

Mitigation of Climate Change – TRANSPORT and other things

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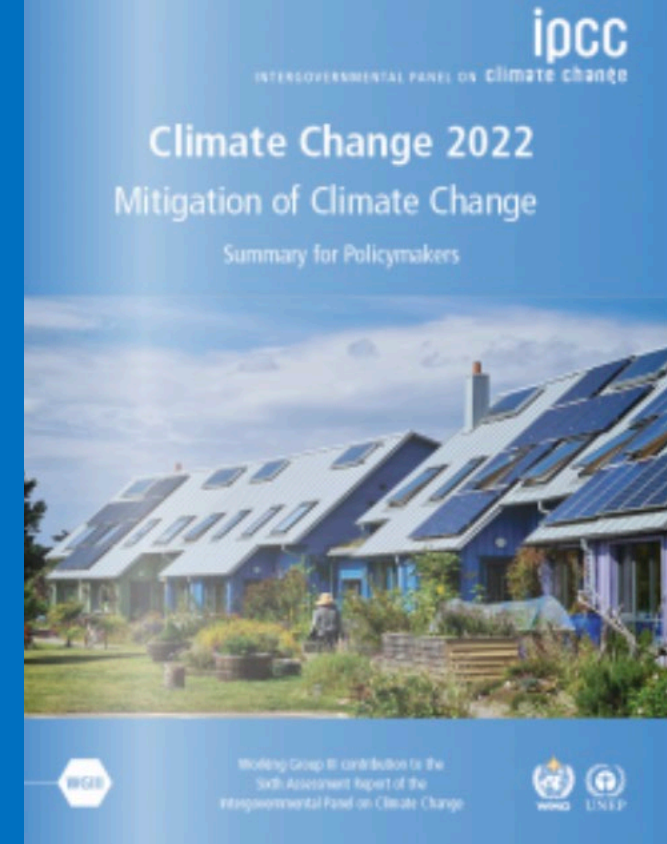
[Credit: Teekay.]



‘This report of the Intergovernmental Panel on Climate Change is a litany of broken climate promises. It is a file of shame, cataloguing the empty pledges that put us firmly on track towards an unlivable world.

‘We are on a fast track to climate disaster...’

IS THIS ALL?



THE CONTEXT.... Intense FOSSIL FUEL lobbying

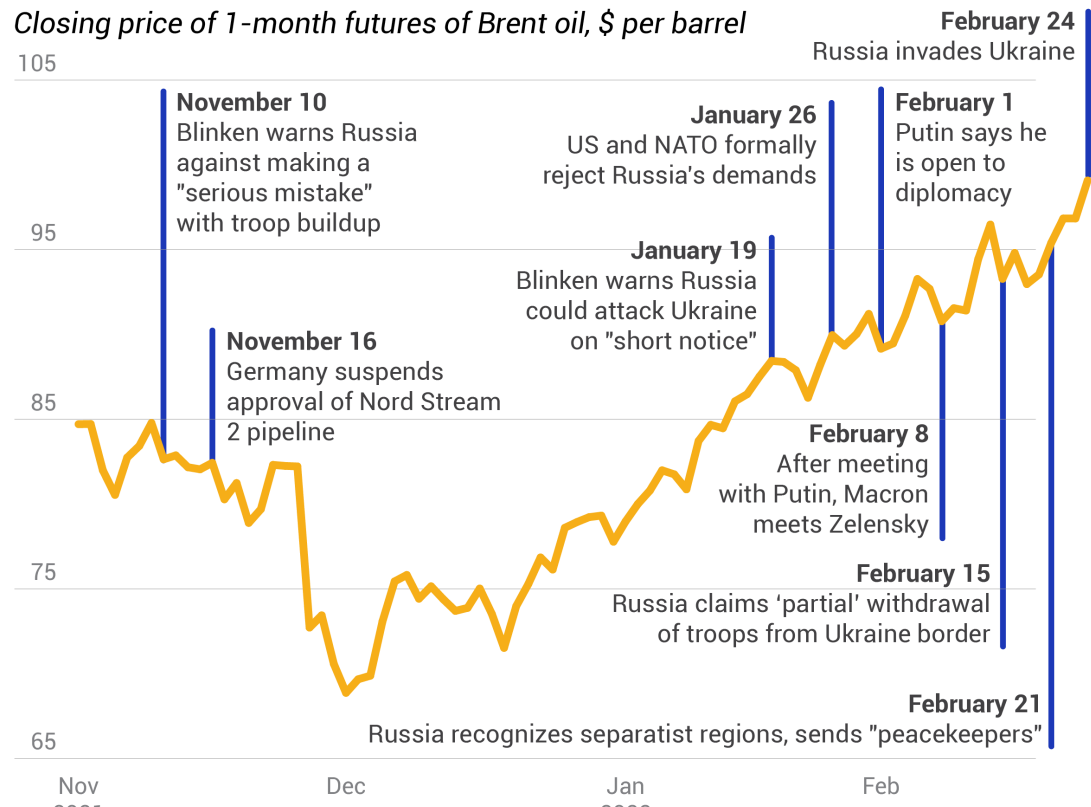
THE ENERGY SECURITY CRISIS

In the same week of IPCC Report saying no more

gas:

Woodside Petroleum secured key approvals for its \$16 billion Scarborough LNG project off the North West coast.....6th April, West Australian

Oil prices surge over Ukraine war



Why we are a 'hold-out'....

