



Decarb Down Under - *An Australian Update*

Tuesday 16 March 2023

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CEO Australasian Centre for Rail Innovation

Executive Director National Transport Research Organisation



AUSTRALIA LEGISLATES EMISSIONS REDUCTION TARGETS

3

Australia's climate change commitments include:

The Paris Agreement.

Australia submitted its revised [National Determined Contribution](#) (NDC) to the UNFCCC in June 2022.

This included:

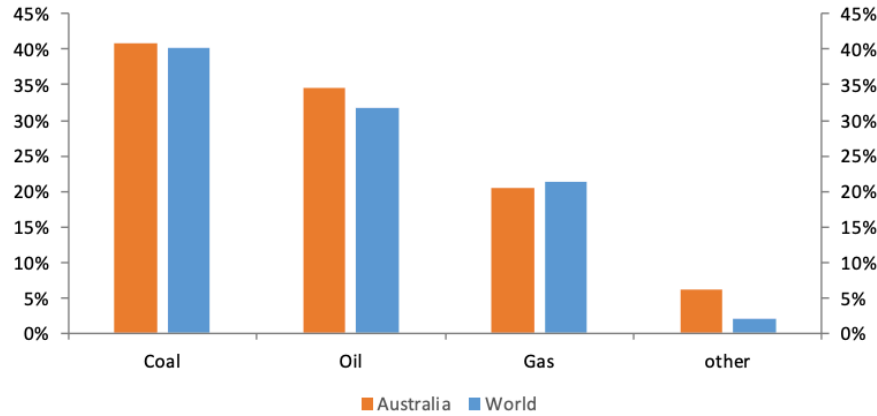
- Reaffirming a target of net zero emissions by 2050.
- Committing to reduce Greenhouse gas emissions by 43% from 2005 levels by 2030

MEDIA RELEASE

08 Sep 2022

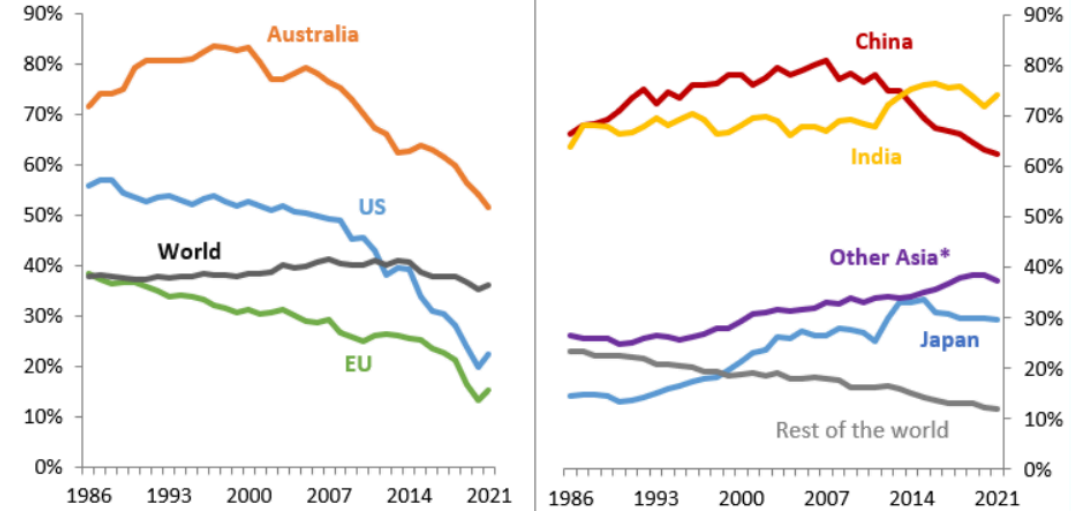
Australia's Progress towards Climate Change Commitments

Carbon emissions by fuel source



- Australia's overall emissions by fuel source profile is similar to the world average.
- Australia currently generates just over 50% of its electricity from coal, however this proportion is decreasing as the share of renewables increases.

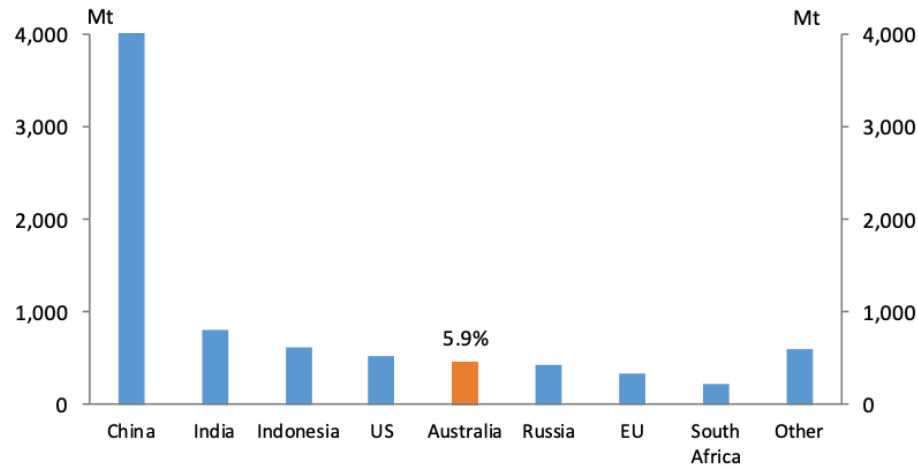
Coal-fired electricity generation as a share of region's total electricity generation



Source: BP statistical review of world energy, June 2022

Source: CAIT Climate Data Explorer via. Climate Watch

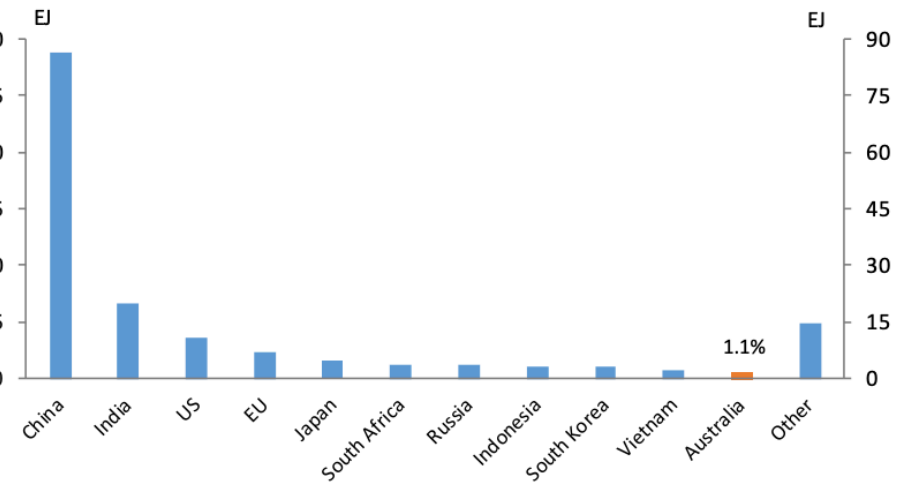
Global coal production (2021)



Source: BP statistical review of world energy, June 2022

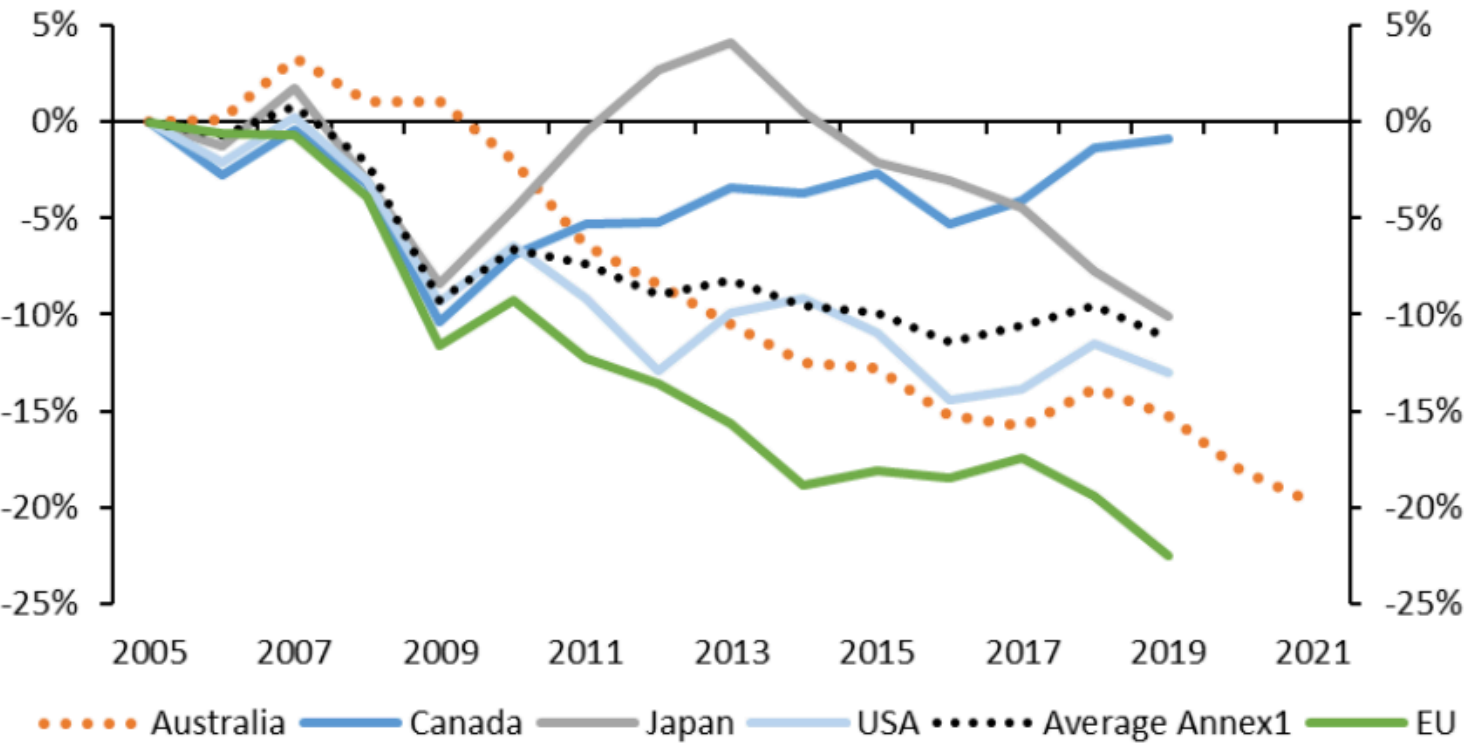
- Australia accounts for around 6% of global coal production and around 1% of coal consumption.
- Coal exports comprise a relatively small proportion of global coal production.
- Australia is a significant exporter of coal. It contributes around 20% of thermal coal exports and 50% of metallurgical coal exports.

