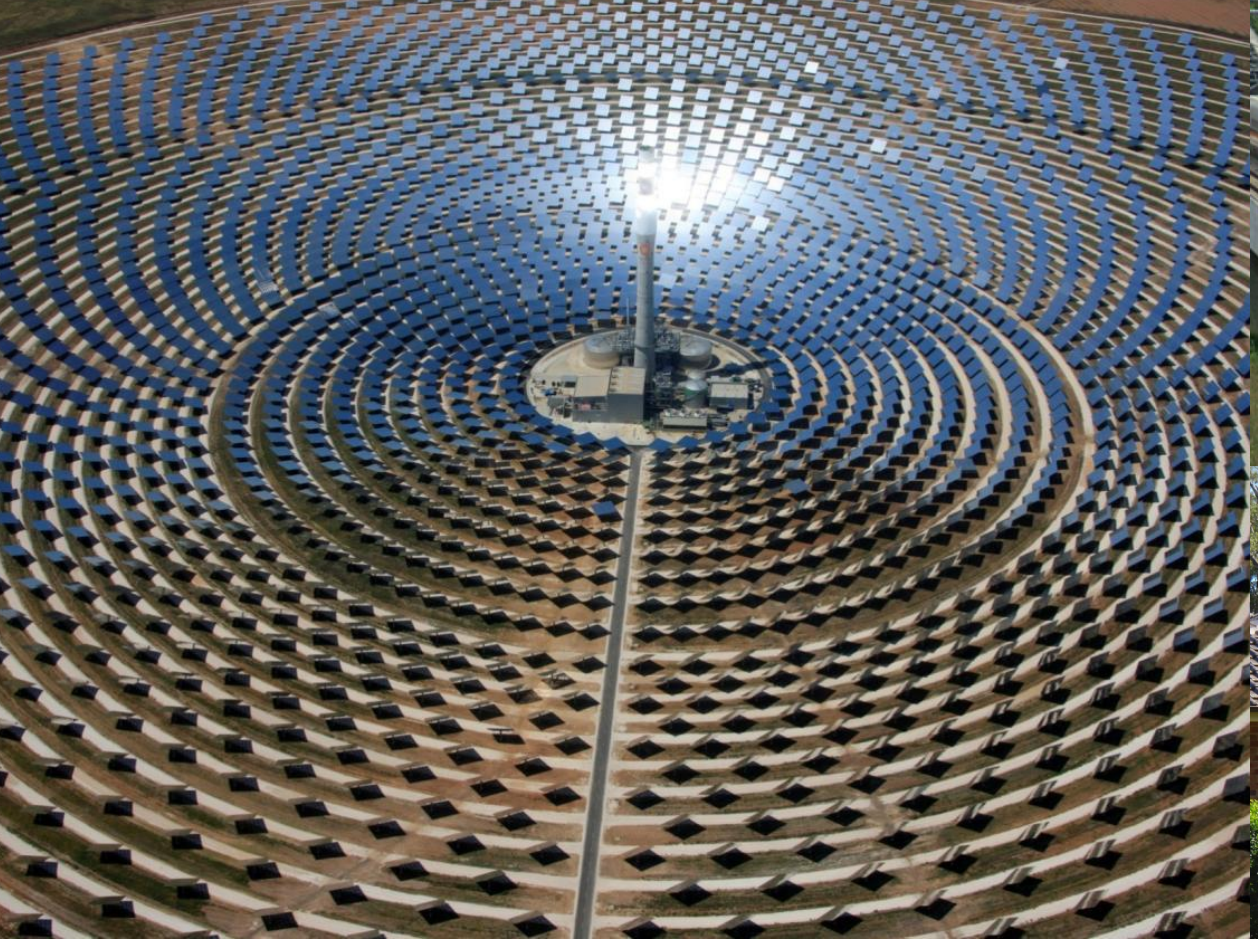


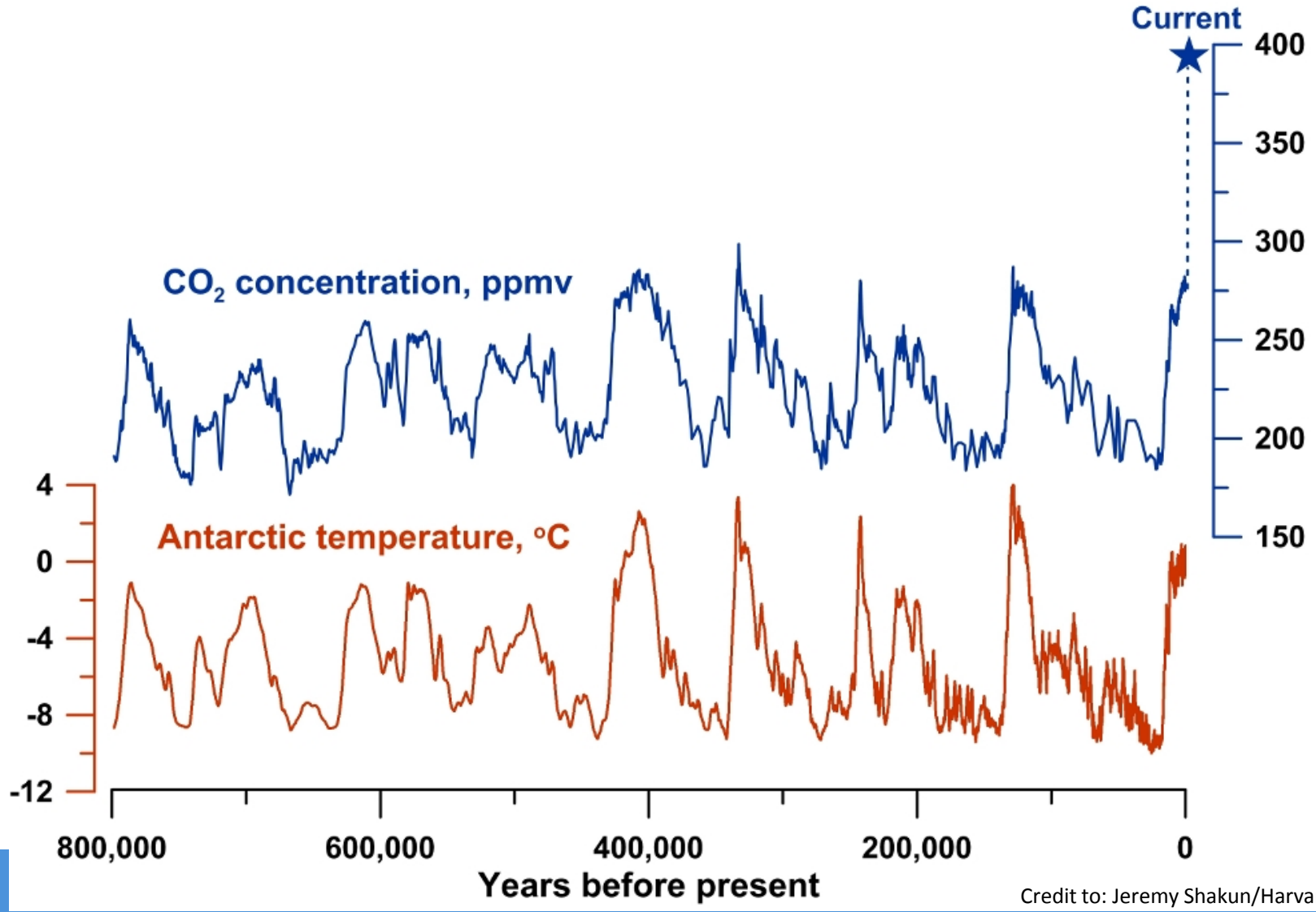
Raising the reality of a zero emissions future
Clean Energy Conference, Newcastle

