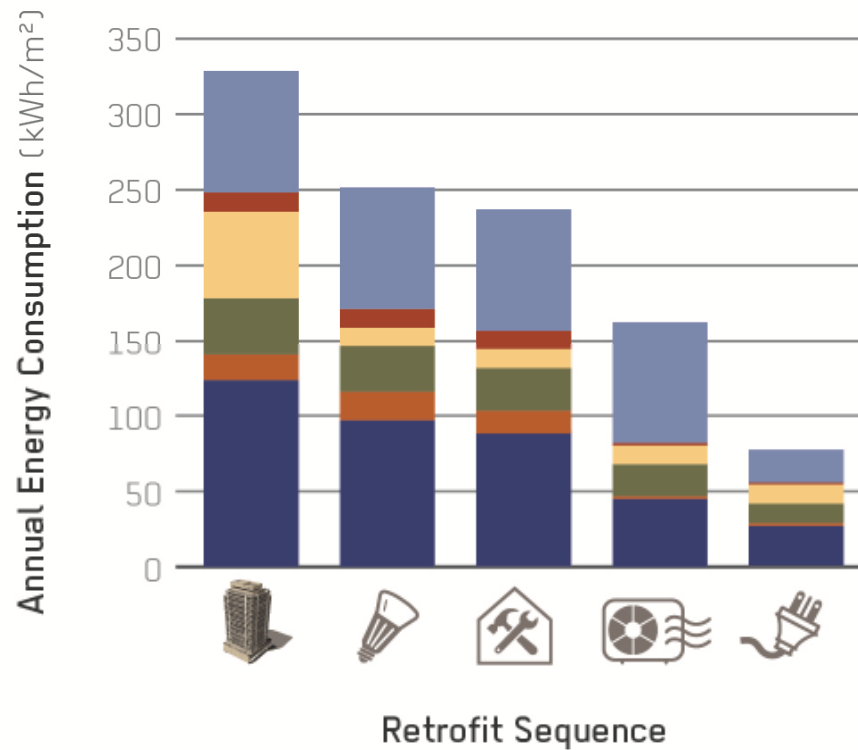
# Retrofit + No Gas + Solar = Energy freedom

REDUCTION IN ENERGY CONSUMPTION RESULTING FROM RETROFIT



# Non-residential savings

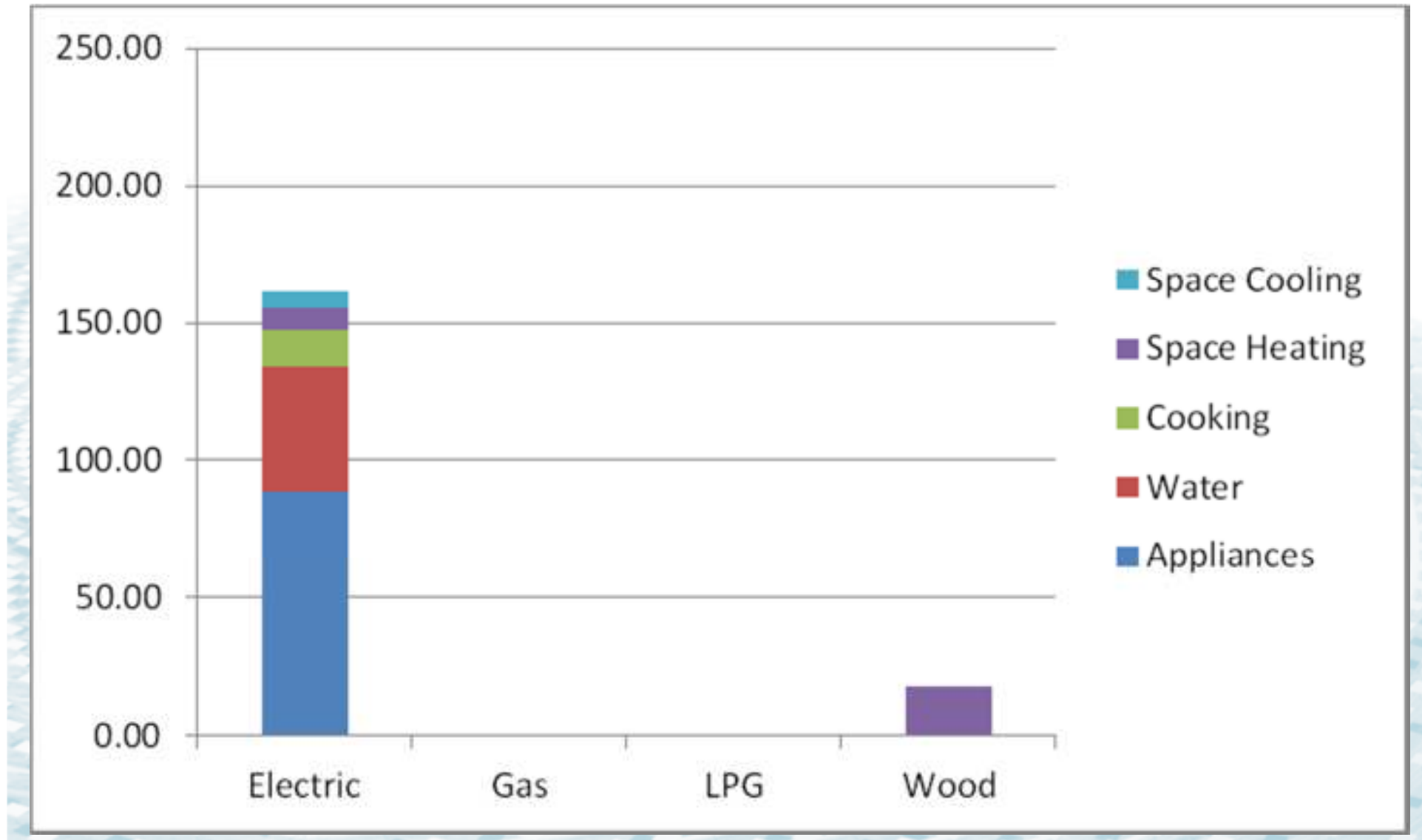
**BRISBANE** — 1945 - 1980 OFFICE TYPE TYPE