'Australia overtook Qatar to become the world's largest exporter of liquefied natural gas (LNG).

We're still the second-largest exporter of thermal coal, and the largest for metallurgical coal'.

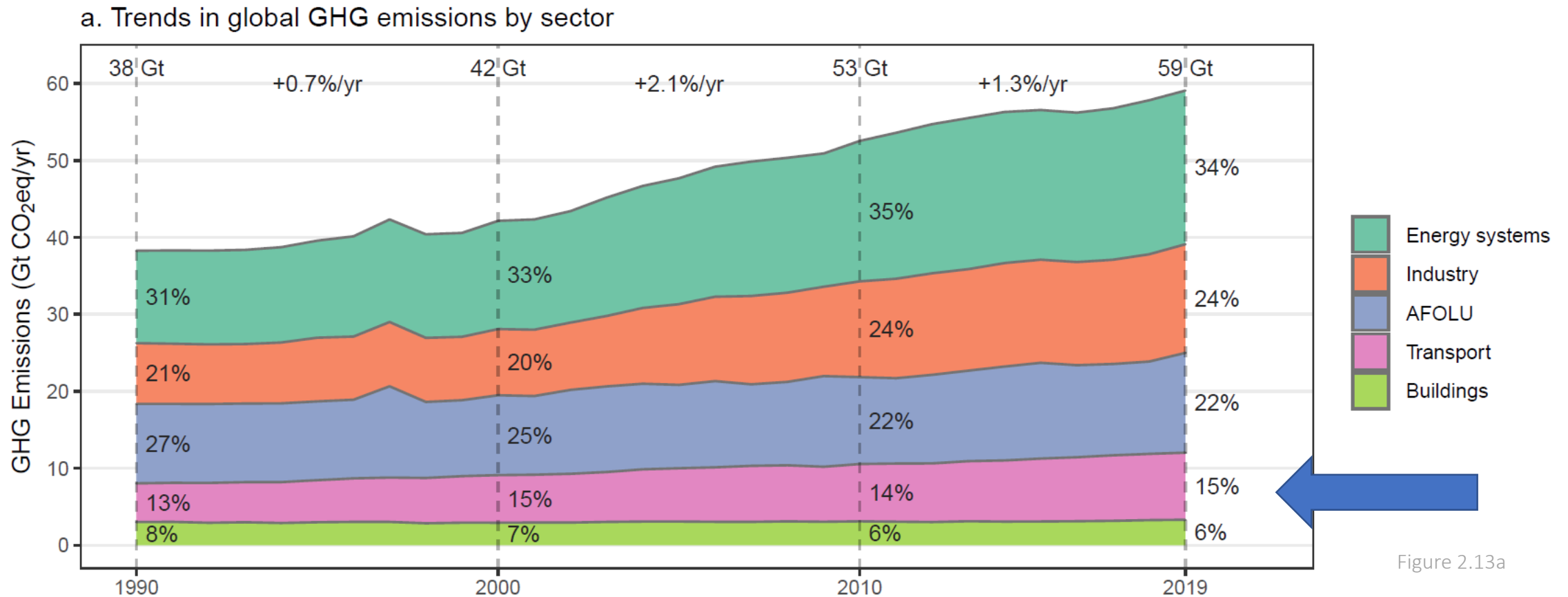
John Quiggan, *The Conversation*, 7th April

We are also the biggest exporter of Lithium for batteries....

Are we a 'holdout' or a leader for the next economy?