Stephen Bygrave
CEO, Beyond Zero Emissions

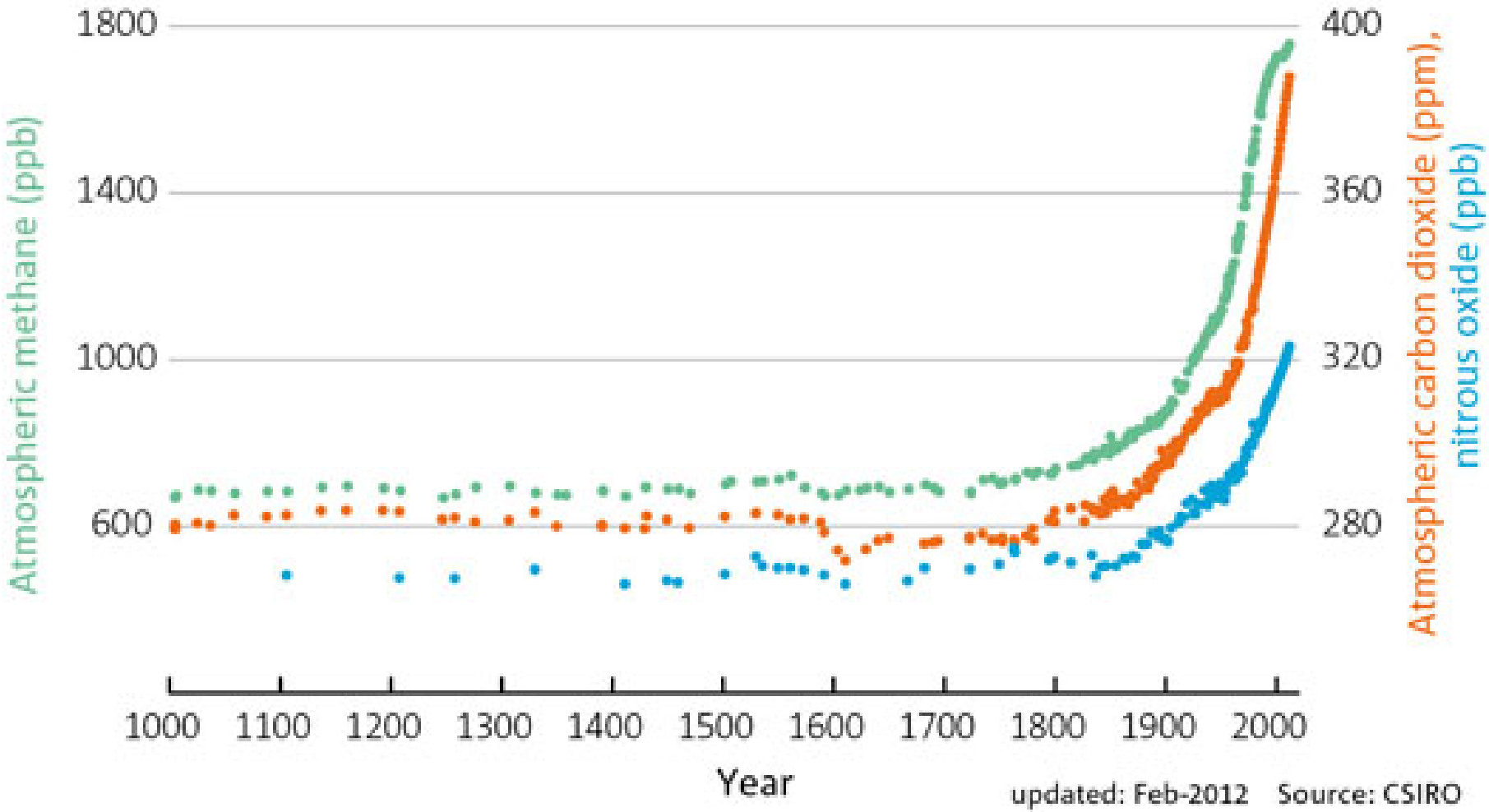
beyond ZERO emissions

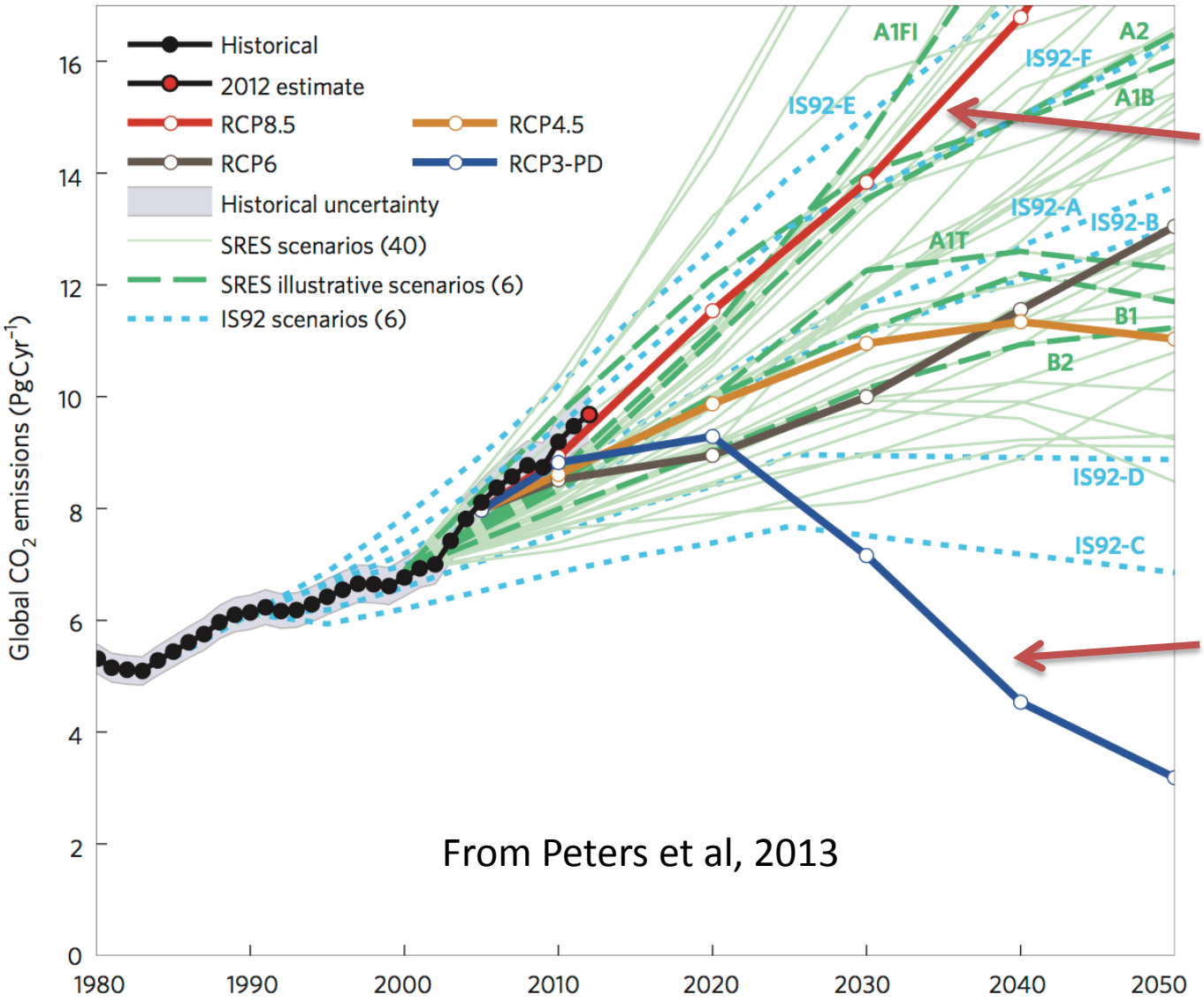
Temperature and CO2 from Antarctic ice cores over the past 800 thousand years

CO2 ppm projection for 40 years time at current rate



Credit to: Jeremy Shakun/Harvard University


1800
1400
1000
600
Atmospheric methane (ppb)
400
360
320
280
Atmospheric carbon dioxide (ppm), nitrous oxide (ppb)
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Year
updated: Feb-2012
Source: CSIRO

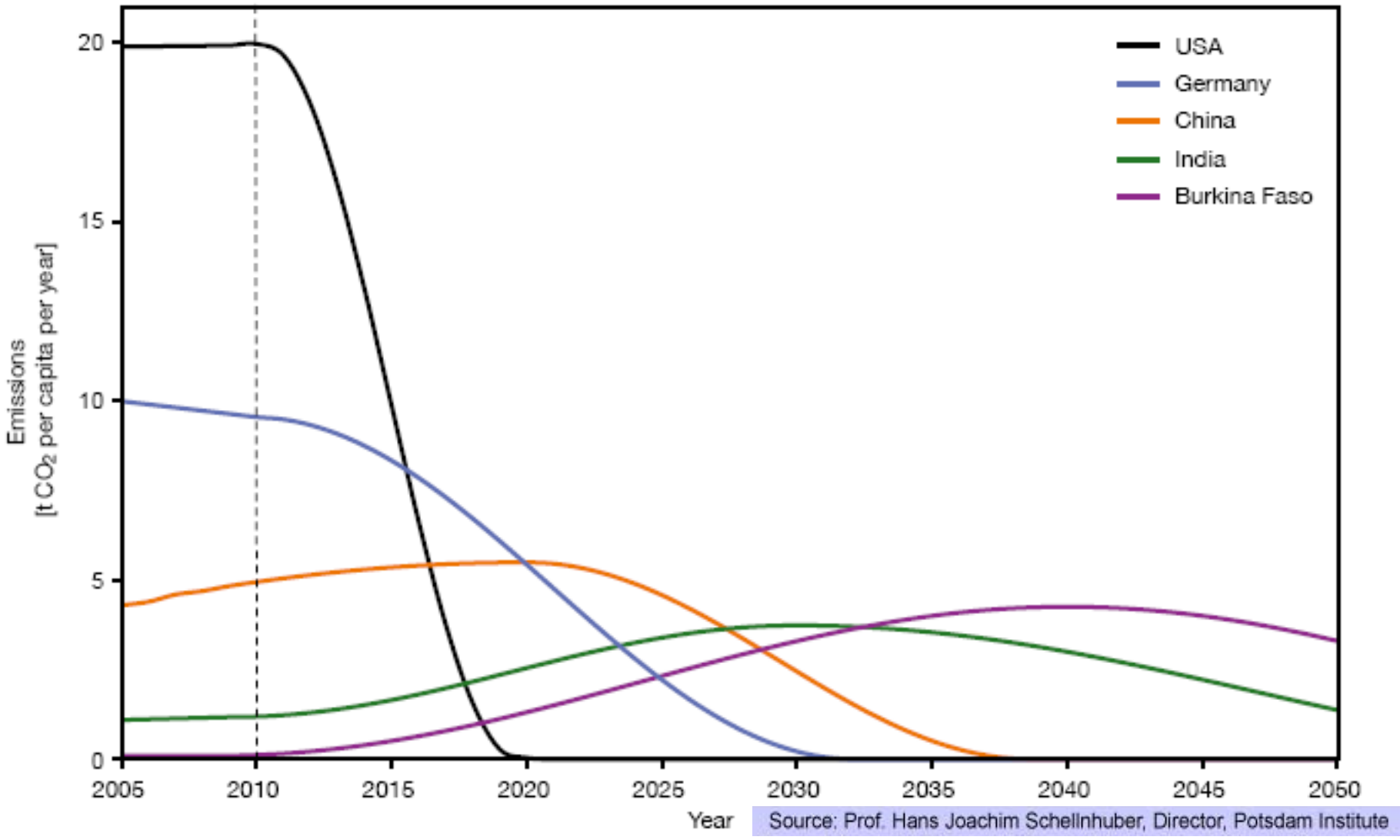


From Peters et al, 2013

BAU, Warming in 2100 >4C

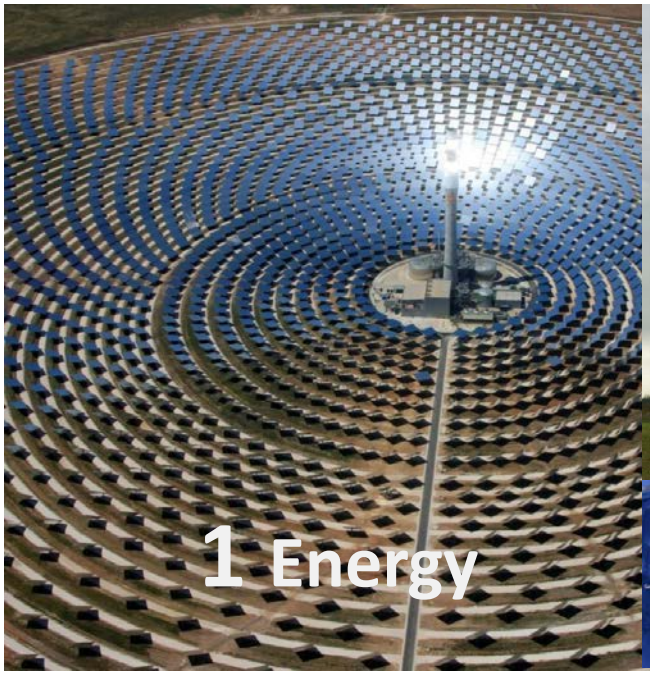
Warming in 2100 <2C

Carbon Budget 2010-2050



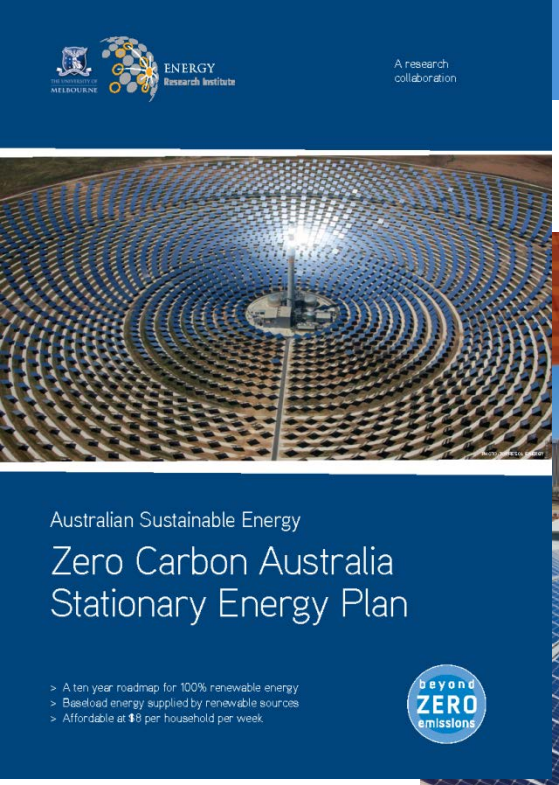
IPCC 5th Synthesis Report November 2014

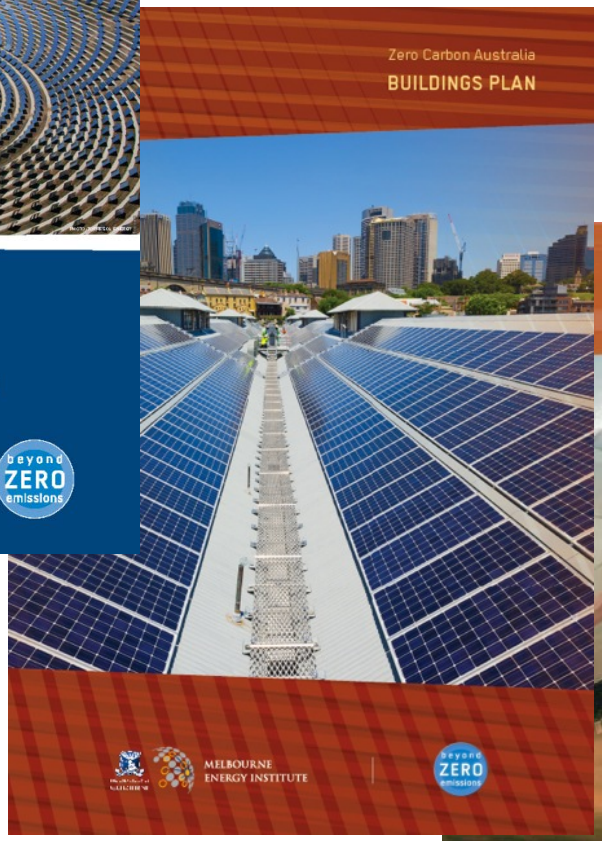
- To stabilise global greenhouse emissions at a level to limit warming to 2 degrees:
  - Reduce emissions by 40-70 % by the year 2050
  - Go below zero emissions by the year 2100