Global coal consumption (2021)



Source: BP statistical review of world energy, June 2022

Australia's decline in GHG emissions since 2005



Source: UNFCCC Annex1 parties. Last inventory year 2019.

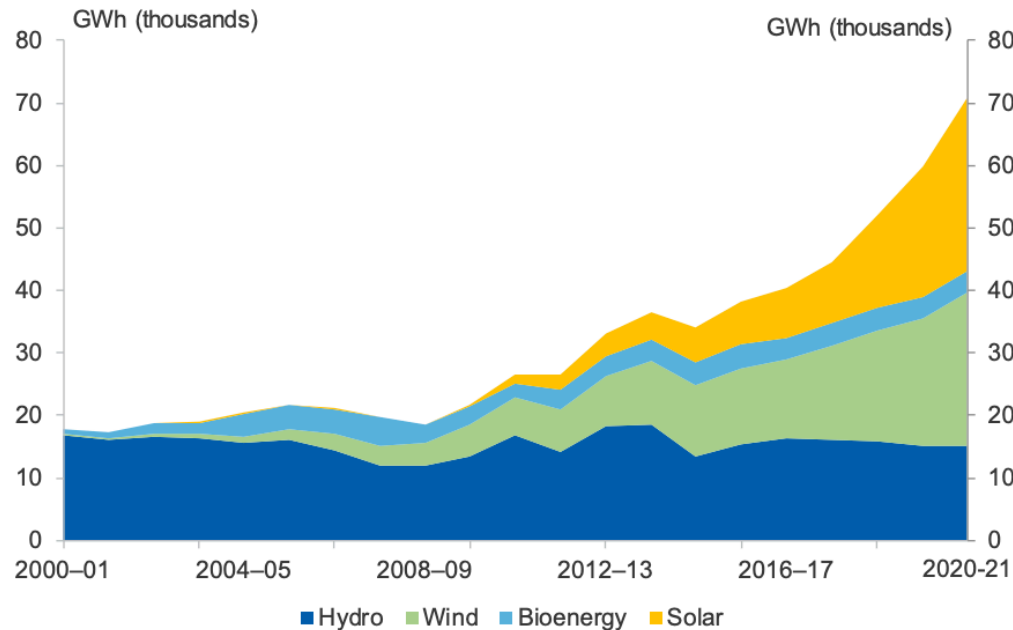
Australia's Progress towards Climate Change Commitments

While national Greenhouse Gas Accounts show we reduced emissions by 21.6 per cent on 2005 levels in the year to March 2022, we must achieve a similar reduction in just eight years to reach our targeted 43 per cent reduction by 2030.

Australia's technology focus on renewable energy

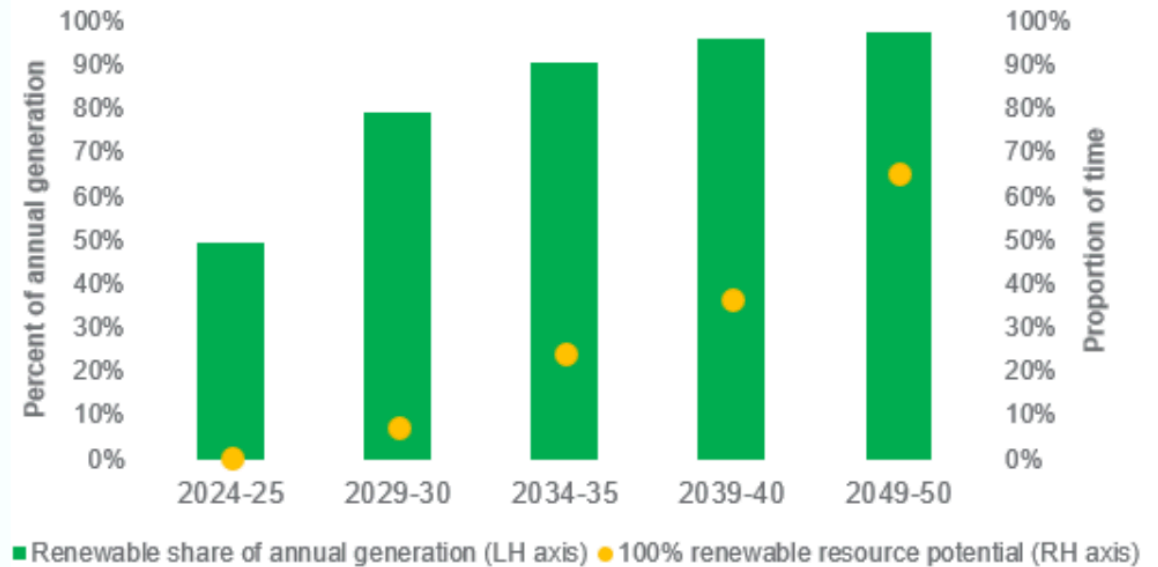
- Australia plans to grow the renewable share of the National Electricity Market to 82 per cent by 2030.
- Australia has the highest uptake of rooftop solar globally, with one in three homes having rooftop solar PV.

Historical electricity generation from renewable sources



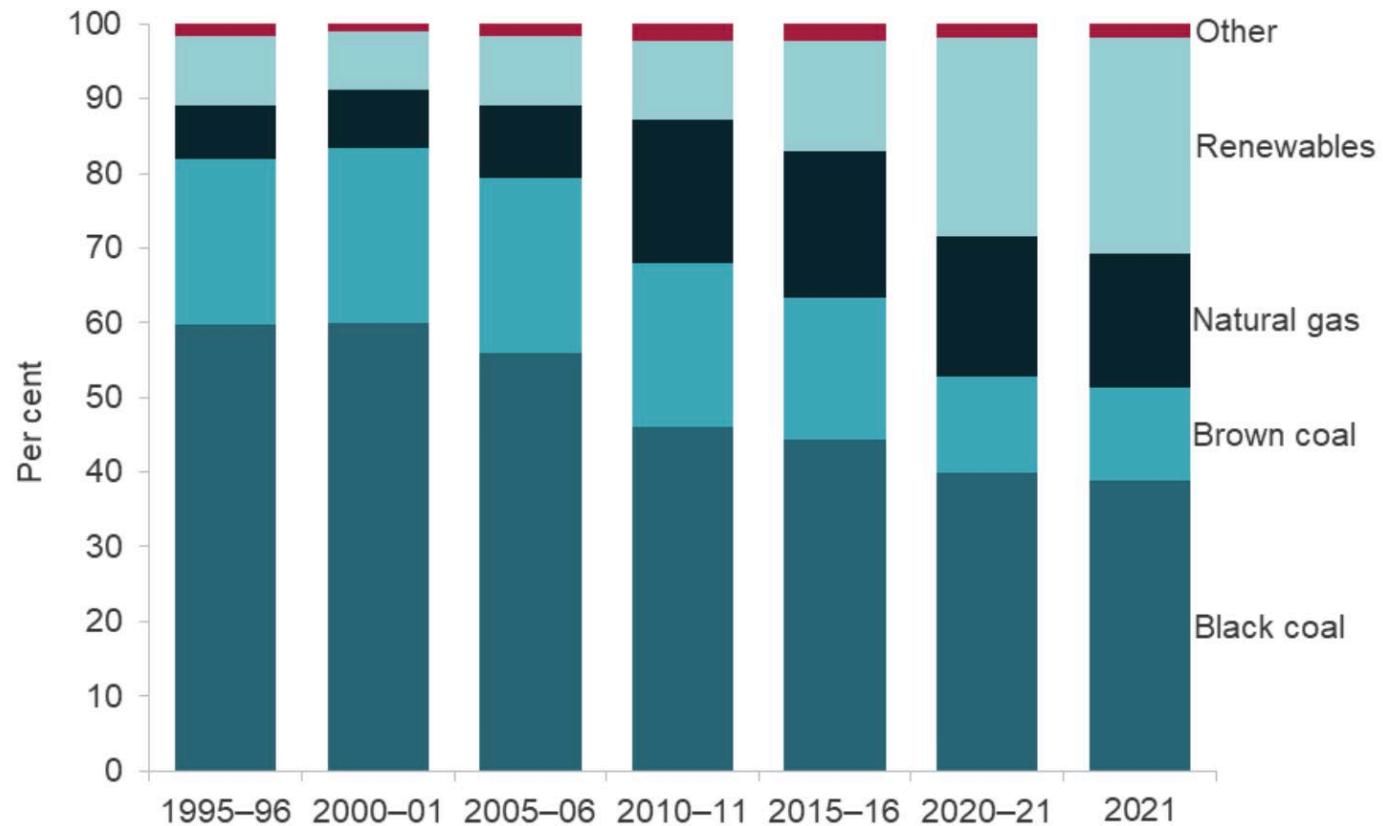
Source: Department of Climate Change, Energy, the Environment and Water