THE BAD NEWS –

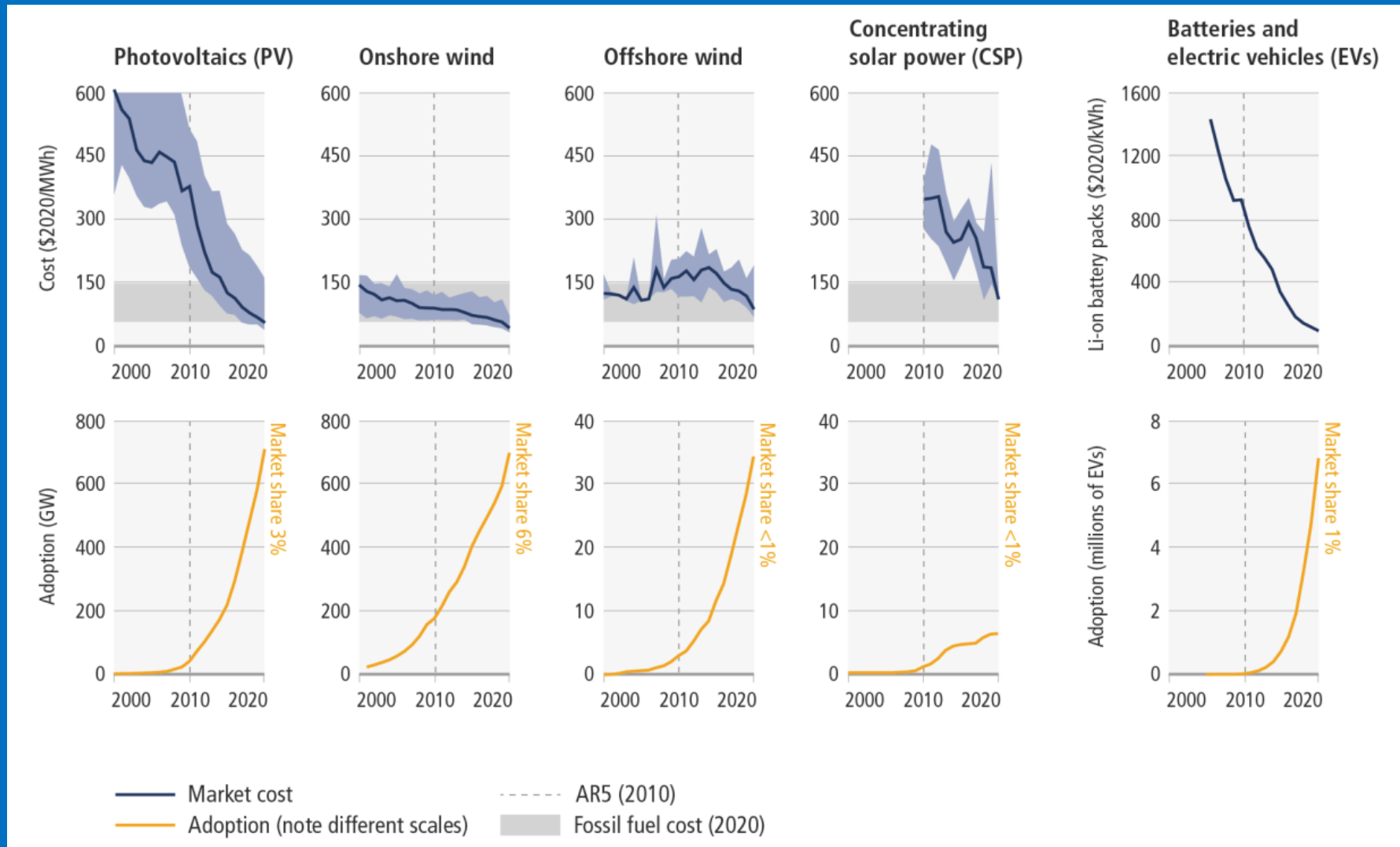
Net GHG emissions have increased since 2010 across all major sectors globally.



THE GOOD NEWS –

SPM B.4

The unit costs of key low-emission technologies have fallen continuously since 2010 and their adoption continues to rise...



Need to integrate
With smart
technologies

Signs of Progress and Continuing Challenges

Emissions trends

The rate of global emissions growth has slowed in recent years, from 2.1% per year in 2000-2009, to 1.3% / year in 2010-2019. {TS.3; 2.2}

GHG emissions have continued to grow at high absolute rates. Emissions increased by 8.7 GtCO₂eq from 2000-2009 and by 6.7 GtCO₂eq 2010-2019, reaching 59 GtCO₂eq in 2019. {TS.3; 2.2}

24 countries have reduced absolute CO₂ and GHG emissions for at least 10 years, including consumption-based CO₂ emissions. Of these, six are Western and Northern European countries that started reducing in the 1970s, six are former Eastern Bloc countries with consistent reductions since the 1990s, and 12 more, including the US, have reduced since the mid-2000s. Some have done so at rapid sustained CO₂ reduction rates of -4% per year. {TS.3; 2.2}

The combined emissions reductions of these 24 countries were outweighed by rapid emissions growth elsewhere, particularly among developing countries that have grown from a much lower base of per capita emissions. The per capita emissions of developed countries remains high, particularly in Australia, Canada, and the United States. {2.2}

Lockdown policies in response to COVID 19 led to an estimated global drop of 5.8% in CO₂ emissions in 2020 relative to 2019. Energy demand reduction occurred across sectors, except in residential buildings due to teleworking and homeschooling. The transport sector was particularly impacted and international aviation emissions declined by 45%. {Box TS.1; 2.2.2.1}

Atmospheric CO₂ concentrations continued to rise in 2020 and emissions have already rebounded as lockdown policies are eased. Economic recovery packages currently put into place by governments include support for fossil fuel industries. {Box TS.1; Box TS.9}

Sectors

Multiple low-carbon electricity generation and storage technologies have made rapid progress: costs have reduced, deployment has scaled up, and performance has improved. These include solar PV, onshore and offshore wind, biomass cofiring, and batteries. In many contexts solar PV and onshore wind power are now competitive with fossil-based generation. {TS.3; 2.5, 6.3}

The rate of emissions growth from coal slowed since 2010 as coal power plants were retired in the United States and Europe, fewer new plants were added in China, and a large number of planned global plants were scrapped or converted to co-firing with biomass. {TS.3; 2.7, 6.3}

Deforestation has declined since 2010 and net forest cover increased. Government initiatives and international moratoria were successful in reducing deforestation in the Amazon between 2004 and 2015, while regrowth and regeneration occurred in Europe, Eurasia and North America. {TS.5.6.1; 7.3.1}

Although deployment is increasing rapidly , low-carbon electricity generation deployment levels and rates are currently insufficient to meet stringent climate goals. The combined market share of solar PV and wind generation technologies are still below 10%. Global low-carbon electricity generation will have to reach 100% by 2050, which is challenged by the continuous global increase in electricity demand. The contribution of biomass has absolute limits {TS.5}.