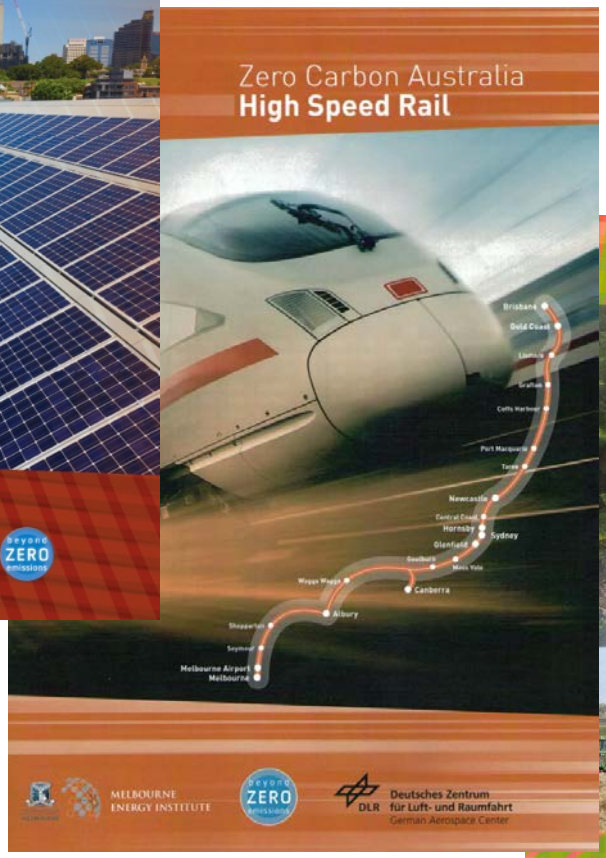


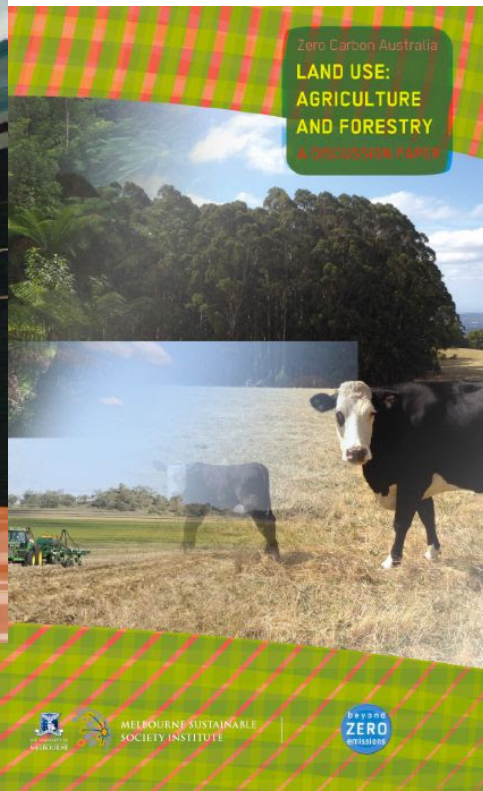
beyond ZERO emissions

Pathways to a Zero Carbon Australia



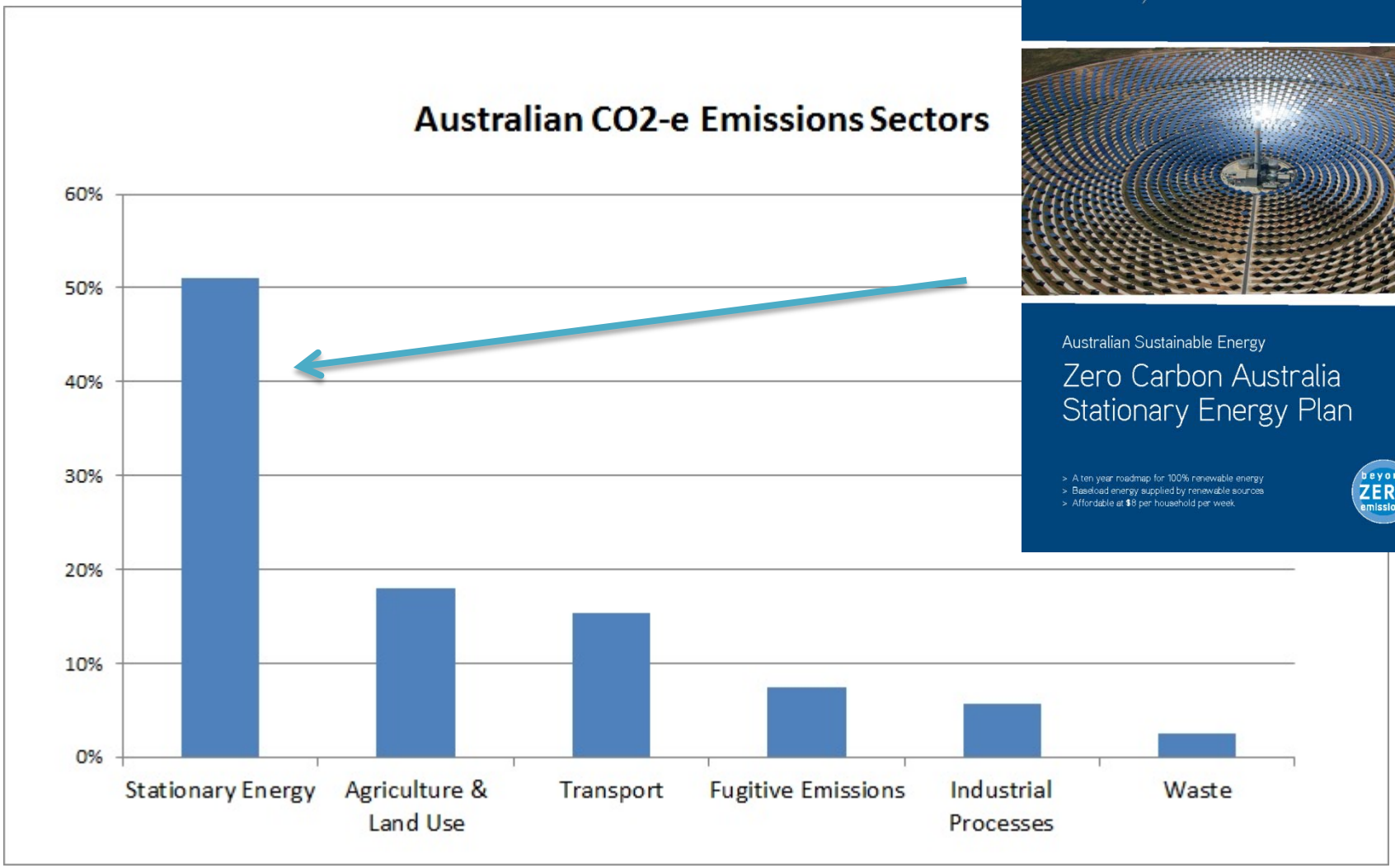






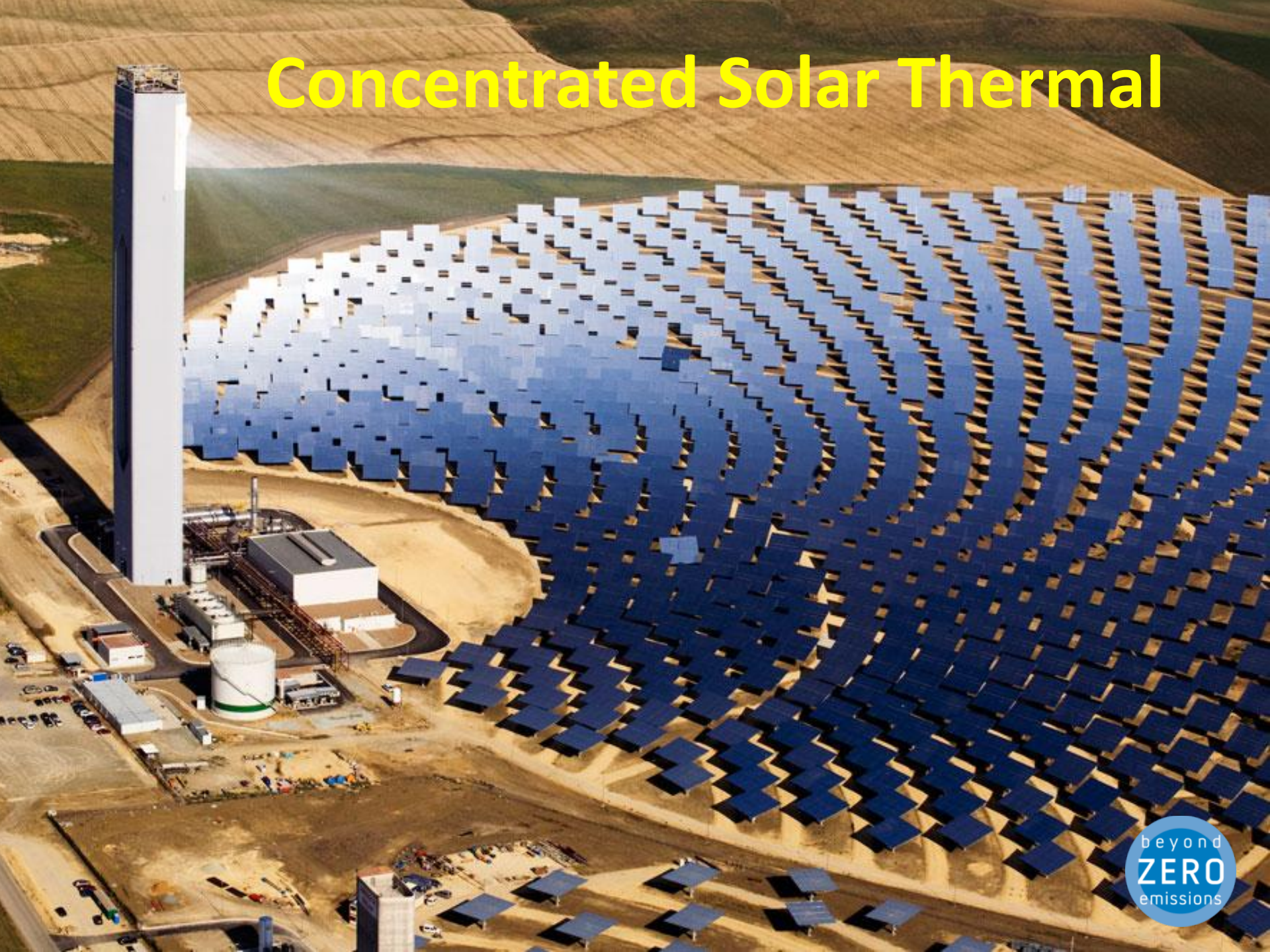
beyond ZERO emissions

Energy

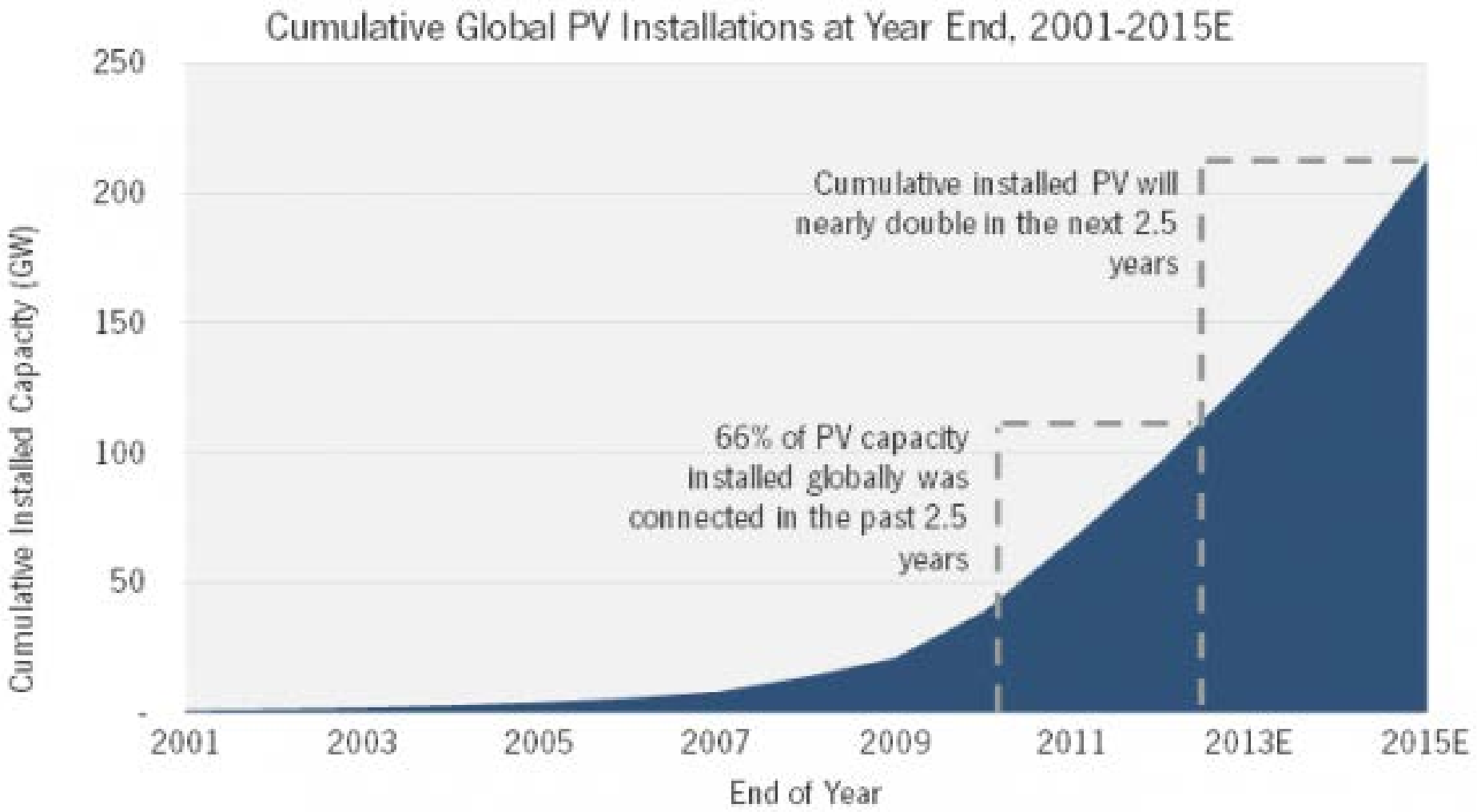

Australian CO2-e Emissions Sectors
60%
50%
40%
30%
20%
10%
0%
Stationary Energy
Agriculture & Land Use
Transport
Fugitive Emissions
Industrial Processes
Waste