NEM annual share of renewable generation and 100% resource potential, 2025-2050 Step Change scenario

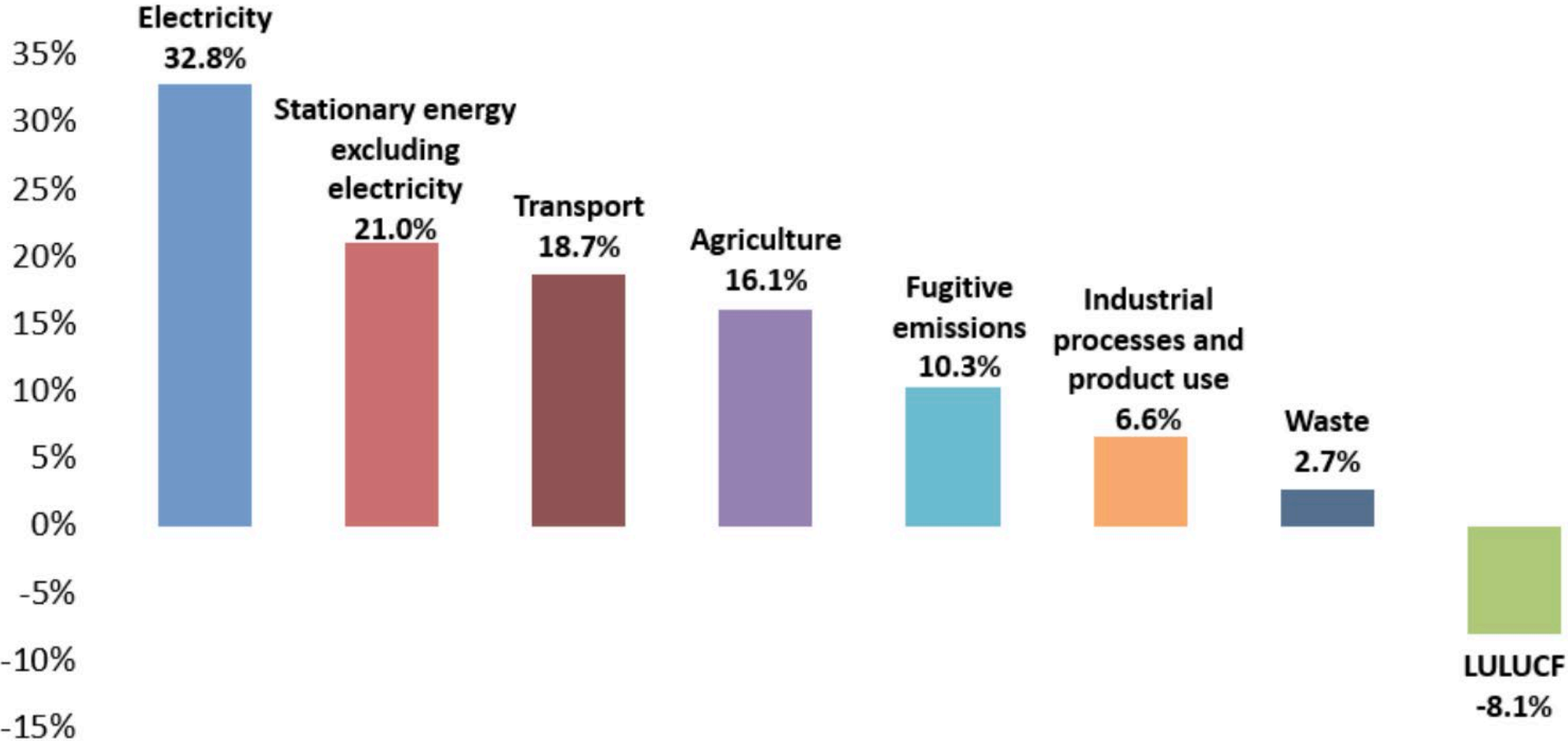


Source: AEMO 2022 Integrated System Plan

Australian electricity generation - fuel mix



Share of total emissions by sector for the year to March 2022



Source: [Department of Climate Change, Energy, the Environment and Water](#)

The Clean Energy Regulator

The Clean Energy Regulator is a Government body responsible for accelerating carbon abatement for Australia through the administration of the National Greenhouse and Energy Reporting scheme, Renewable Energy Target and the Emissions Reduction Fund.

READ MORE >

CLEAN
ENERGY
REGULATOR



Australian Government
Clean Energy Regulator

Our role is determined by climate change law. We have administrative responsibilities for the:

- National Greenhouse and Energy Reporting Scheme, under the [National Greenhouse and Energy Reporting Act 2007](#)
- Emissions Reduction Fund, under the [Carbon Credits \(Carbon Farming Initiative\) Act 2011](#)
- Renewable Energy Target, under the [Renewable Energy \(Electricity\) Act 2000](#), and
- Australian National Registry of Emissions Units, under the [Australian National Registry of Emissions Units Act 2011](#).

THE AUSTRALASIAN CENTRE FOR RAIL INNOVATION (ACRI)

<https://www.energy.gov.au/data/australian-electricity-generation-fuel-mix>

Safeguard Mechanism

- The reformed Safeguard Mechanism will commence from 1 July 2023 and legislative rules were registered on 5 May 2023 (original legislation in 2014)
- Applies to facilities that emit >100,000 tonnes of carbon dioxide (CO₂) equivalent in a year
- ~215 Safeguard facilities - across the mining, manufacturing, transport, oil, gas & waste sectors
- These facilities produce ~28% of Australia's greenhouse gas emissions
- Reforms will require large industrial facilities to deliver a proportional share of Australia's 2030 climate target.
- Baselines will decline in a predictable and gradual way from 1 July 2023.
- The decline rate will be set at 4.9 per cent each year to 2030
- Net emissions from all Safeguard facilities should
 - Not exceed 100 million tonnes of CO₂ equivalent in 2029-30
 - Be zero from 2049-50, and
 - Deliver over 200 million tonnes of abatement by the end of the decade.
- The maximum civil penalty will be set at 1 penalty unit per tonne of excess emissions per year
- Infringement notice charged at one-third of the maximum civil penalty to a maximum of 150,000 penalty units.
- As of 1 January 2023, a penalty unit is \$275.

Safeguard Mechanism

2021–22 Safeguard facility data

This spreadsheet contains all information related to facilities covered by the Safeguard Mechanism in 2021-22.

Some facilities in this table have multiple entries due to more than one responsible emitter having operational control during 2021-22.