**ZCA MODELLING RESULTS OF RETROFITS RETAIL BUILDINGS**



# Australian Residential Energy





Building category	Baseline Energy PJ/annum	2022 Energy PJ/annum	Percentage reduction
Retail	49.3	24.9	49.5%
Offices	46.0	27.5	40.2%
Accommodation	16.6	10.9	34.1%
Hospitals	16.1	10.0	37.7%
Warehouses	15.3	8.6	43.8%
Universities	8.5	4.7	44.8%
Aged Care	8.3	5.1	39.3%
Education	6.6	1.7	74.0%
Clubs & Pubs	2.6	1.5	42.1%
Museums-Galleries	2.2	1.0	54.0%
Cafes and Restaurants	1.6	0.9	41.8%
Prisons	0.7	0.4	45.3%
Libraries	0.6	0.3	54.4%
Cinemas	0.4	0.2	53.5%
Total	174.7	97.7	44.1%

## TOTAL BUILDINGS ENERGY CONSUMPTION

EFFECT OF ZCA RETROFITS AND SOLAR PV

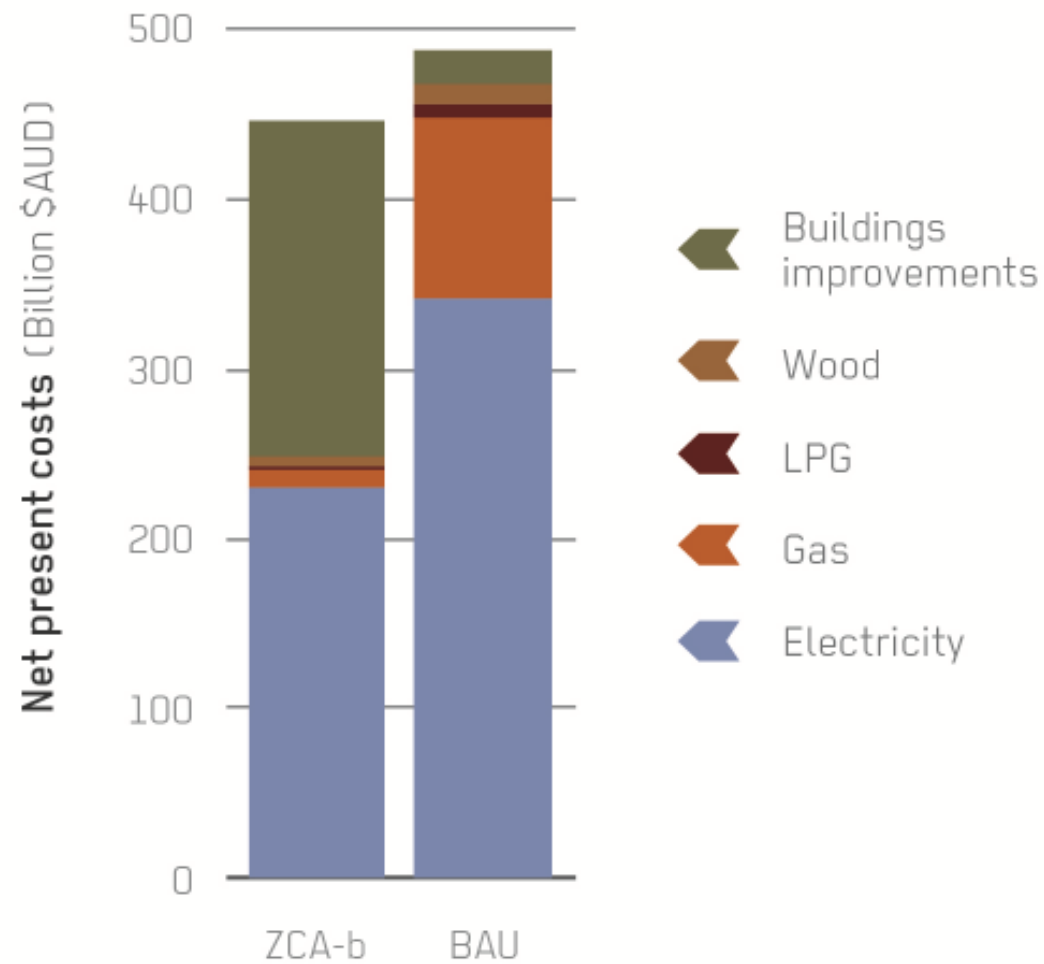


# Economic benefits

- Across all scenarios Buildings Plan is a similar expenditure to business as usual
- Full retrofit for residential leads to \$40 Billion net present saving over 30 years
- No more gas bills!
- Lower electricity bills
- \$37 billion less expenditure for the Stationary Energy Plan