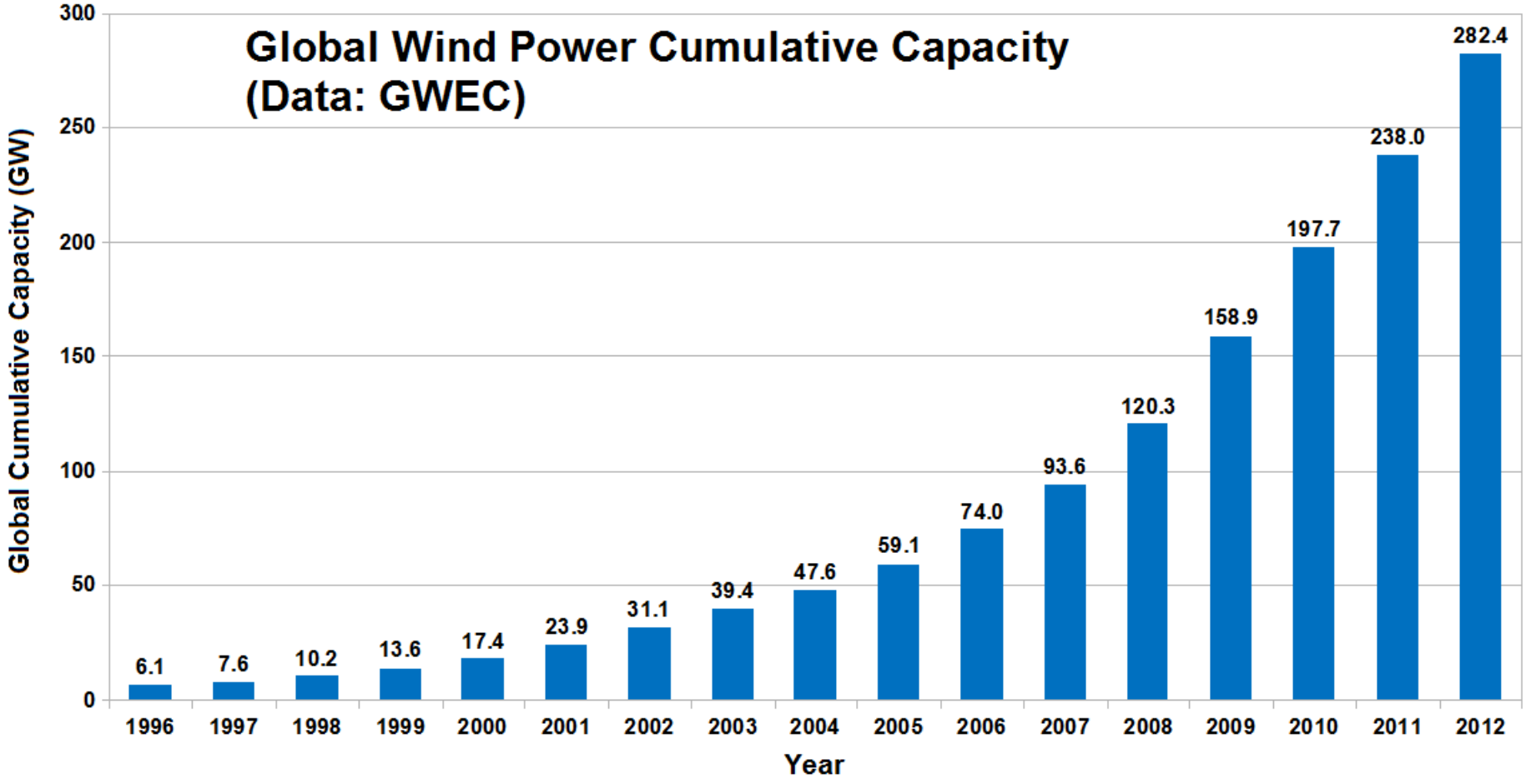
ENERGY
Research Institute
A research collaboration
Australian Sustainable Energy
Zero Carbon Australia
Stationary Energy Plan
> A ten year roadmap for 100% renewable energy
> Baseload energy supplied by renewable sources
> Affordable at $8 per household per week
beyond
ZERO
emissions

Concentrated Solar Thermal



36 days straight of 24/7 Power


Cumulative Global PV Installations at Year End, 2001-2015E
Cumulative Installed Capacity (GW)
250
200
150
100
50
-
Cumulative installed PV will nearly double in the next 2.5 years
66% of PV capacity installed globally was connected in the past 2.5 years
2001
2003
2005
2007
2009
2011
2013E
2015E
End of Year


Global Wind Power Cumulative Capacity
(Data: GWEC)
Global Cumulative Capacity (GW)
300
250
200
150
100
50
0
6.1
7.6
10.2
13.6
17.4
23.9
31.1
39.4
47.6
59.1
74.0
93.6
120.3
158.9
197.7
238.0
282.4
1996
1997
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1999
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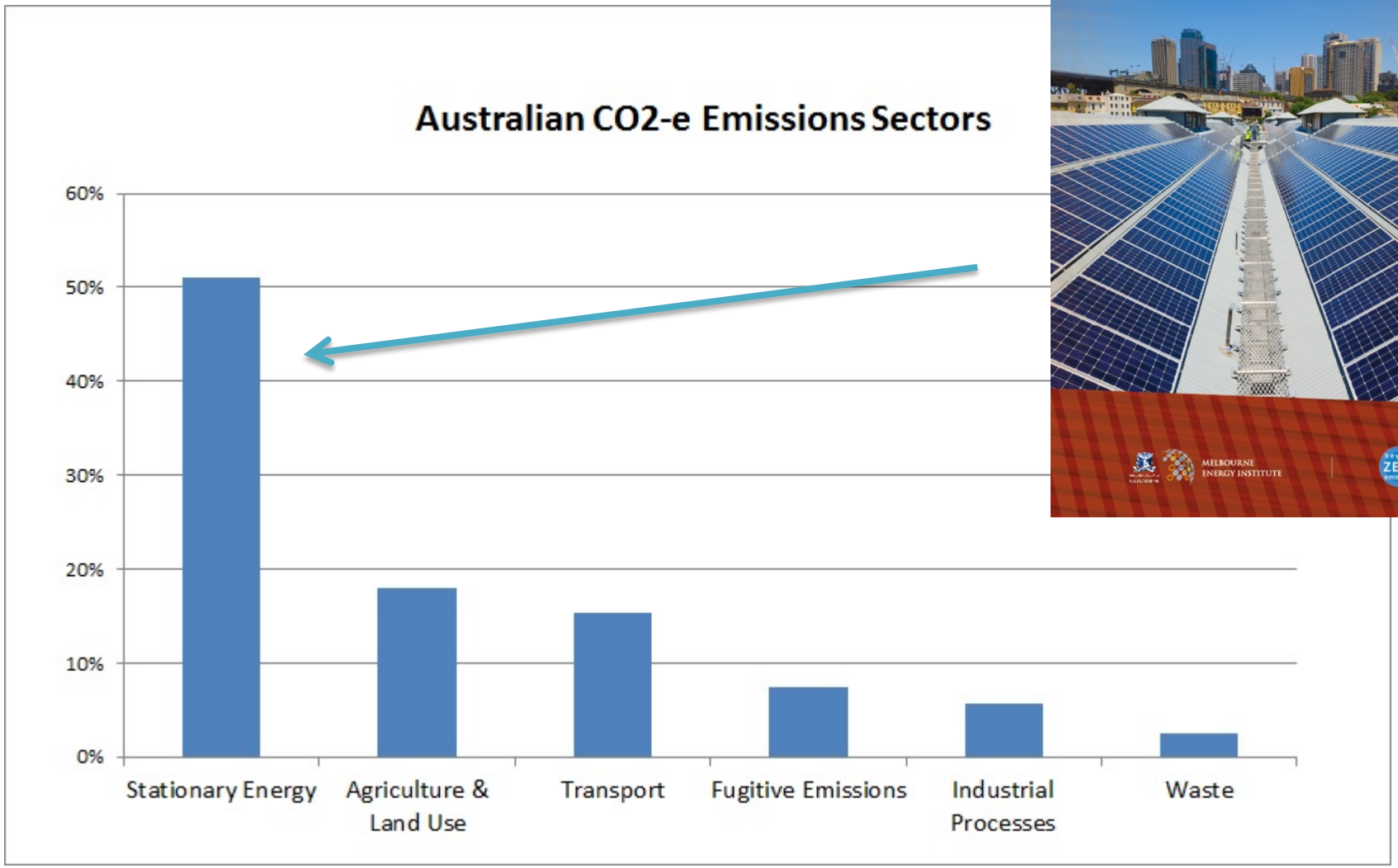
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year

Buildings


Australian CO2-e Emissions Sectors
60%
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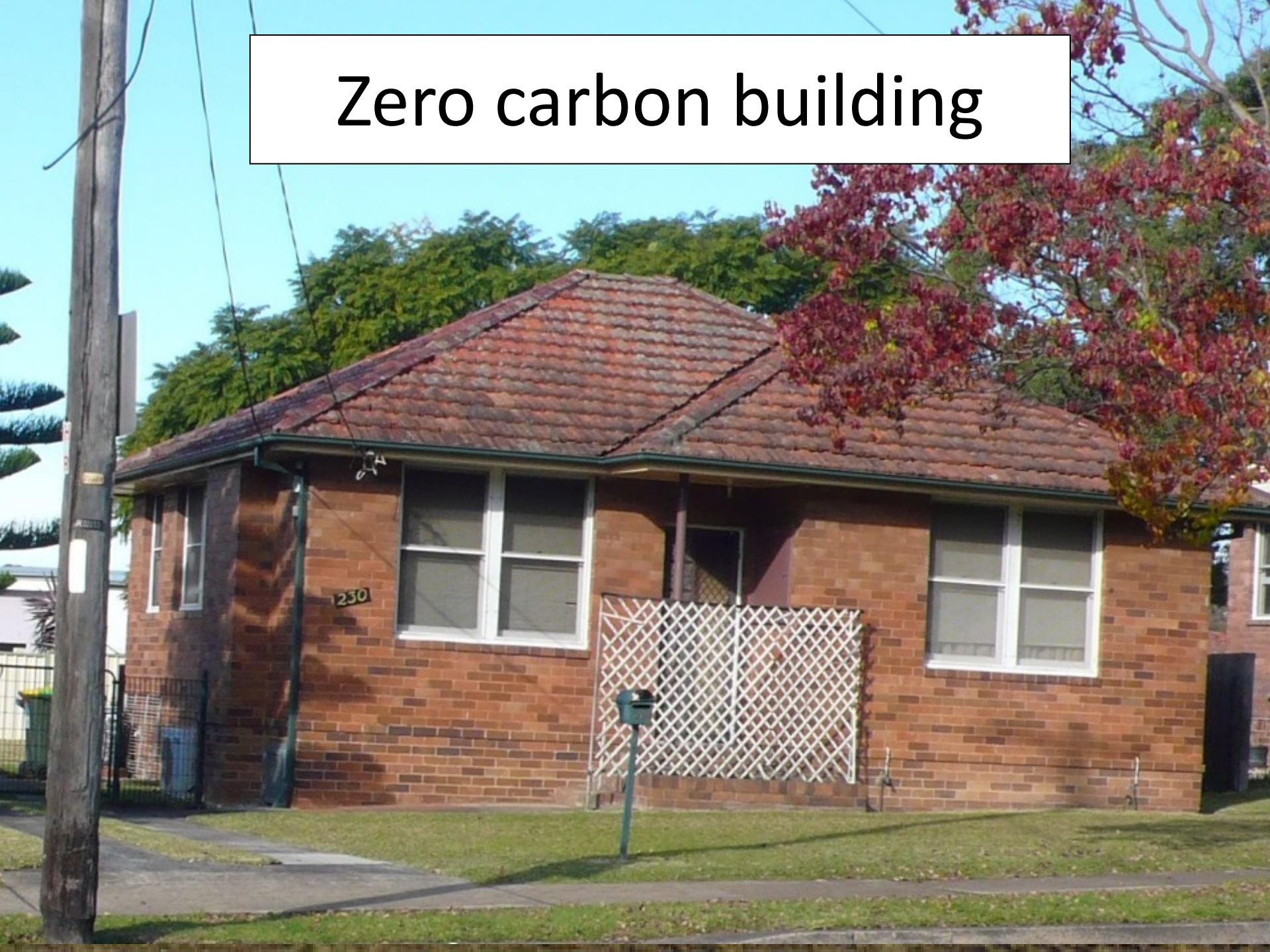
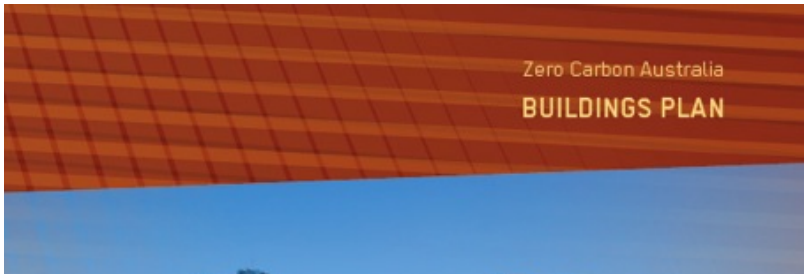
40%
30%
20%
10%
0%
Stationary Energy
Agriculture & Land Use
Transport
Fugitive Emissions
Industrial Processes
Waste