Data as at 17/03/2023

Facility name	State of operation	Responsible emitter	Baseline number	Type of baseline	Reported covered Emissions
Gorgon Operations	WA	CHEVRON AUSTRALIA PTY LTD	8,336,476	Production-adjusted baseline	8,318,842
Start up and Operations of the Ichthys LNG Project	NT	INPEX Operations Australia Pty Ltd	7,067,789	Calculated baseline	6,739,077
North West Shelf Project	WA	Woodside Energy Ltd.	n/a	Multi-year monitoring period	6,418,032
Port Kembla Steelworks	NSW	BLUESCOPE STEEL (AIS) PTY. LTD.	6,920,344	Production-adjusted baseline	6,198,685
Wheatstone Operations	WA	CHEVRON AUSTRALIA PTY LTD	4,343,119	Calculated baseline	3,907,075
WOR01	WA	South32 Worsley Alumina Pty Ltd	3,718,777	Calculated baseline	3,553,775
Queensland Alumina Limited Refinery	QLD	QUEENSLAND ALUMINA LIMITED	3,434,256	Calculated baseline	3,129,823
Qantas Airways Limited National Transport Facility	National	Qantas Airways Limited	5,285,611	Calculated baseline	3,057,585
Moomba Plant	SA	Santos Limited	2,252,960	Production-adjusted baseline	2,175,400
Liberty Primary Steel Whyalla Steelworks	SA	ONESTEEL MANUFACTURING PTY LIMITED	2,690,509	Calculated baseline	2,150,574
APLNG Facility	QLD	CONOCOPHILLIPS AUSTRALIA OPERATIONS PTY LTD	2,381,120	Production-adjusted baseline	2,132,240
Rio Tinto Yarwun	QLD	RTA Yarwun Pty Ltd	2,141,939	Production-adjusted baseline	2,128,344
Moranbah North Mine	QLD	ANGLO COAL (MORANBAH NORTH MANAGEMENT) PTY LIMITED	4,533,701	Calculated baseline	2,006,377

Assessing New Projects

Guide to assessing greenhouse gas emissions (interim)

Information requirements for submissions to
Infrastructure Australia,
effective from 14 September 2022

<https://www.infrastructureaustralia.gov.au/sites/default/files/2023-02/Guide%20to%20greenhouse%20gas%20emissions%20%28interim%29.pdf>

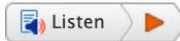
ACRI CENTRE FOR RAIL INNOVATION (ACRI)

Earlier This Month

A new national Net Zero Authority

Friday 5 May 2023 | News

Domestic policy > Climate change, energy, environment and disaster resilience > Net Zero Economy Taskforce



Authors

Department of the Prime Minister
and Cabinet

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The Australian Government is establishing a new Authority to ensure the workers, industries and communities that have powered Australia for generations can seize the opportunities of Australia's net zero transformation.

Who Wants To Talk About Railways? (Oh Yeah Railroads....)





Australian Government

Department of Infrastructure, Transport,
Regional Development and Communications

Bureau of Infrastructure and Transport Research Economics

STATISTICAL REPORT



Rail

Trainline 9

May 2022

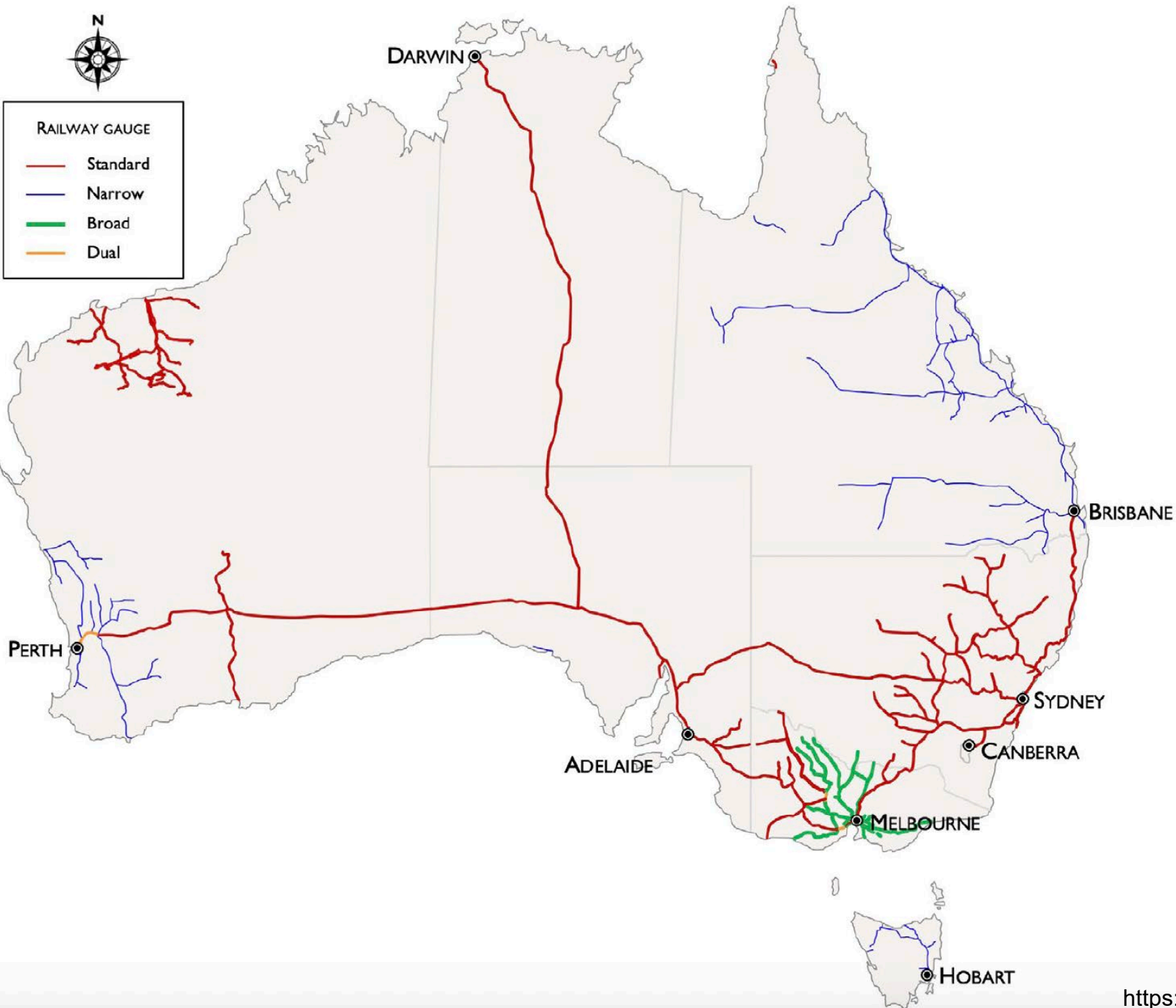
Quick Overview - Australian Rail System Context

THE AUSTRALASIAN CENTRE FOR RAIL INNOVATION (ACRI)