Global coal emissions may not have peaked yet, and a few countries and international development banks continue to fund and develop new coal capacity. The lifetime emissions of current fossil-based energy infrastructures may already exceed the remaining carbon budget for keeping warming below 1.5°C. {TS.3; 2.2; 2.7, 6.7}

Deforestation in the Amazon has risen again in the past 4 years, while emissions from deforestation have been steady in S.E. Asia and rapidly increasing in Africa. The long-term maintenance of low deforestation rates is challenging. {7.2.2.3}

<p>Electric vehicles are the fastest growing segment of the automobile industry, having achieved double-digit market share by 2020 in many countries. E-transit is feasible now. When charged with low-carbon electricity, these vehicles can significantly reduce emissions.</p>	<p>Transport emissions continue to rise at a faster rate than any other sector due to the persistence of high travel demand, heavier vehicles, low efficiencies, and car centric development. The full decarbonisation of e-vehicles depends on decarbonizing electricity, shipping and industry {TS.3; 2.4}.</p>
<p>There has been a significant global transition from coal and traditional use of biomass use in buildings towards modern energy carriers and efficient conversion technologies. This led to efficiency improvements and some emissions reductions in developed countries, as well as significant gains in health and well-being outcomes in developing regions. Nearly Zero Energy (NZE) Buildings or low-energy Buildings are achievable in all regions and climate zones for both new and existing buildings {9.3; 9.8}.</p>	<p>There is a significant lock-in risk in all regions given the long lifespans of buildings and the low ambition of building policies. This is the case for both existing buildings in the Global North and for new buildings in the Global South, which are also challenged by the lack of technical capacity and effective governance. Emissions reductions in the global North have been outweighed by the increase of floor area per capita {9.9; 9.3}.</p>
<p>The decarbonization of most industrial processes has been demonstrated using technologies that include: electricity and hydrogen for energy and feedstocks, carbon capture and utilisation technologies, and innovation in circular material flows. {TS.5.5.3}</p>	<p>Industry emissions continue to increase, driven by a strong global demand for basic materials. Without reductions in material demand growth and a very rapid scale-up of low-carbon innovations, the long lifetimes of industrial capital stock risks locking-in emissions for decades to come. {TS.5.5.1}</p>

Policies and investment

The Paris Agreement established a new global policy architecture to meet stringent climate goals, while avoiding many of the deadlocks that had arisen in trying to extend the Kyoto Protocol. {TS 6.3}

Current national pledges under the Paris Agreement are insufficient to hold global warming under 2°C or 1.5°C, suggesting that the design of the Paris Agreement may not provide sufficient incentives to meet its goals. {TS 6.3}

Most wealthy countries, and a growing list of developing countries, have signaled an intention to achieve net zero emissions by mid-century. National economy-wide GHG emissions targets covered 89% of global emissions in 2017 compared to 45% in 2012. Direct and indirect climate legislation has also steadily increased and this is supported by a growing list of financial investors. {TS.6.2; TS 6.4}

Many net zero targets are ambiguously defined, and it remains unclear whether countries will implement the policies needed to achieve them. Opposition from status quo interests, as well as insufficient low-carbon financial flows, raises doubts that countries will establish and implement stringent climate policies covering all sectors.

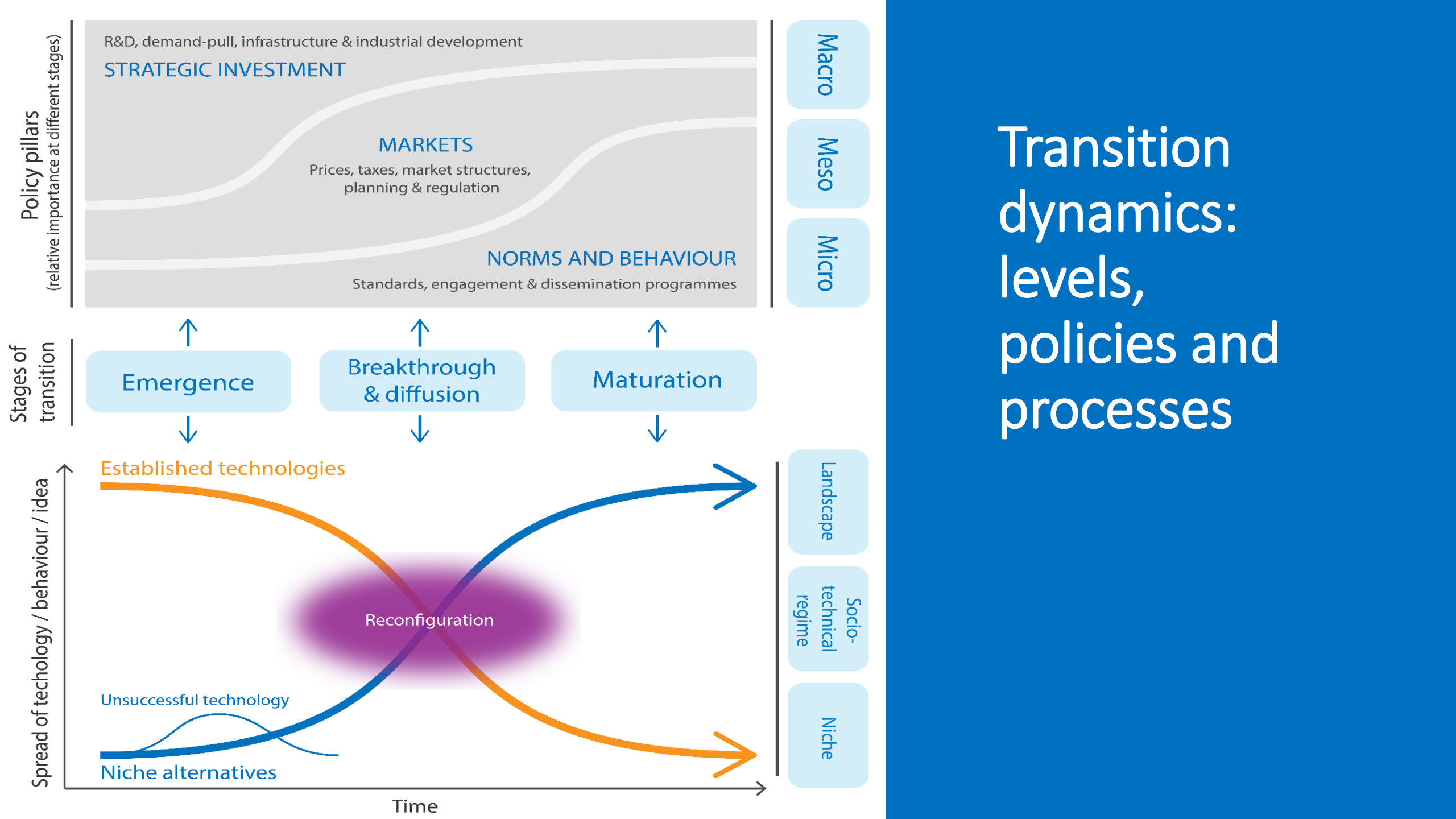
The global coverage of mandatory policies – pricing and regulation – has increased, and sectoral coverage of mitigation policies has expanded.