Zero Carbon Australia
BUILDINGS PLAN
MELBOURNE ENERGY INSTITUTE
ZERO


Zero carbon building
230

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

Lighting

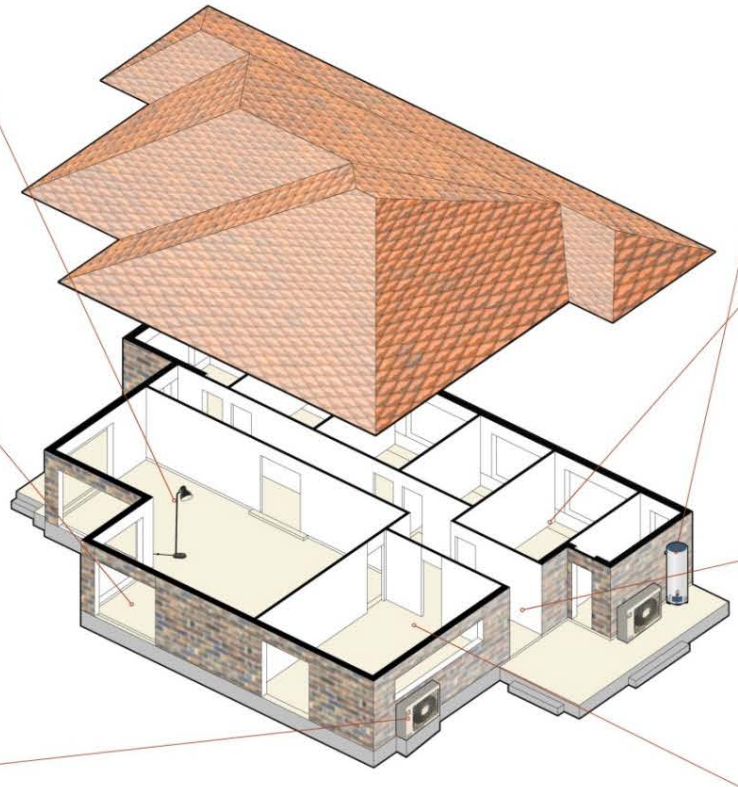
- Replace all linear fluoros and halogen downlights with LED alternatives
- Assumed efficacy of LEDs = 150 lm/W

Fabric Upgrades

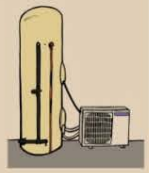
- Insulate roof to R6, insulate walls to R2.5
- Replace windows with thermally broken double glazed units
- Install curtains and pelmets on all windows
- Ventilated downlights to be eliminated; install self sealing exhaust fans
- Full weather sealing on external windows and doors
- External awnings on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

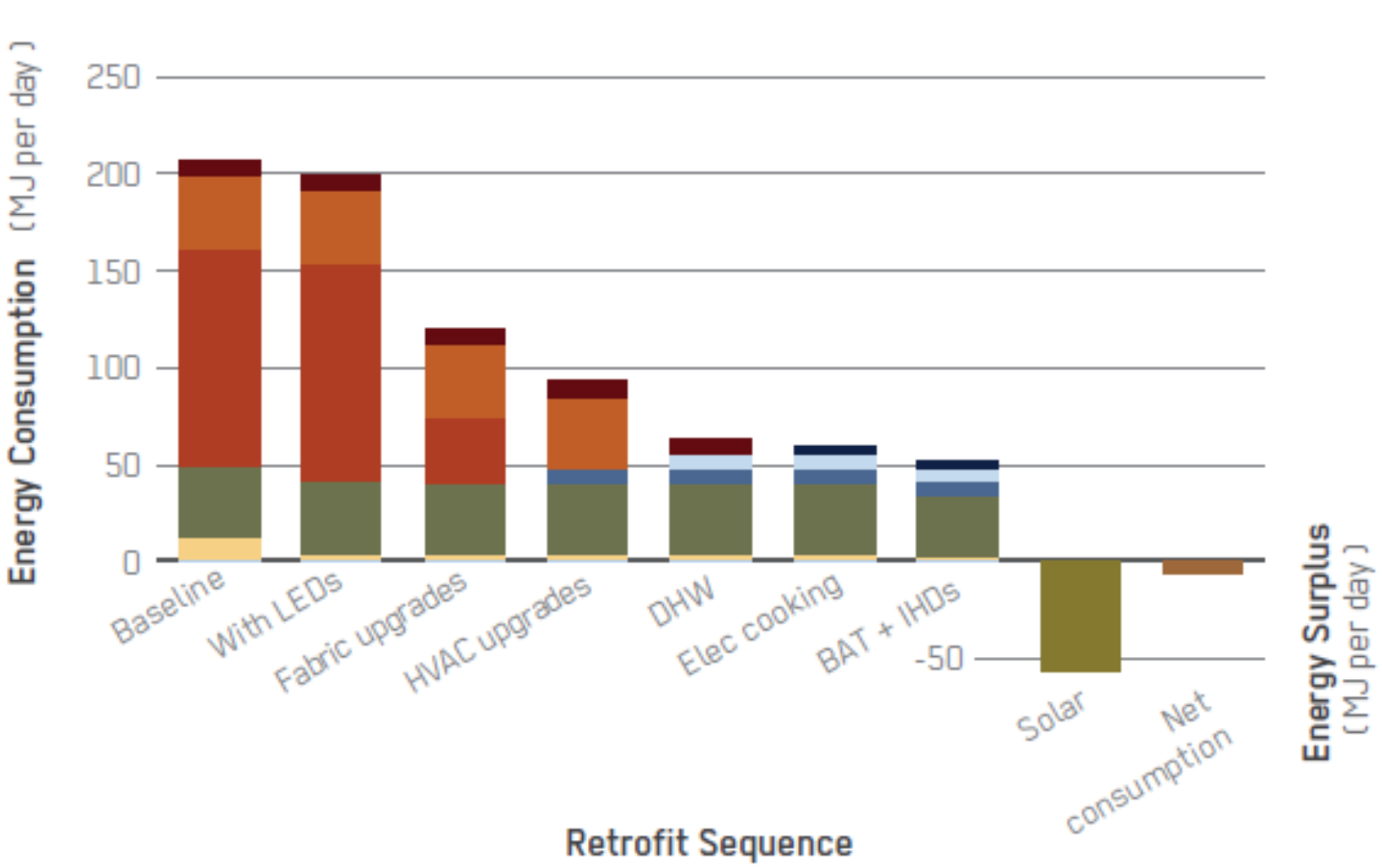
beyond ZERO emissions

9 Steps to Free Your Home

1. LED lighting upgrades
2. Insulation upgrades
3. Efficient electrical appliances
4. Induction cooktops
5. Double glazing
6. In-home displays
7. Heat pump space conditioners
8. Heat pump hot water
9. Rooftop solar

REDUCTION IN ENERGY CONSUMPTION RESULTING FROM RETROFIT

4.5 KW SOLAR SYSTEM

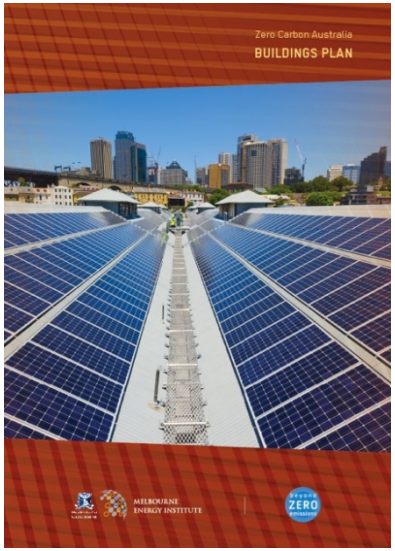


Homes become solar power stations

ENERGY FREEDOM

Brings together

Researched Solutions



Industry

ENERGY MATTERS

cherry LED

KNAUF INSULATION
it's time to save energy

Australians taking action to achieve energy freedom in their homes

Help us implement the Buildings Plan!

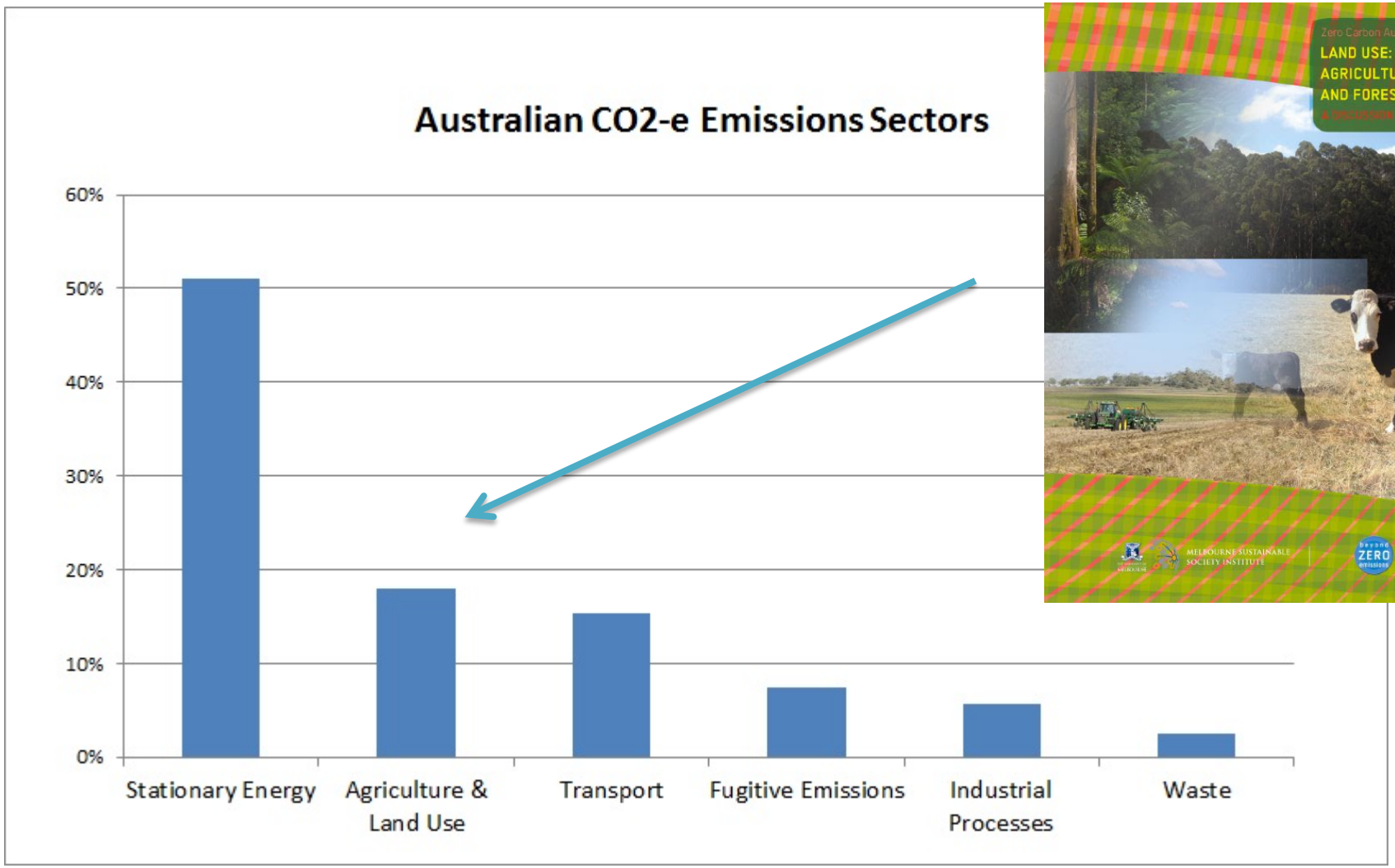
Join thousands of Australians taking climate action in their homes by signing up at:

energyfreedom.com.au

ENERGY FREEDOM

beyond ZERO emissions

Land Use


Australian CO2-e Emissions Sectors
60%
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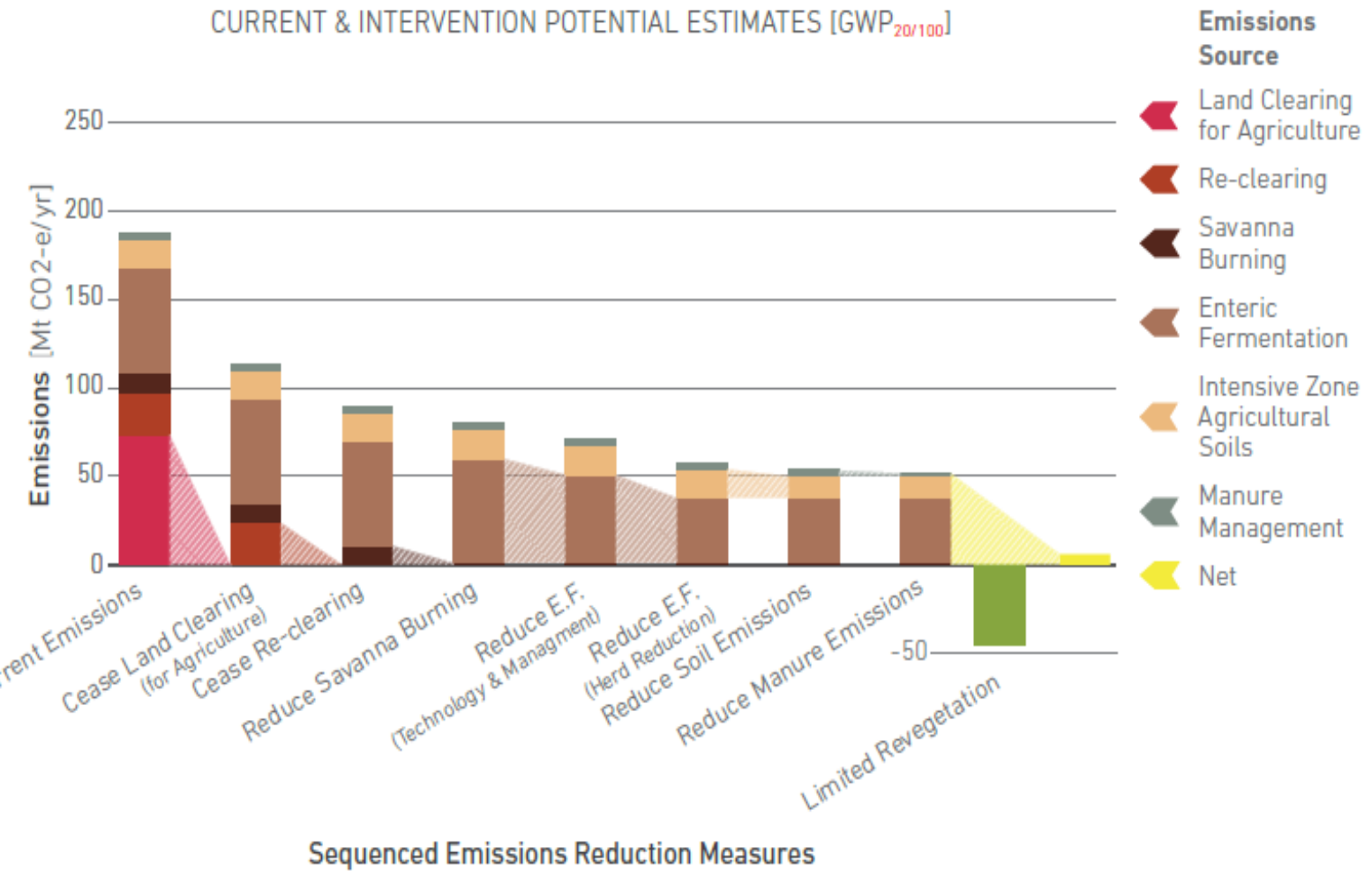
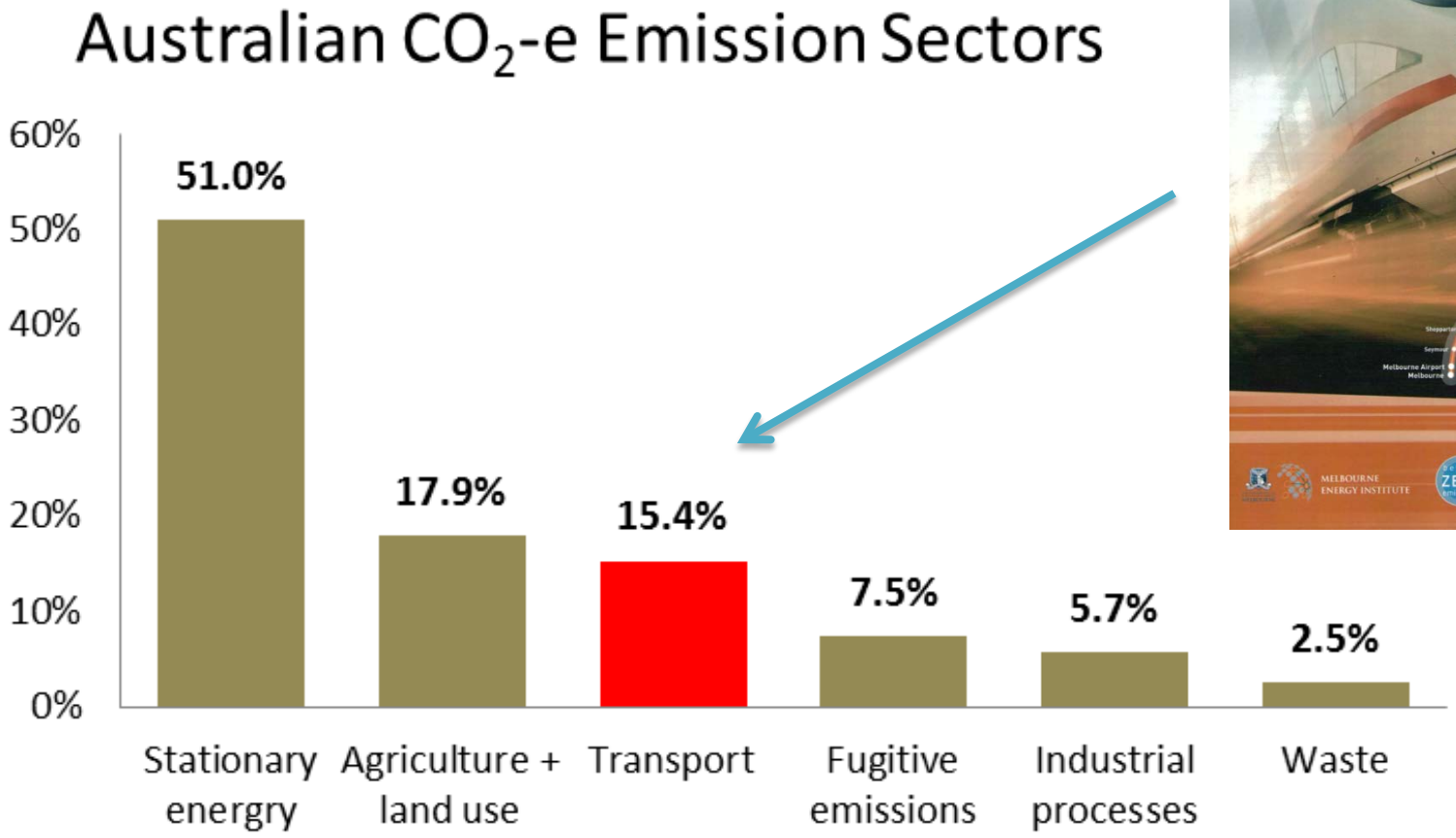
Industrial Processes
Waste

Zero Carbon Australia
LAND USE: AGRICULTURE AND FORESTRY
A DISCUSSION PAPER
MELBOURNE SUSTAINABLE SOCIETY INSTITUTE
beyond ZERO emissions

Figure 6.3 **Agricultural activities, current emissions, abatement interventions and estimated potential abatement at GWP_{100}.**



Transport


Australian CO_2-e Emission Sectors
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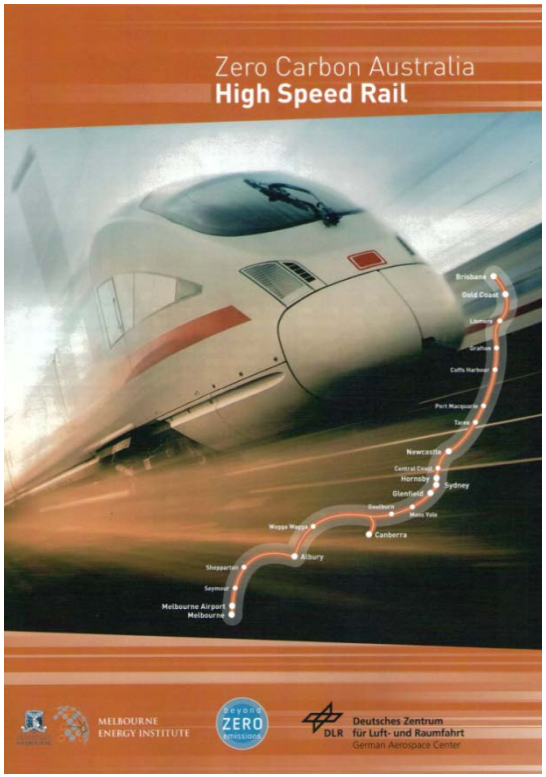
10%
0%
51.0%
17.9%
15.4%
7.5%
5.7%
2.5%
Stationary energry
Agriculture + land use
Transport
Fugitive emissions
Industrial processes
Waste


Zero Carbon Australia
High Speed Rail
MELBOURNE ENERGY INSTITUTE
ZERO
DLR
Deutsches Zentrum für Luft- und Raumfahrt
German Aerospace Center