<https://www.bitre.gov.au/sites/default/files/documents/trainline-9.pdf>



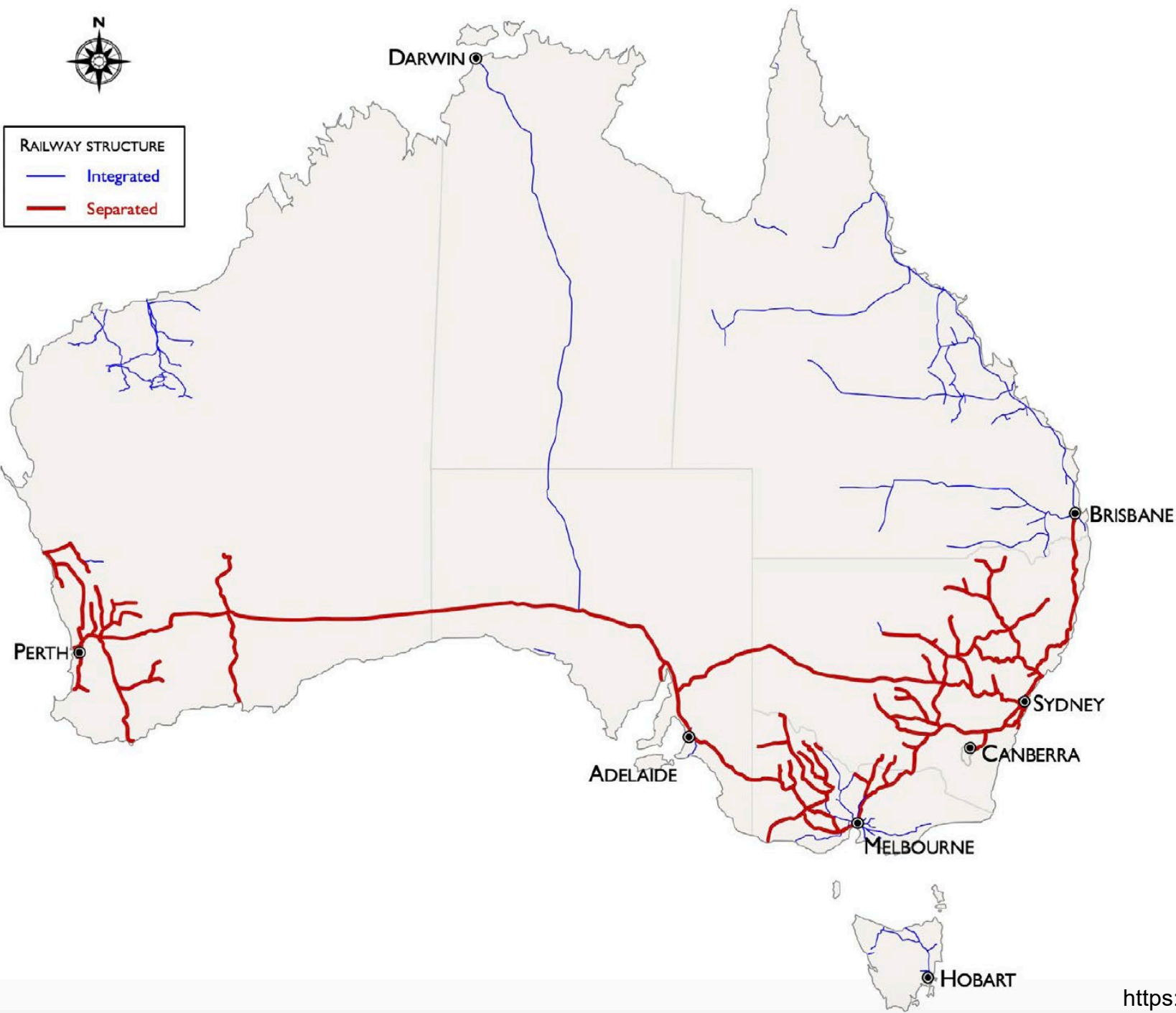
Gauge



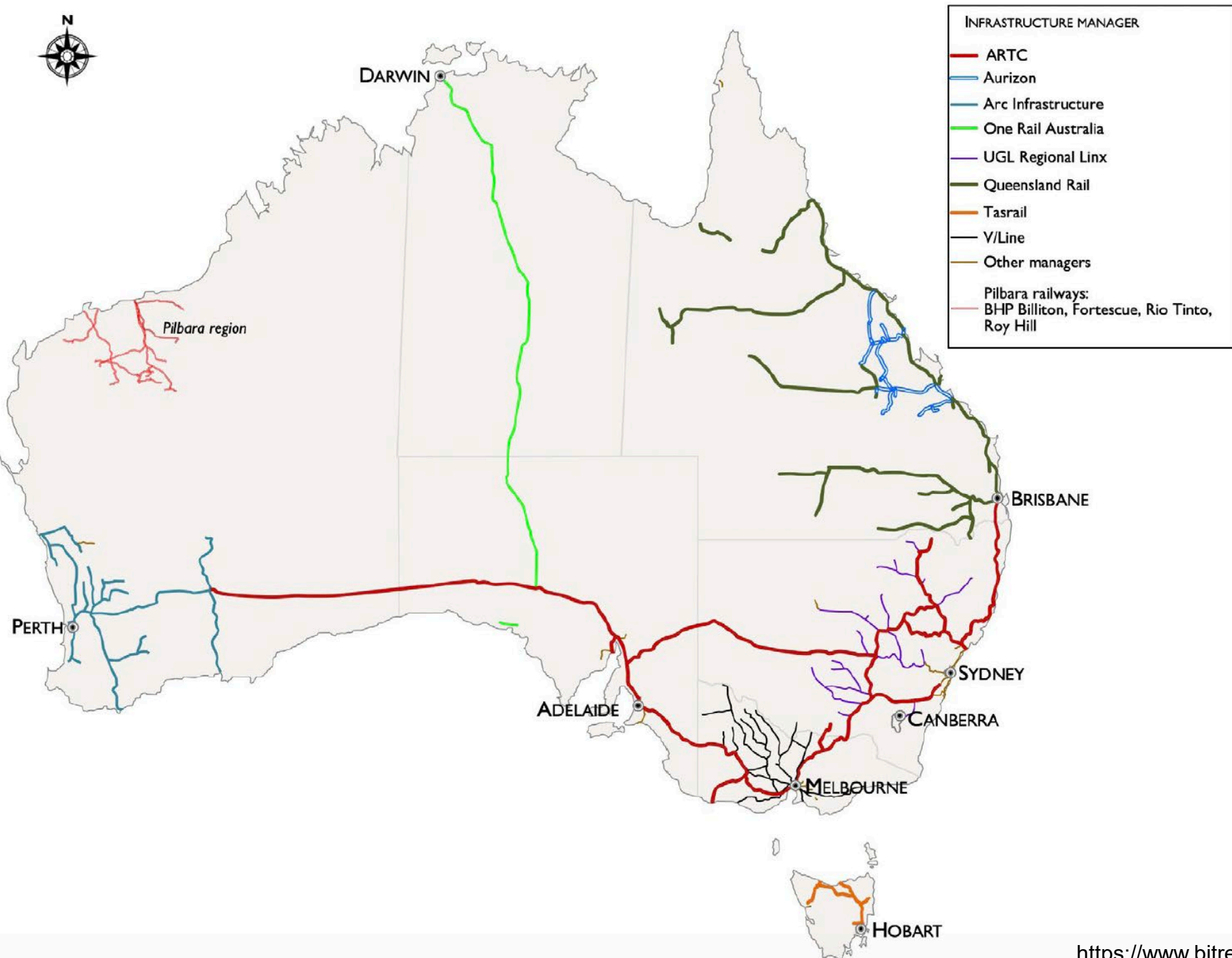


RAILWAY STRUCTURE

- Integrated
- Separated

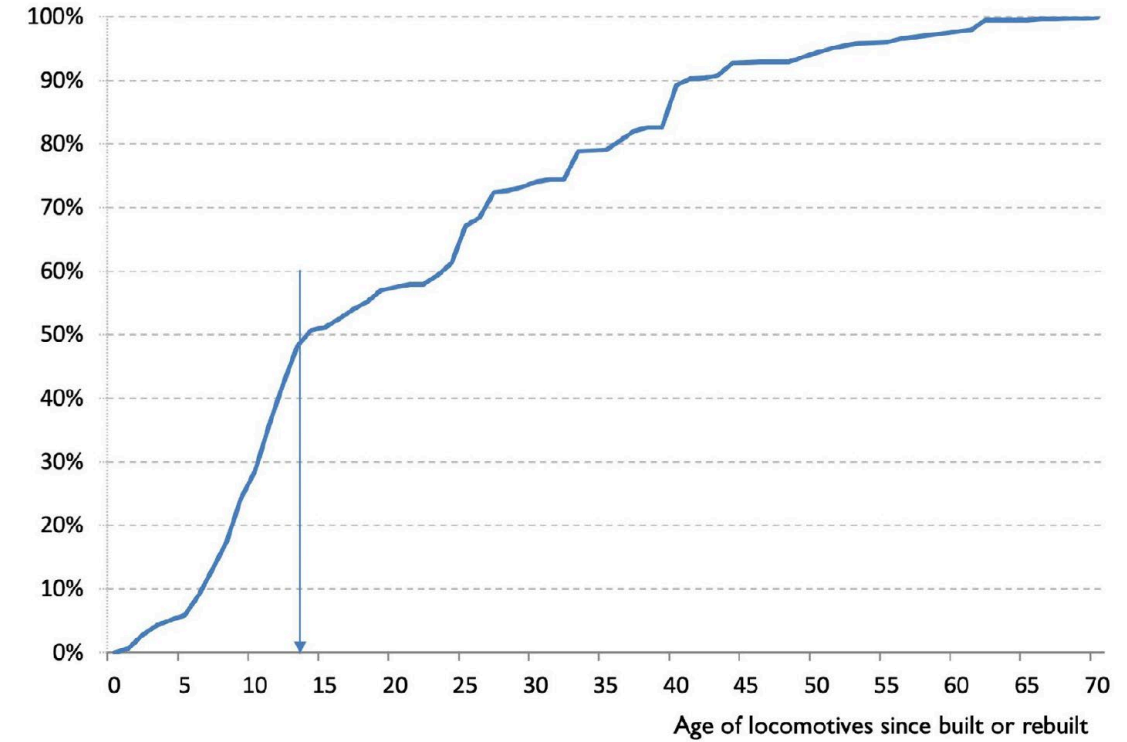
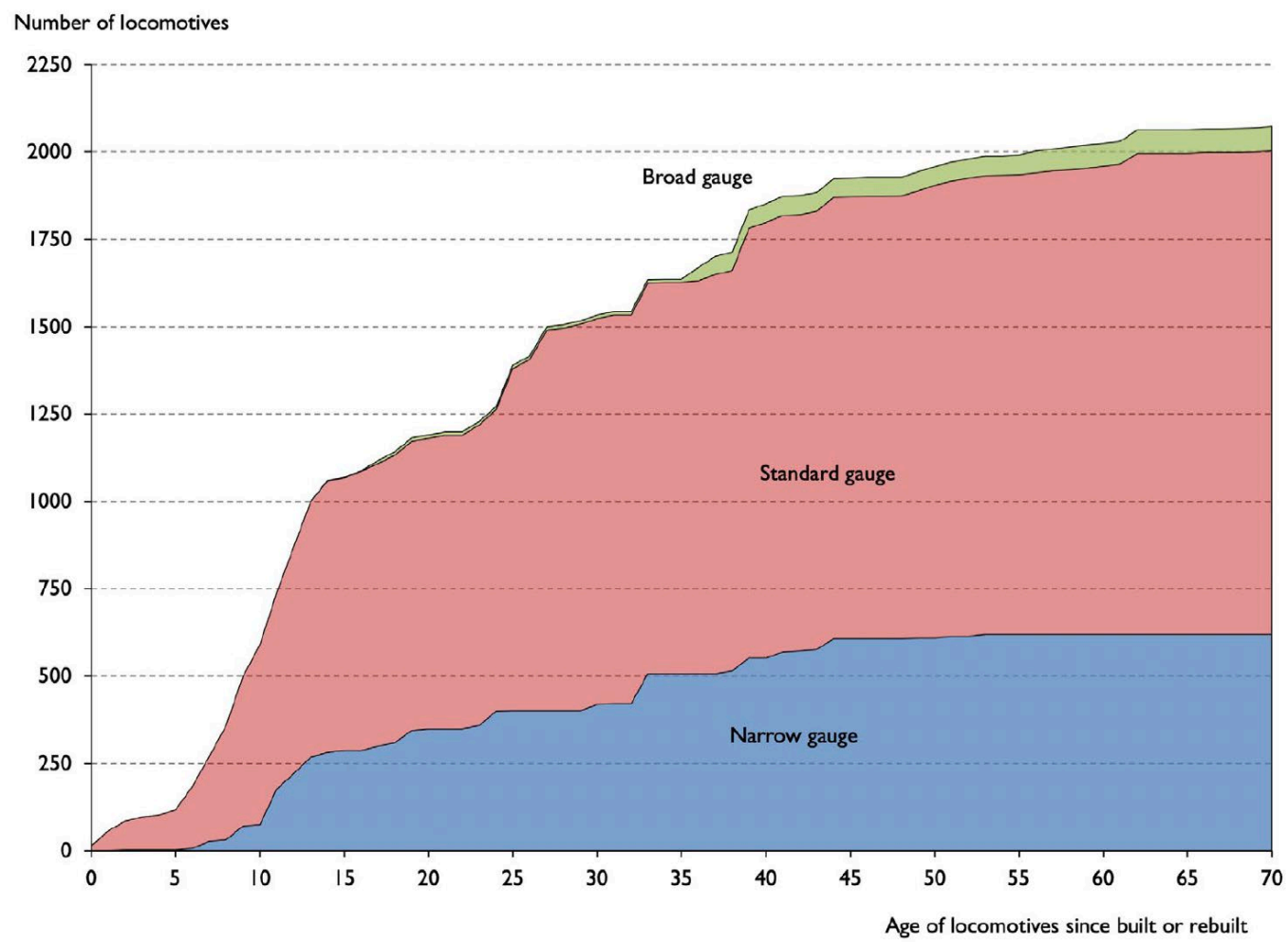