Carbon pricing policies now cover @% of global emissions. Effective carbon price level increased from USD 2 to USD 13 per tCO₂ between 2012 to 2019 {13.6.1.2} Many countries have introduced sectoral regulations that block new investment in fossil fuel technologies.

There is incomplete global policy coverage of non-CO₂ gases, CO₂ from industrial processes and emissions outside the energy sector, particularly in many developing countries. In many jurisdictions carbon prices are lower than estimated climate change damages and in some countries fossil fuel subsidies exceed the cost of mitigation measures thus limiting their effectiveness.

There has been a marked increase in civic and private engagement with climate governance. This includes business measures to limit emissions, invest in reforestation and develop carbon-neutral value chains including building with wood. There is an upsurge in climate activism, and growing engagement of groups such as labour unions. The media coverage of climate change has also grown steadily across platforms. {TS.6.2}

There is no conclusive evidence that an increase in engagement results in overall pro-mitigation outcomes. There is an increasing anti-climate governance in some countries, and growing protests against climate policies and low-carbon infrastructure. Climate change counter-movements have utilized media to rapidly spread misinformation about climate change and the benefits of mitigation actions. {TS.6.2}



Transition dynamics: levels, policies and processes

Transport Mitigation Options and Enabling Conditions

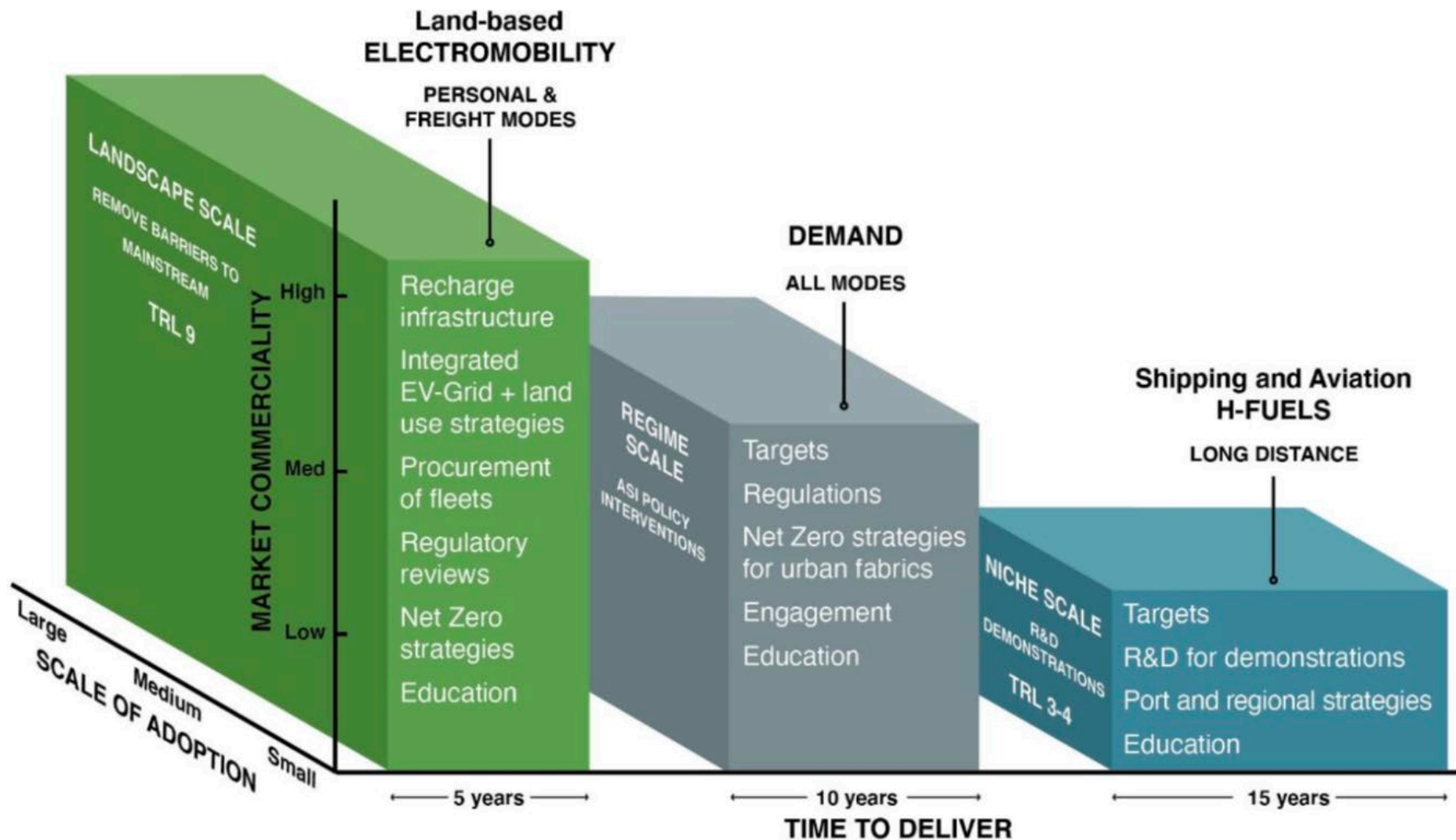


Figure 10.22 Mitigation Options and Enabling Conditions for Transport. Niche scale includes strategies that still require innovation.

Many options available now in all sectors are estimated to offer substantial potential to reduce net emissions by 2030. Relative potentials and costs will vary across countries and in the longer term compared to 2030.