ZCA Transport

Zero Carbon Australia

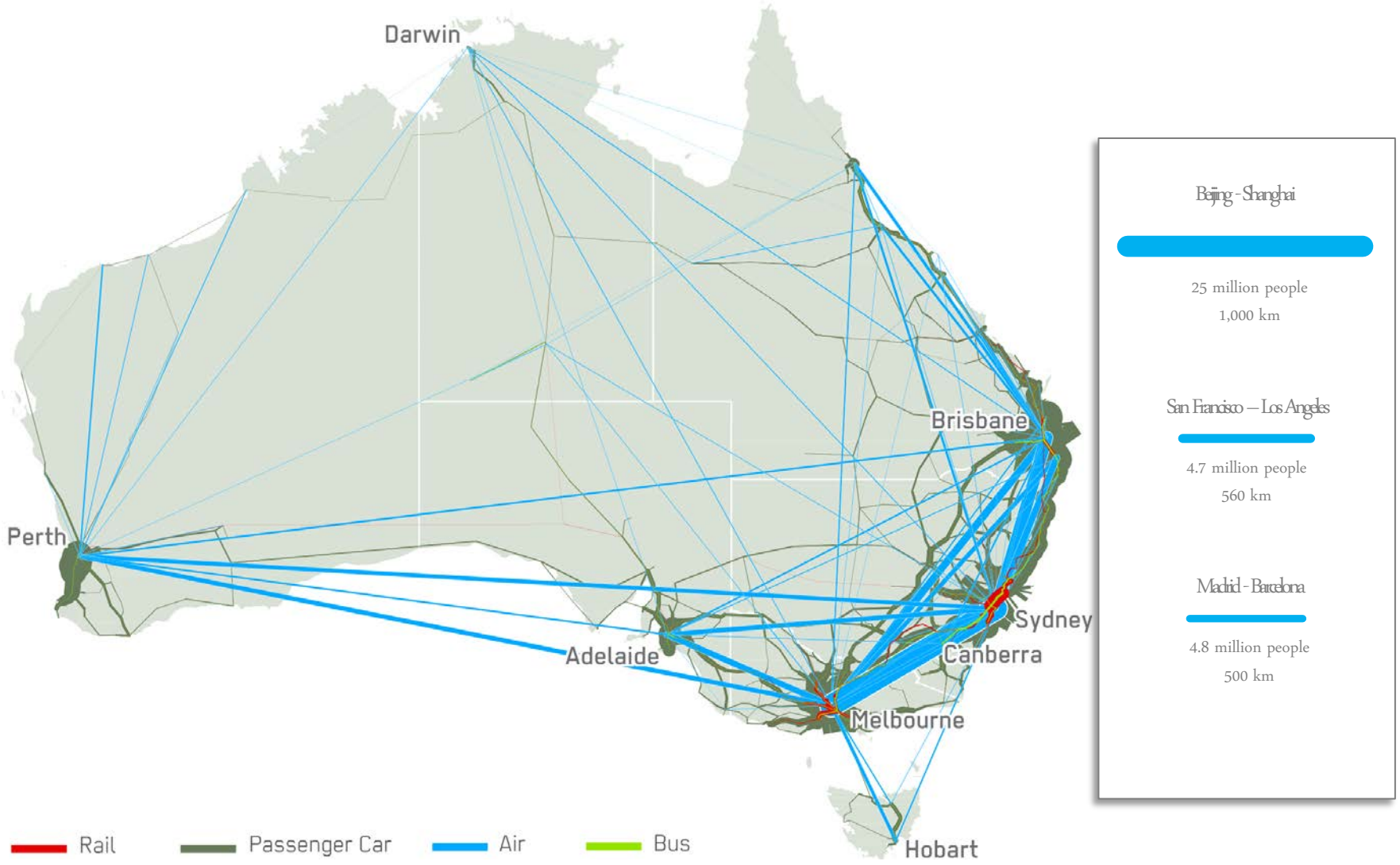
High Speed Rail

beyond ZERO emissions

DLR Deutsches Zentrum für Luft- und Raumfahrt
German Aerospace Center

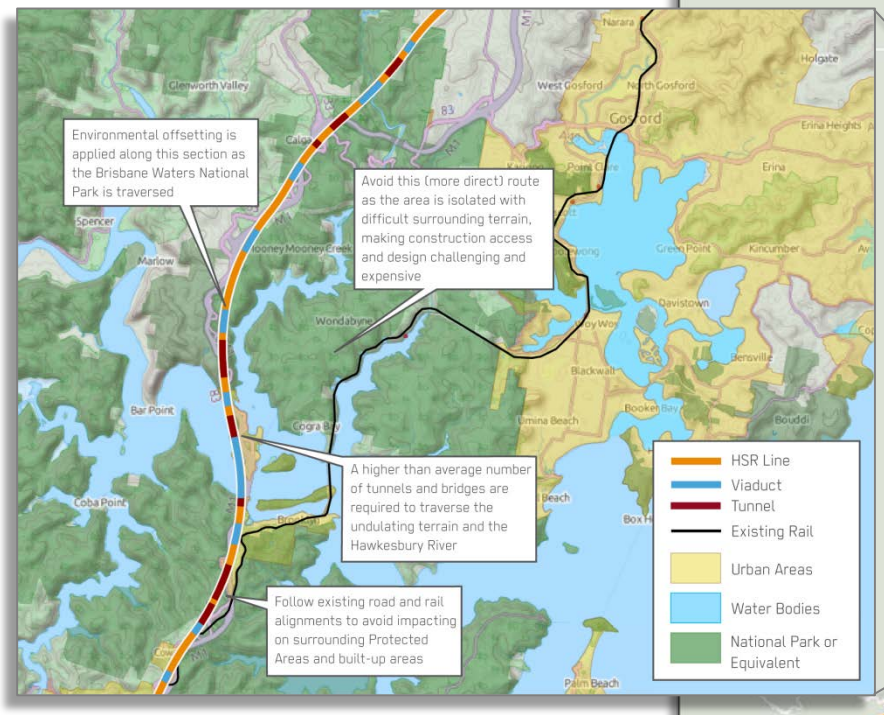
THE UNIVERSITY OF MELBOURNE

MELBOURNE ENERGY INSTITUTE

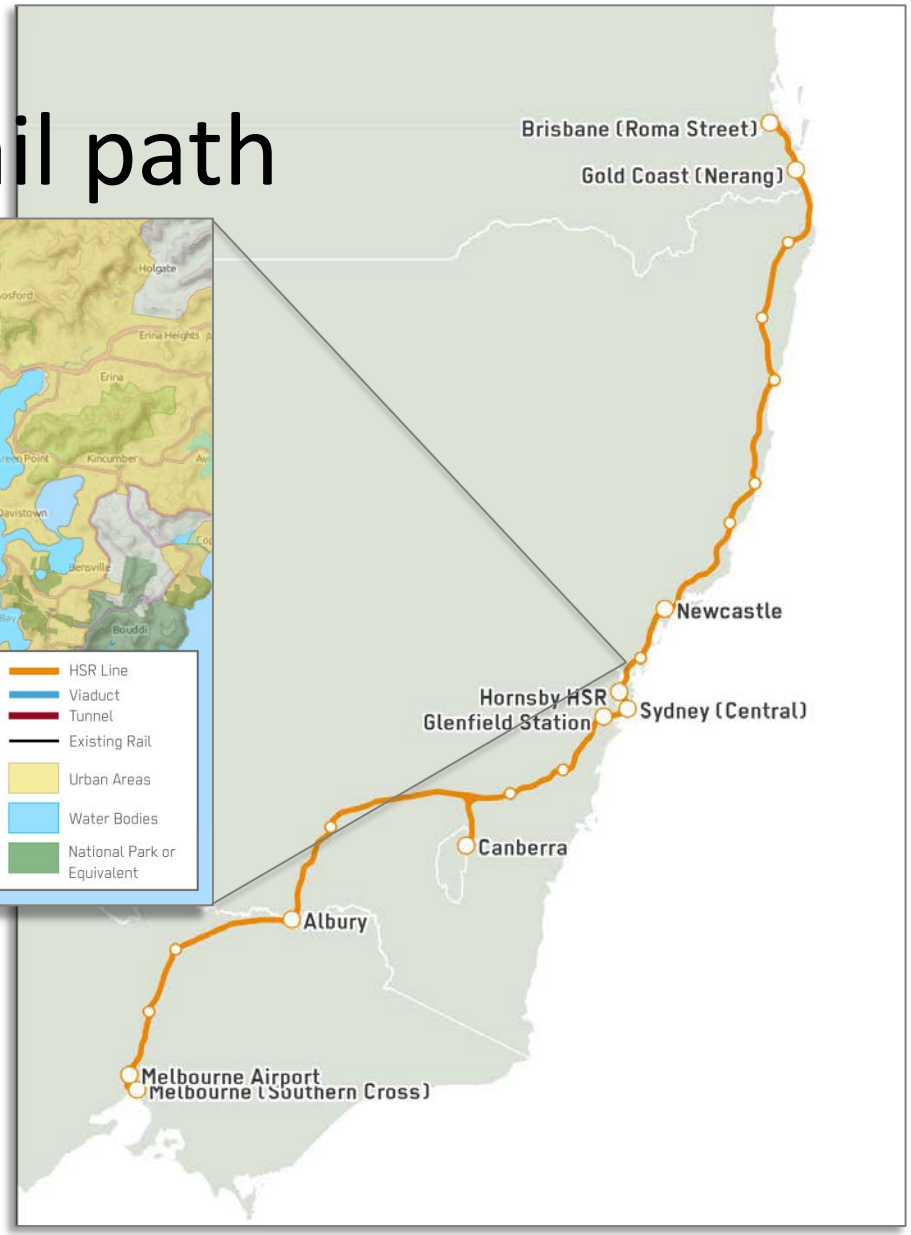

Darwin
Brisbane
Perth
Sydney
Canberra
Adelaide
Melbourne
Hobart
Rail
Passenger Car
Air
Bus
Beijing - Shanghai
25 million people
1,000 km
San Francisco – Los Angeles
4.7 million people
560 km
Madrid - Barcelona
4.8 million people
500 km