Access



Ownership

Rolling Stock Fleet



Cities Are Making Green Progress

This was published 1 year ago

Sydney rail network goes green with renewable energy deal

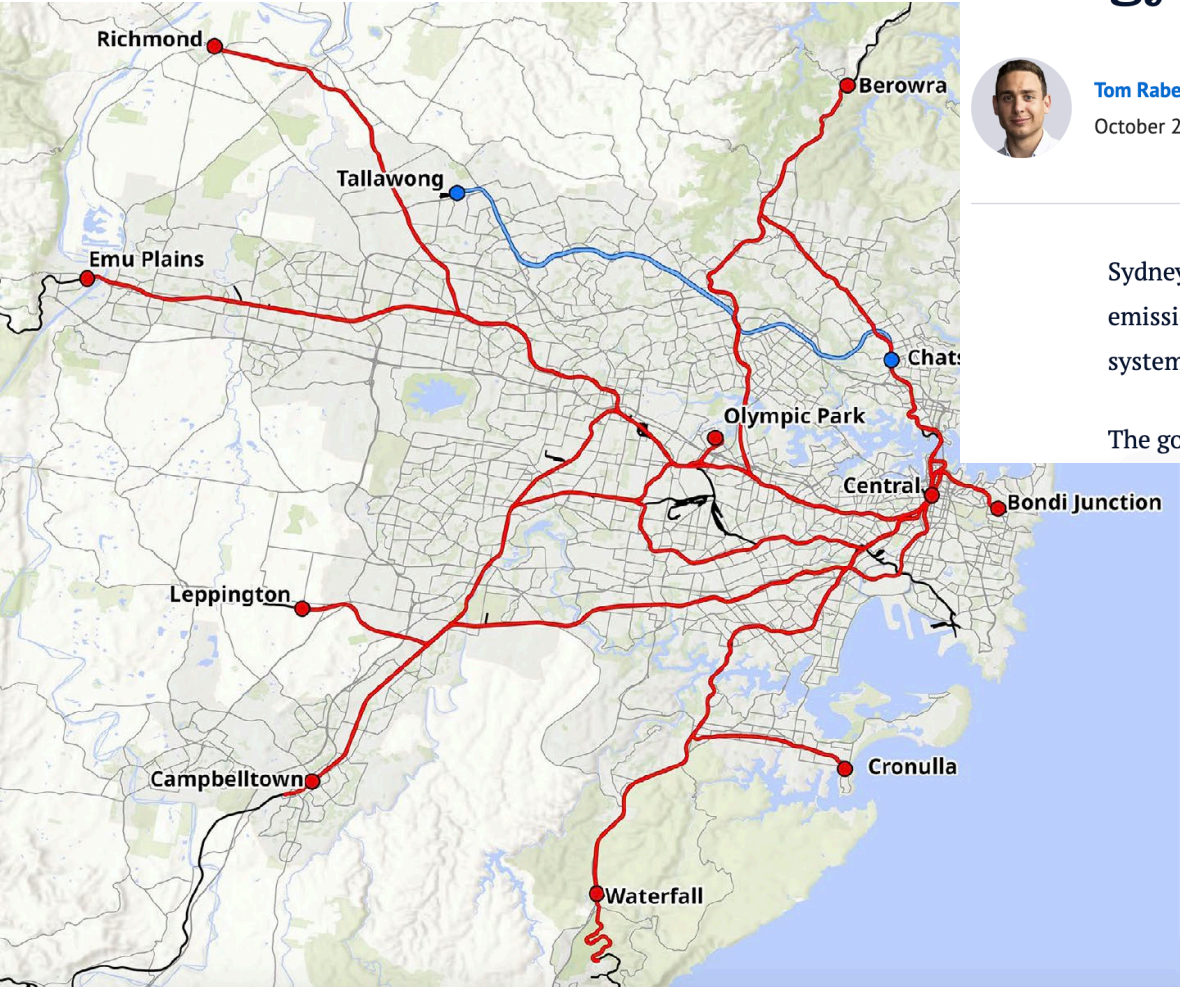


Tom Rabe
October 21, 2021 – 12:03am

Save Share A A A 6 View all comments

Sydney's train network has become the first in Australia to transition to net zero emissions after the NSW government moved to power the massive transport system with renewable energy.

The government has committed to a four-year agreement with Snowy Hydro-



<https://www.smh.com.au/national/nsw/sydney-rail-network-goes-green-with-renewable-energy-deal-20211020-p591n1.html>

Cities Are Making Green Progress

#1 Melbourne's network spans 245km and is the largest in the world with 28 lines and 1,813 stops