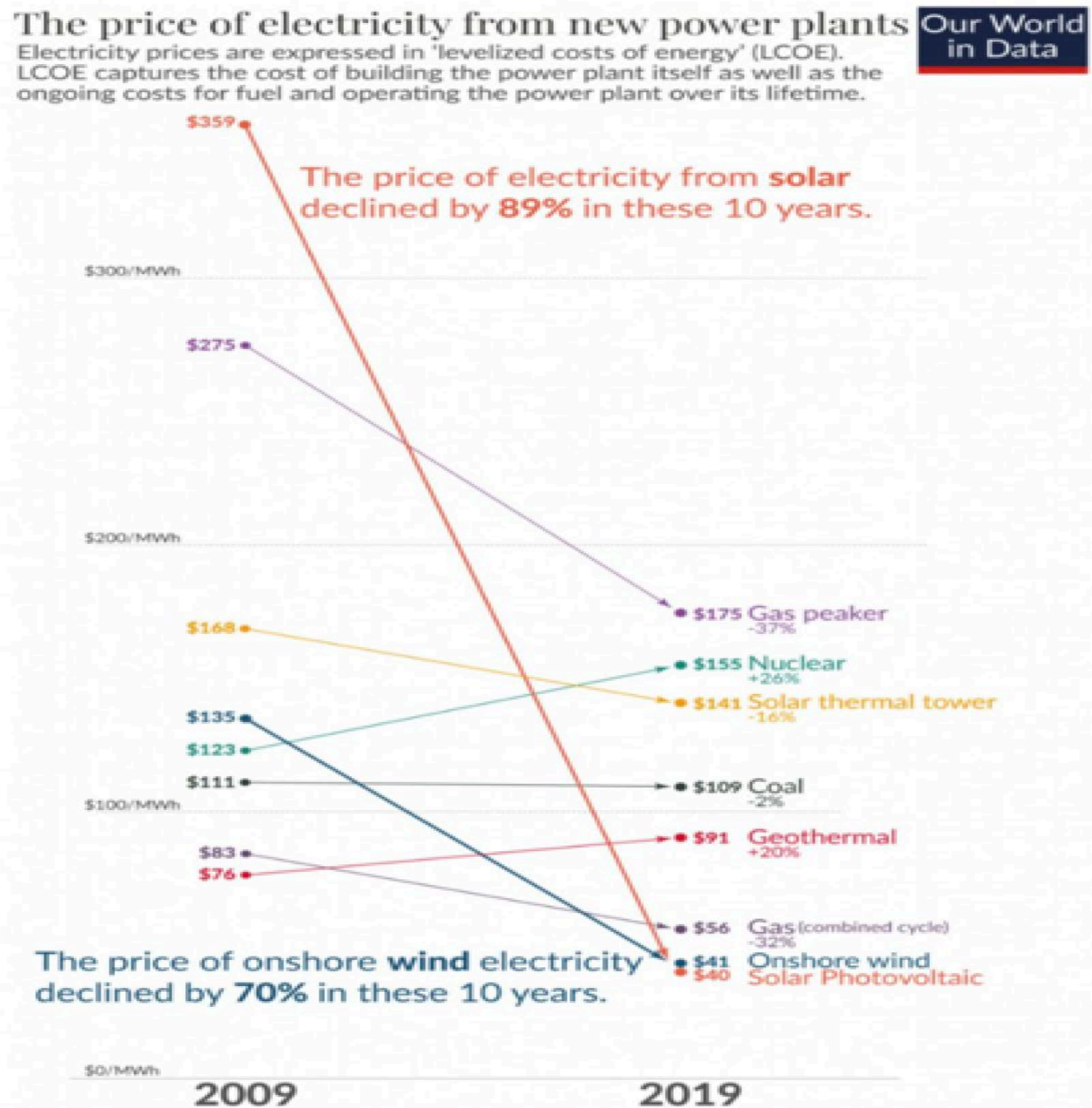
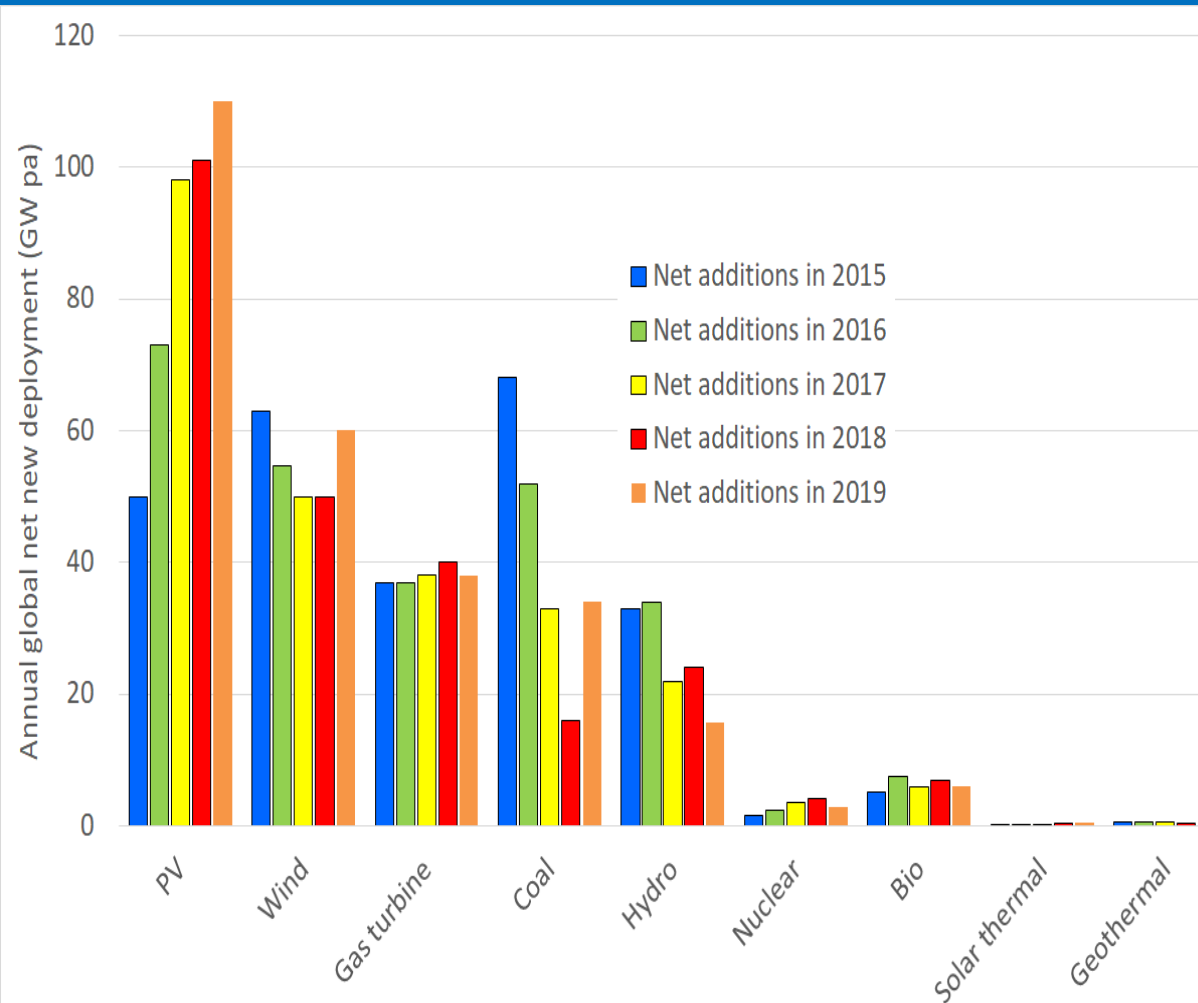


Most blue equals most mitigation options for 2030....