TGV
SNCF

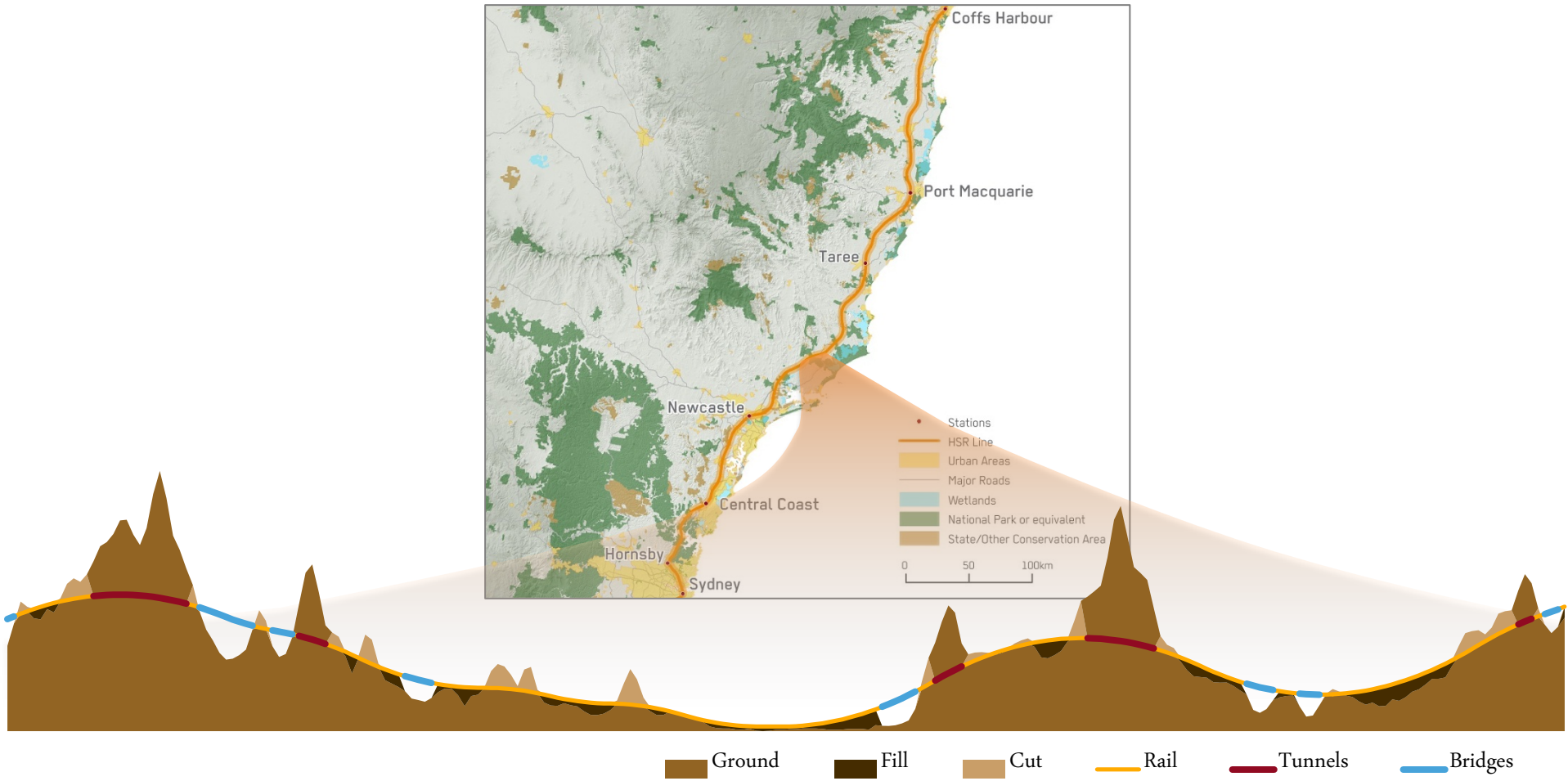
Rail path



Hawkesbury River



Construction and cost



Australian Transport

In 2011

Consumed

49 Billion

Litres oil based fuel

Australian Government
Department of Resources, Energy and Tourism

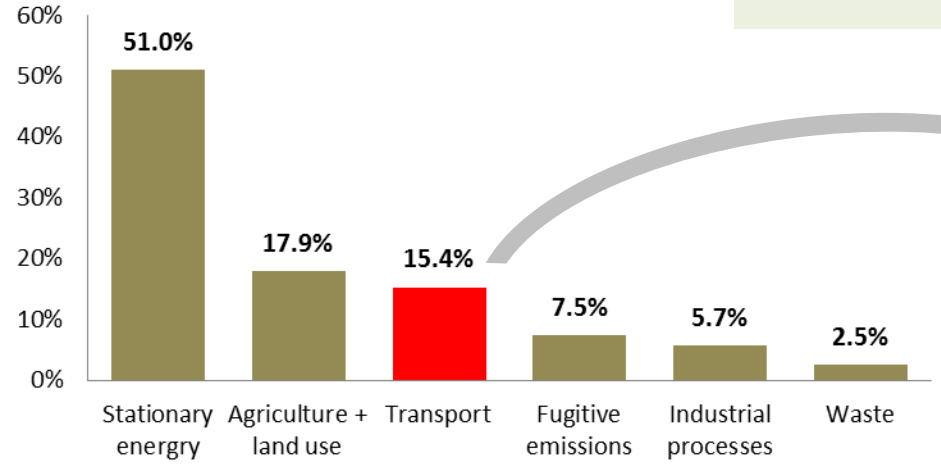
Emitted

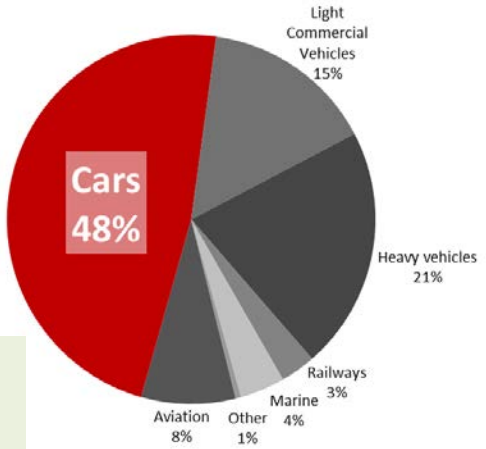
87.6 Million

Tonnes CO_2-e

Australian Government
Department of Climate Change

Australian CO_2-e Emission Sectors



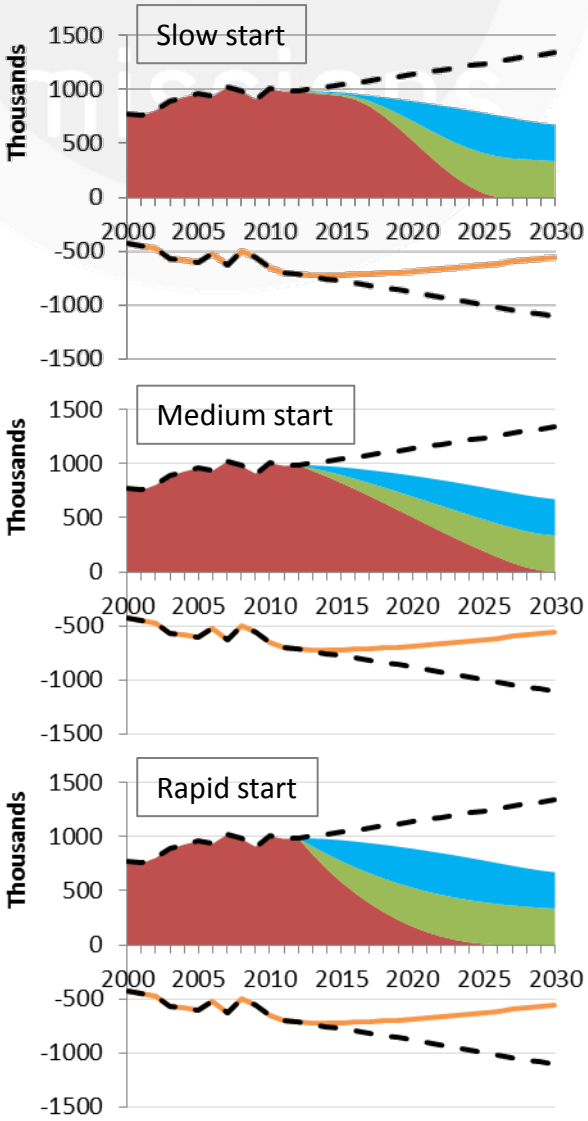


7.4% of total emissions

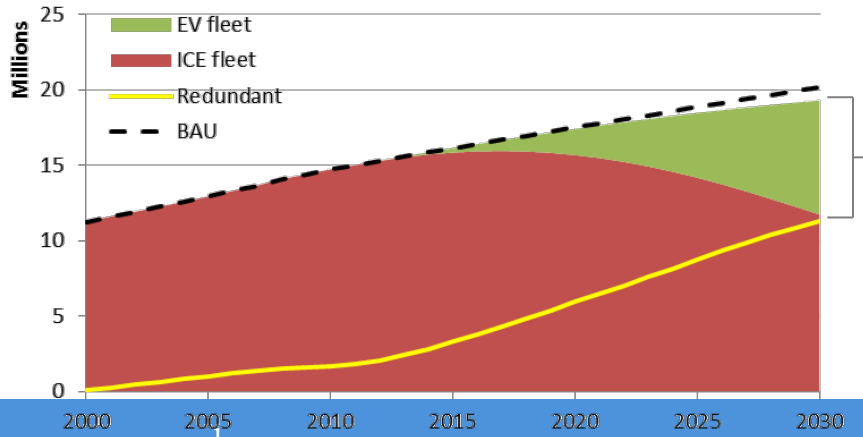
EV fleet

Introduce electric vehicles into the private fleet

Considering a reducing vehicle usage and steady sales per VKT, there are different pathways to achieve 100% penetration of the *active* vehicle fleet. Each has different cost and emission implications.



Passenger Fleet Composition



$$\textbf{\textit{Active Fleet}} = \frac{Drivers}{Vehicles} \times \frac{VKT_{ZCAT}}{VKT_{BAU}}$$

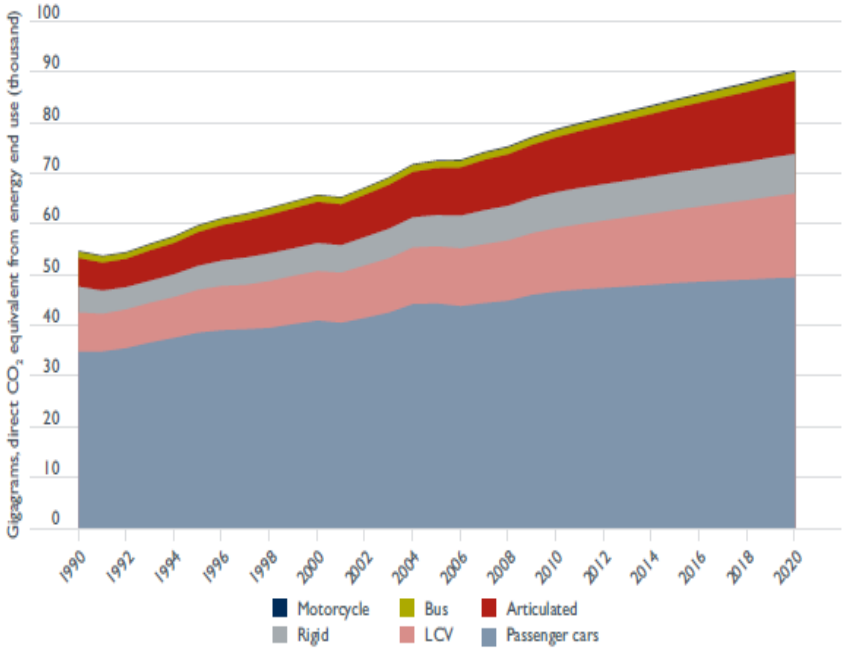
The Electric Vehicle Report

Cars are part of Australian life

- 1.1 million sold annually
- Consuming 18 billion litres of petrol, all imported, for $20 billion
- Passenger vehicles account for 7% of Australian emissions

- The transition to electric vehicles running on green power will drastically change our balance of trade and reduce our emissions.

Figure 2.5 Base case projected growth in greenhouse gas emissions by road vehicles for Australia, 1990–2020



Notes: Emission estimates relate to energy end use (i.e. do not include emissions from fuel supply and processing). Emissions exclude CO_2 released from the combustion of biofuels.

Cars include 4WD passenger vehicles ('All Terrain Wagons'—ATWs). LCVs refers to light commercial vehicles.

'Rigid' refers to all non-articulated truck types.

Sources: ABARE (2007a), ABS (2006a and earlier), BTE (1999a), BTRE (2002a, 2003a, 2006a, 2007a), DITR (2007a, 2004) and BITRE estimates.

	Cost	Range (Battery type)	Charge Time	Top Speed (km/h)	Supported Charging	Capacity
BMW i3 	60,000 (estimated)	130-160 km (22kWh Li-ion)	4.5 hrs 3 hrs Other: <30m	150	Type 1 & 2 and Wallbox Pure	
Tesla Model S 	100,000 (estimated)	370 km (60 kWh)	8 hrs Other: 40m	193 (60 kWh)	10 kW on-board charger 10 kW Universal Mobile Connector	(+ optional)
Chevrolet/Holden Volt 	59,990 AUD	55 km pure electric L.R.E.V over 600 km	4 hrs			
Mitsubishi i-Miev 	48,800	170 km	7hrs 30m	130		
Nissan Leaf 	39,990	117 km	8 hrs 30mn	150		
smart For Two Electric 	18,990	110 km	4hrs	120		

- Update on EV makes and models
- Market and other incentives in various OECD countries
- Barriers to uptake
- Strategic approaches – EV manufacturers
- Opportunities in manufacturing sector

What does an EV future look like?

Now

- The hum of engines at all hours
- Petrol stations
- Exposure to oil price rises from imports

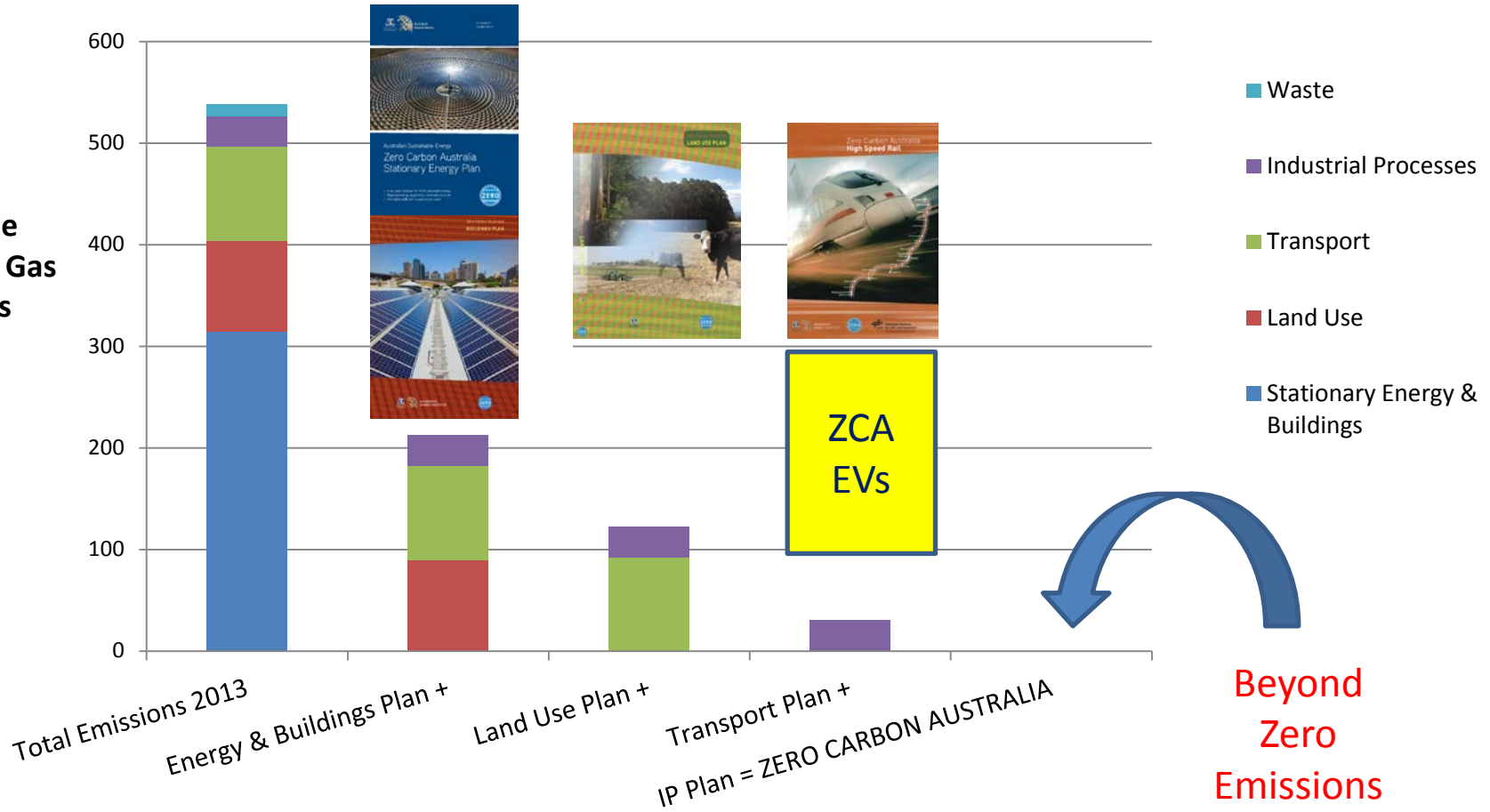
Inevitable

- Engine noise reduced
- Cars charge at home or in charge carparks
- Prices linked to electricity prices
- Make your own ‘petrol’

Bringing it all together:

A Zero Carbon Australia

2013 CO2e Greenhouse Gas Emissions (Mt)



Emissions Reductions through the Zero Carbon Australia Plan

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Support our work

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- Like us on
- **Sign up** online for monthly e-mail updates
- Follow us on **@beyondzeronews**

We can all be part of the solution