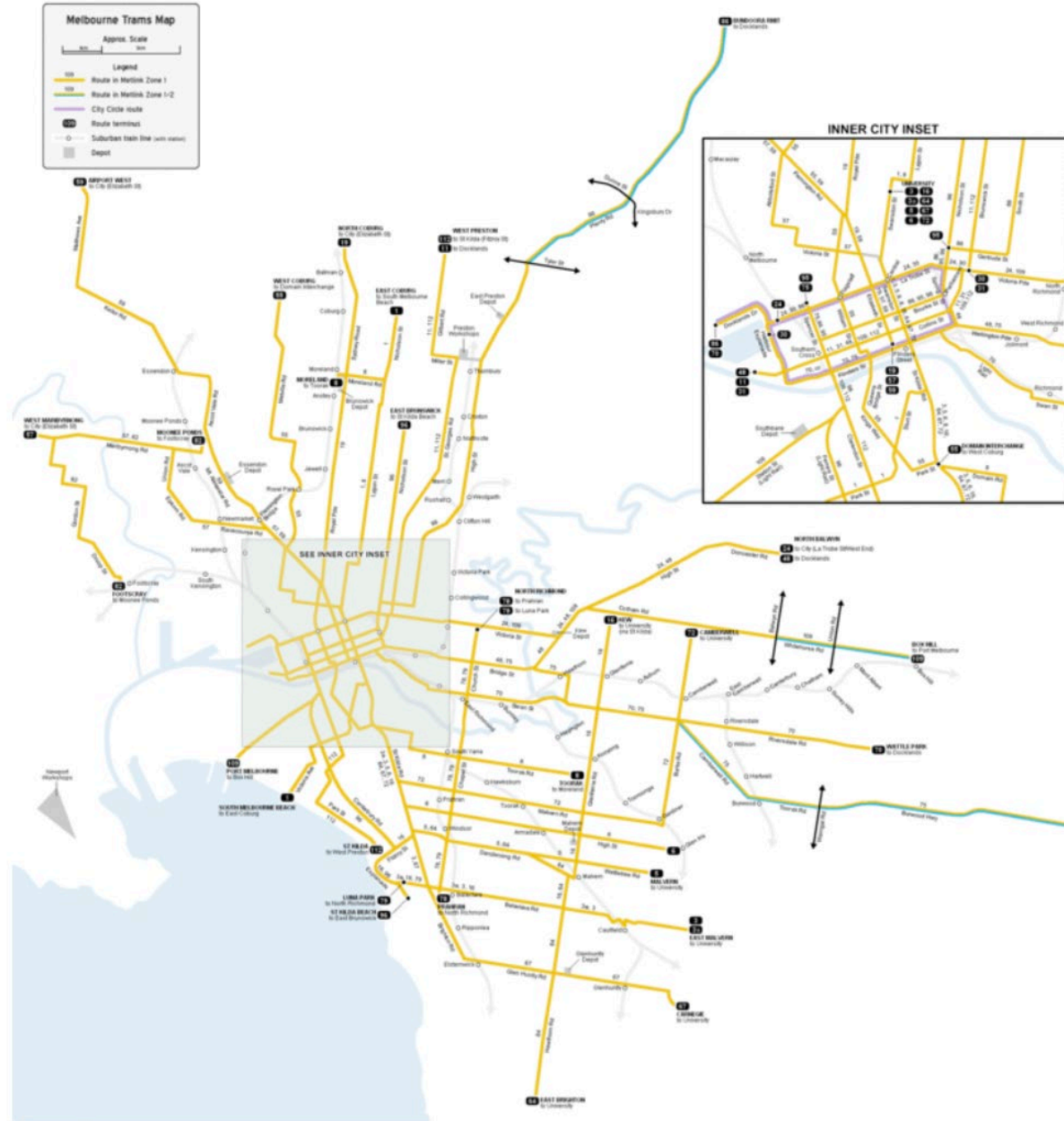
Department of Transport and Planning

Department update Our transport future Getting around News About

Home > Our transport future > Future directions for transport > Our strategic directions > Environmentally sustainable transport > Solar-powered trams

Solar-powered trams

Melbourne's tram network is now 100 per cent offset by renewable energy thanks to two Victorian solar farms.



TH

Credits JohnnoShadbolt-wikipedia - Tram network Melbourne

<https://dtp.vic.gov.au/our-transport-future/future-directions-for-transport/our-strategic-directions/environmentally-sustainable-transport/solar-powered-trams>

Rail Freight Has Challenges

2021–22 Safeguard facility data

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Some facilities in this table have multiple entries due to more than one responsible emitter having operational control during 2021-22.

Data as at 17/03/2023

Facility name	State of operation	Responsible emitter	Baseline number	Type of baseline	Reported covered Emissions
Pacific National Transport Facility	National	PACIFIC NATIONAL PTY LTD	n/a	Multi-year monitoring period	871,855
Aurizon Rail Freight QLD	QLD	AURIZON OPERATIONS LIMITED	263,233	Production-adjusted baseline	223,097
Aurizon Rail Freight WA	WA	AURIZON OPERATIONS LIMITED	156,679	Production-adjusted baseline	141,227
Aurizon Rail Freight NSW	NSW	AURIZON OPERATIONS LIMITED	151,367	Production-adjusted baseline	120,406

Heavy Haul is Loving Potential to Kinetic Energy

We are trialling battery electric locomotives

Preparing for the replacement of our diesel powered locomotive fleet



~180 locomotives

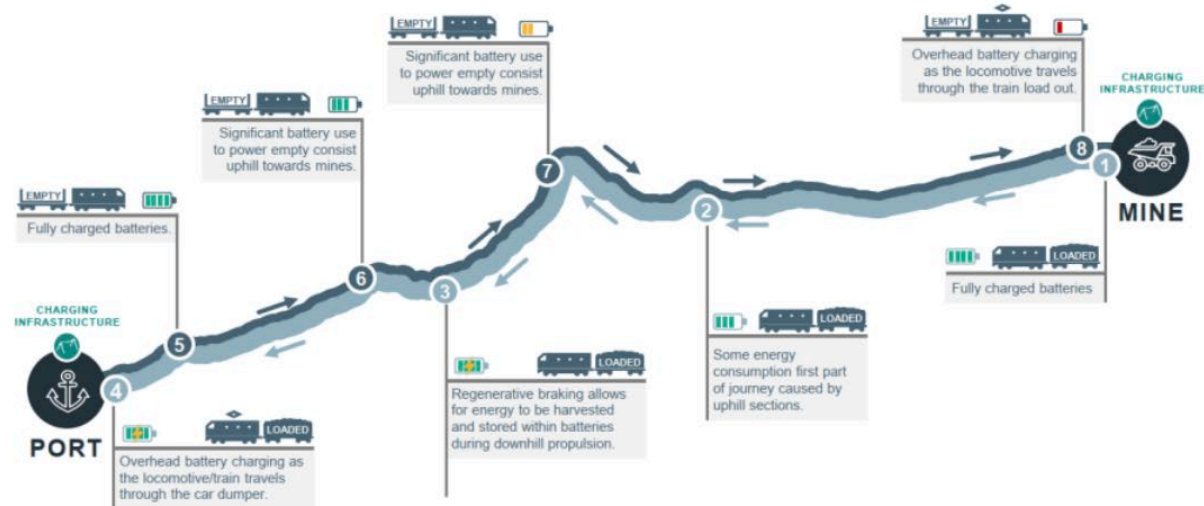


~190 million litres of diesel annually



~490 kt of CO₂-e GHG emissions (~20% of WAIO total)

- Partnership agreements signed with Wabtec and Progress Rail in January 2022
- Each OEM will supply two battery electric locomotives for an operational trial in Q3 FY2024
- Trial will test the potential of energy recapture using the unique topography of the rail network
- On completion of a successful trial, battery electric locomotives are expected to be delivered from 2027



Western Australia Iron Ore site tour
3 October 2022

28

BHP

THE AUSTRALASIAN CENTRE FOR RAIL INNOVATION (ACRI)

https://www.bhp.com/-/media/documents/media/reports-and-presentations/2022/221003_waiospeeches.pdf

Assumptions Are Necessary



Battery Electric Locomotive (BEL)

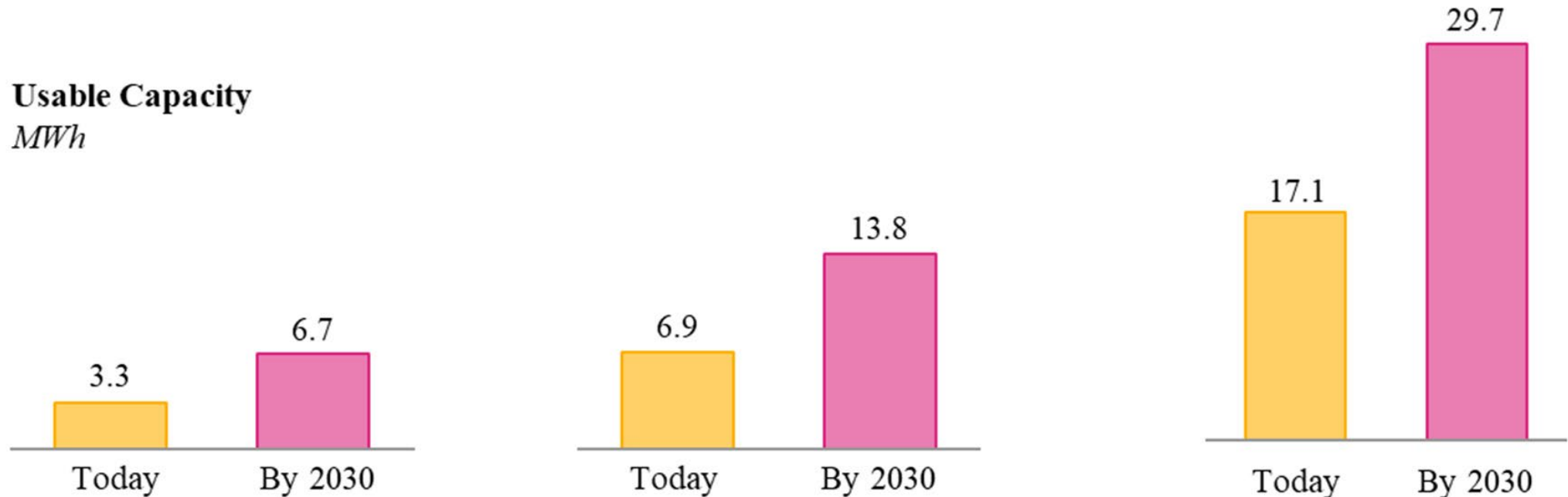


BEL +
Battery Electric Tender (BET)