# Residential economic comparison



# Worst case residential costs

---

Item	Cost
------	------

Double Glazing	\$10500
----------------	---------

Insulation	\$8700
------------	--------

Curtains, Pelmets, Awnings	\$3000
----------------------------	--------

Draught Proofing	\$350
------------------	-------

Reverse cycle A/C multi split system	\$8800
--------------------------------------	--------

Cooktop	\$1100
---------	--------

Heat Pump Hot Water System	\$4000
----------------------------	--------

<b>TOTAL</b>	<b>\$36,450</b>
--------------	-----------------

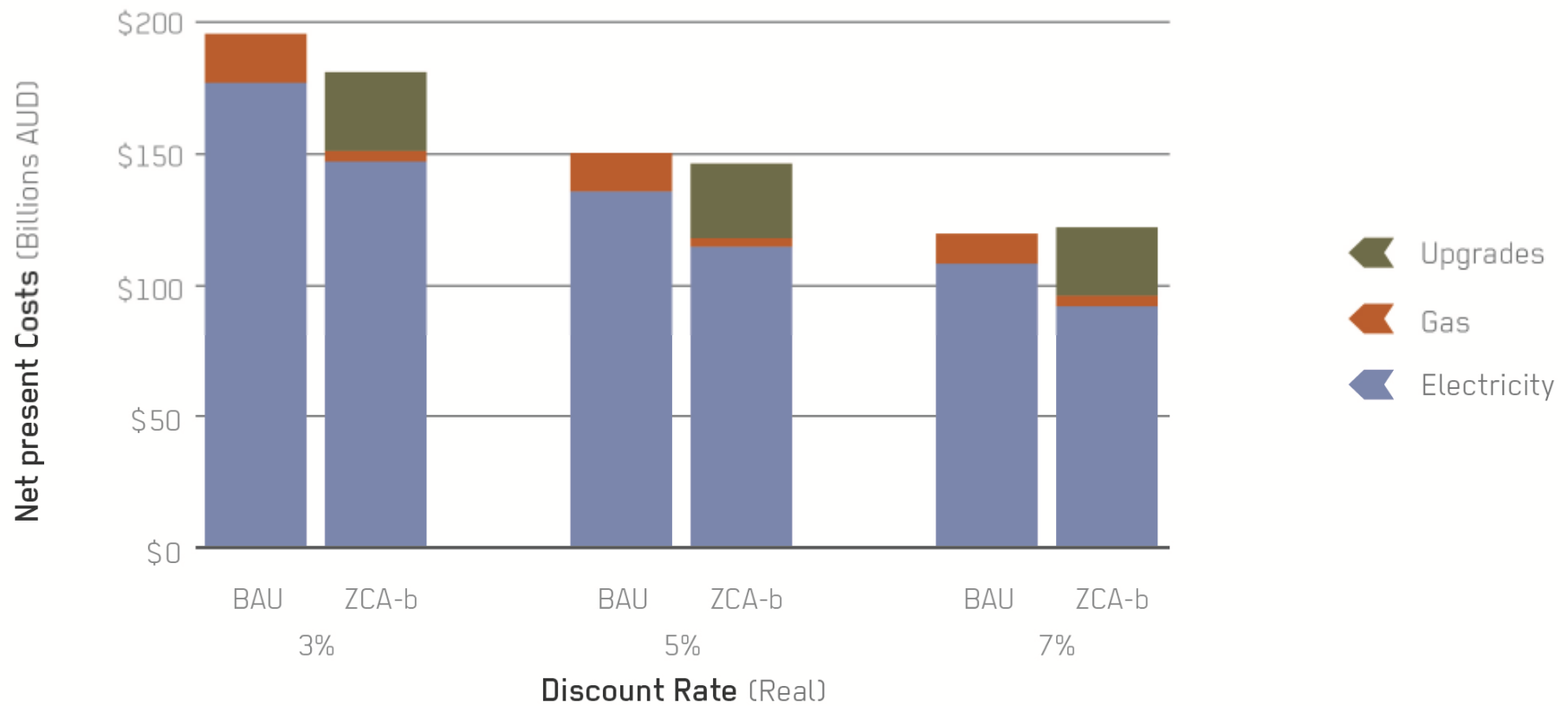
Roof Top Solar	
----------------	--

<b>4.5kW</b>	<b>\$10,350</b>
--------------	-----------------

---



# Non-residential economic comparison





We know this is doable





# Our Choice





# Our Choice