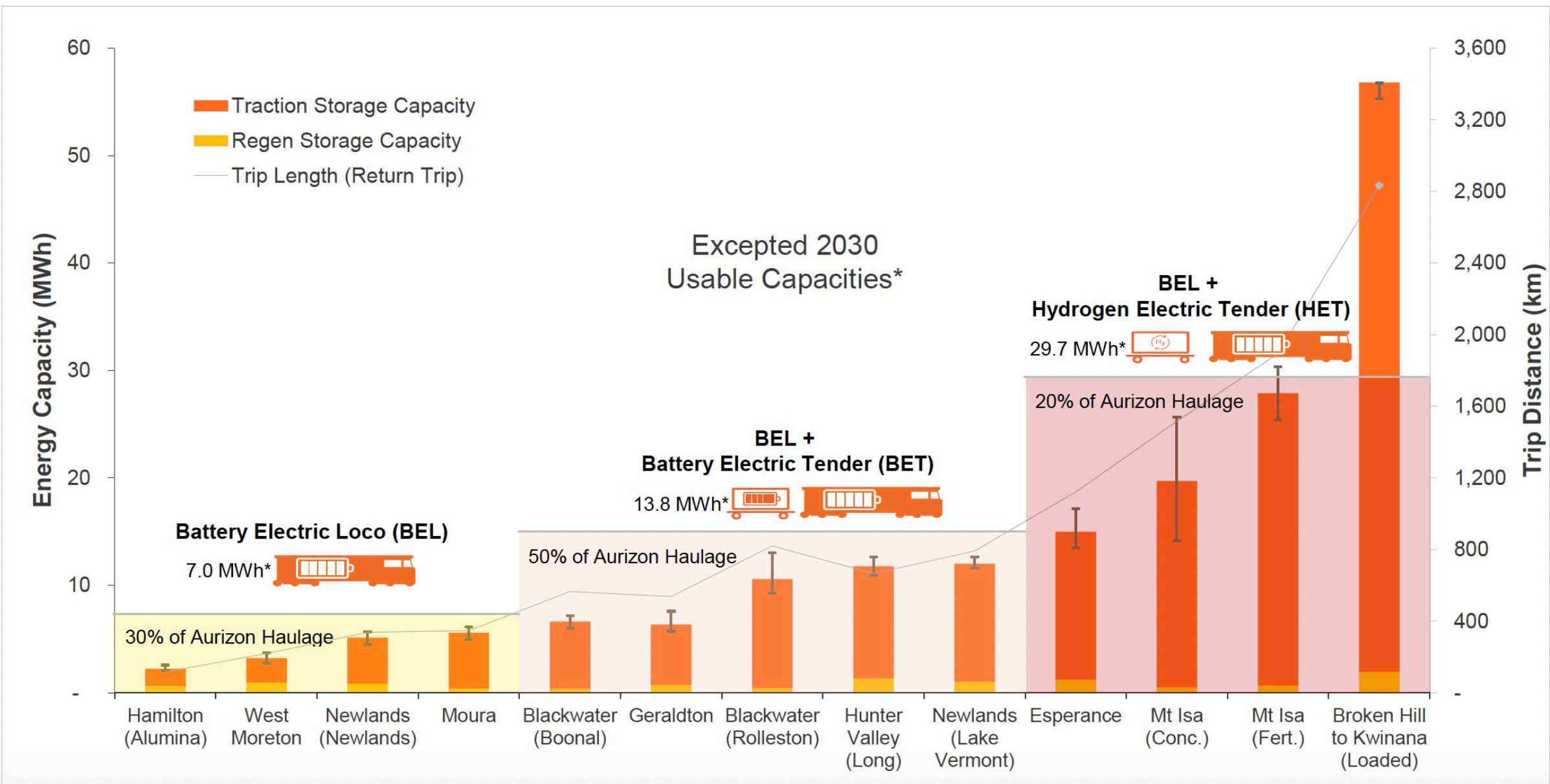
BEL +
Hydrogen Electric Tender (HET)

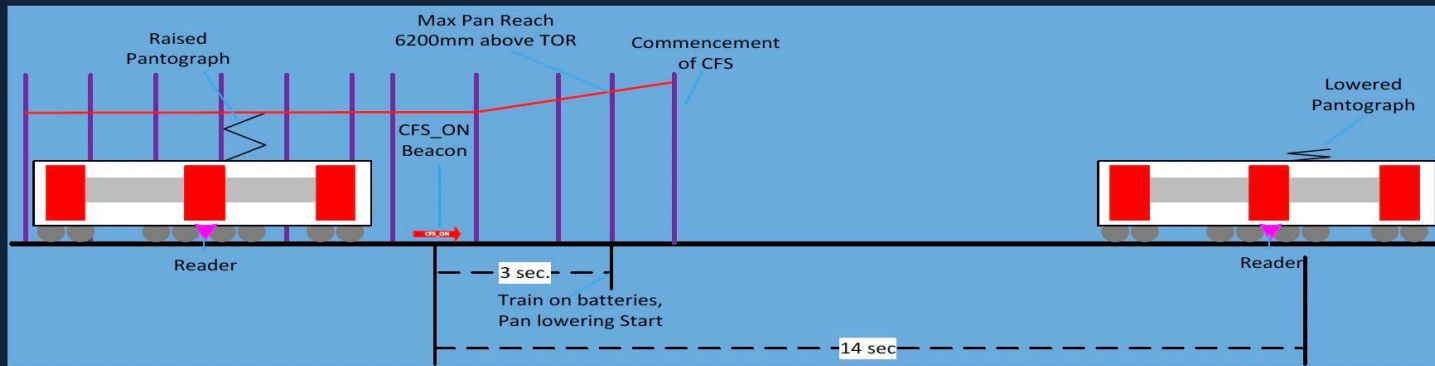
Usable Capacity *MWh*



Corridor Energy Requirements vs Platform Solutions

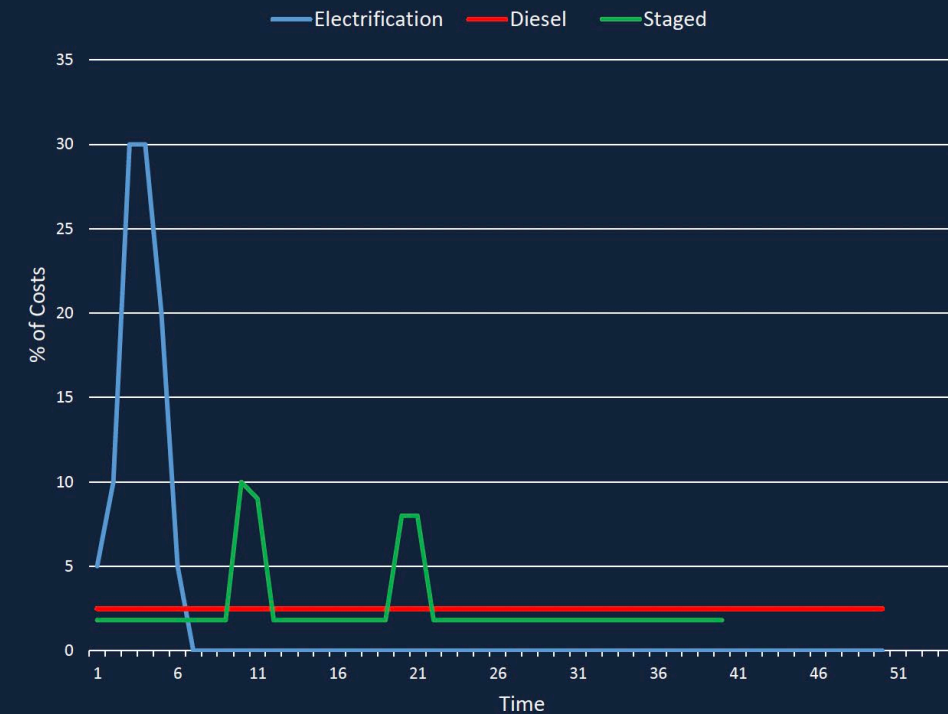
Low energy demands require BELs, moderate energy demands require BELs + BET range extenders, high energy demands required BELs + HET range extenders.





12 Staged Approach

- Capital Spend
- Utilities
- Technology
- Adaptability
- Asset Management
- Lower Risk



Leading the world effort to decarbonise heavy industry



Real Zero by 2030

Scope 1 and 2 emissions

Green fleet development

Investing in renewable energy technologies

Stationary energy

Incorporating renewable energy infrastructure

Net Zero Scope 3 emissions by 2040

Addressing emissions across the value chain

Green fleet development



Williams Advanced Engineering

Critical technology and expertise in high performance battery systems and electrification

Liebherr partnership

First green haul truck operational at site by 2025

Locomotives

World's first zero emission regenerating battery electric iron ore train; first battery electric locomotive to be operational in 2023

FORTESCUE | 17

Challenges & Opportunities





The National Transport Research Organisation is the source of independent expert transport knowledge, advising key decision makers on Australasia's most important challenges.



OUR VISION

An Integrated Mobility Future which is safe, sustainable and a driver of economic well-being.



OUR VALUES

**Transformative,
Collaborative,
Energy & Passion
Integrity**



Australian Government

**Department of Infrastructure, Transport,
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**Government of Western Australia
Department of Transport**



**Queensland Government
Department of Transport and Main Roads**



Department of Transport



**Government of South Australia
Department for Infrastructure and Transport**



Transport for NSW



**ACT
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Transport Canberra and City Services



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Department of State Growth



**AUSTRALIAN
LOCAL GOVERNMENT
ASSOCIATION**

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and Transport



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not profit

62 years
road
research

14 years rail
CRC's

9 years ACRI

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