- SOLAR and WIND

- TRANSPORT EV's mostly

The solar transition is *now*. It is cheaper than anything in history

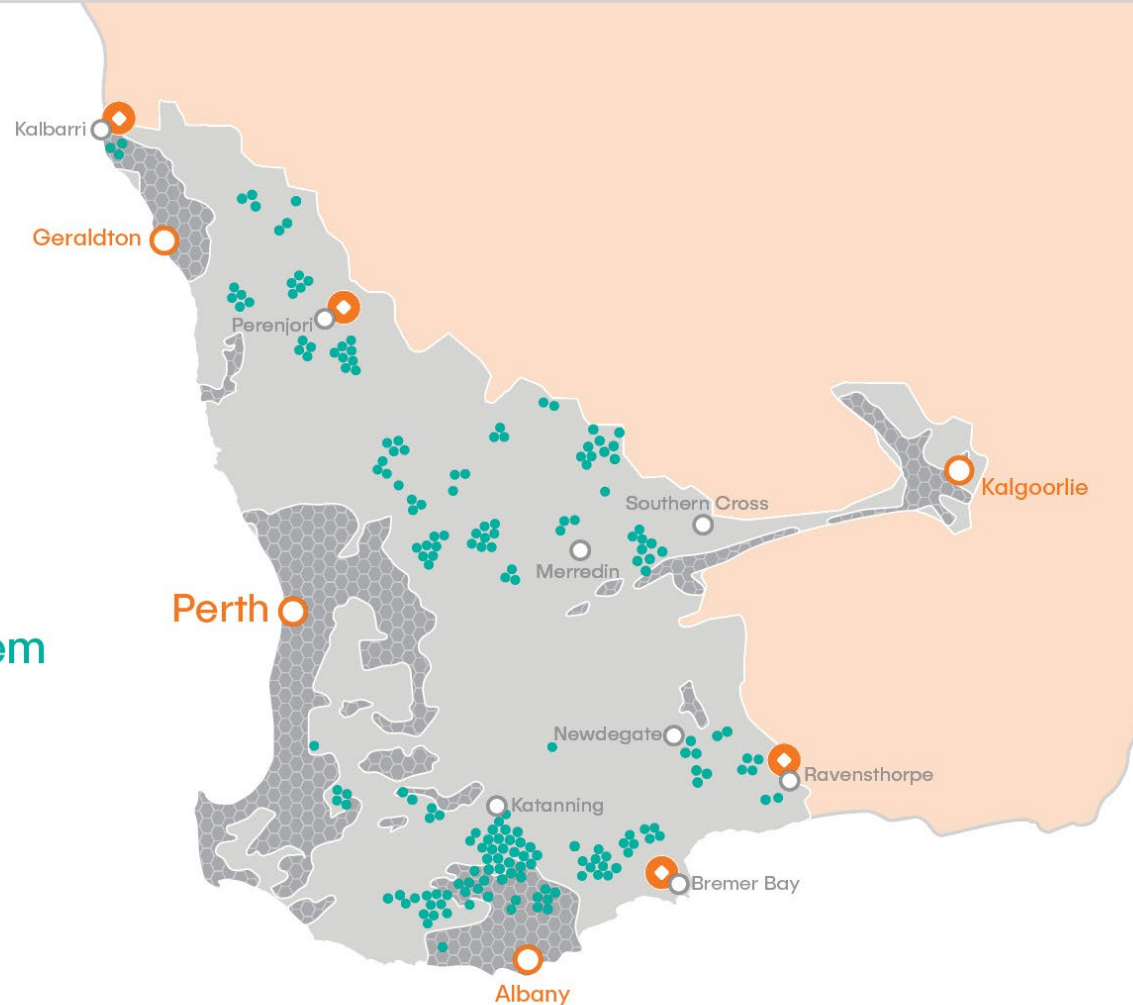


Western Power Network – NOW DOMINATED BY ROOFTOP SOLAR

becoming smarter, distributed and net zero...HOW?

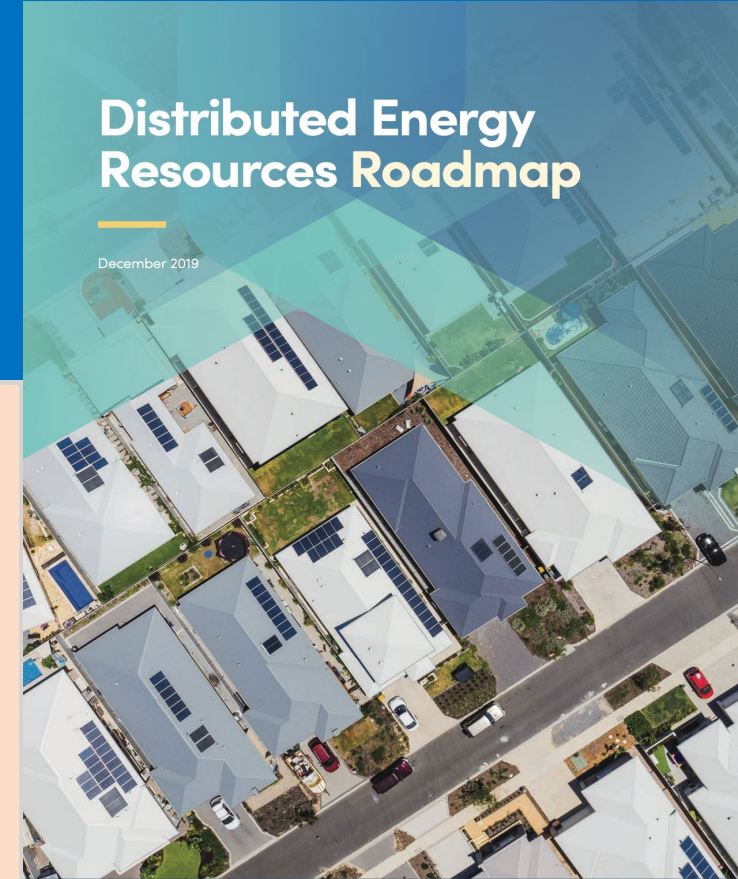
WA's future energy mix

- Microgrid
- Stand-alone power system
- Mesh network
- Autonomous network



Distributed Energy Resources Roadmap

December 2019



Energy Transformation
Taskforce



'Rewiring the Nation' ALP promise
\$20 billion...to integrate power, buildings and transport
CRC RACE is showing *how* along with all the early
leaders like DevtWA, Hesperia, Witchcliffe, and
thousands of households and small businesses...

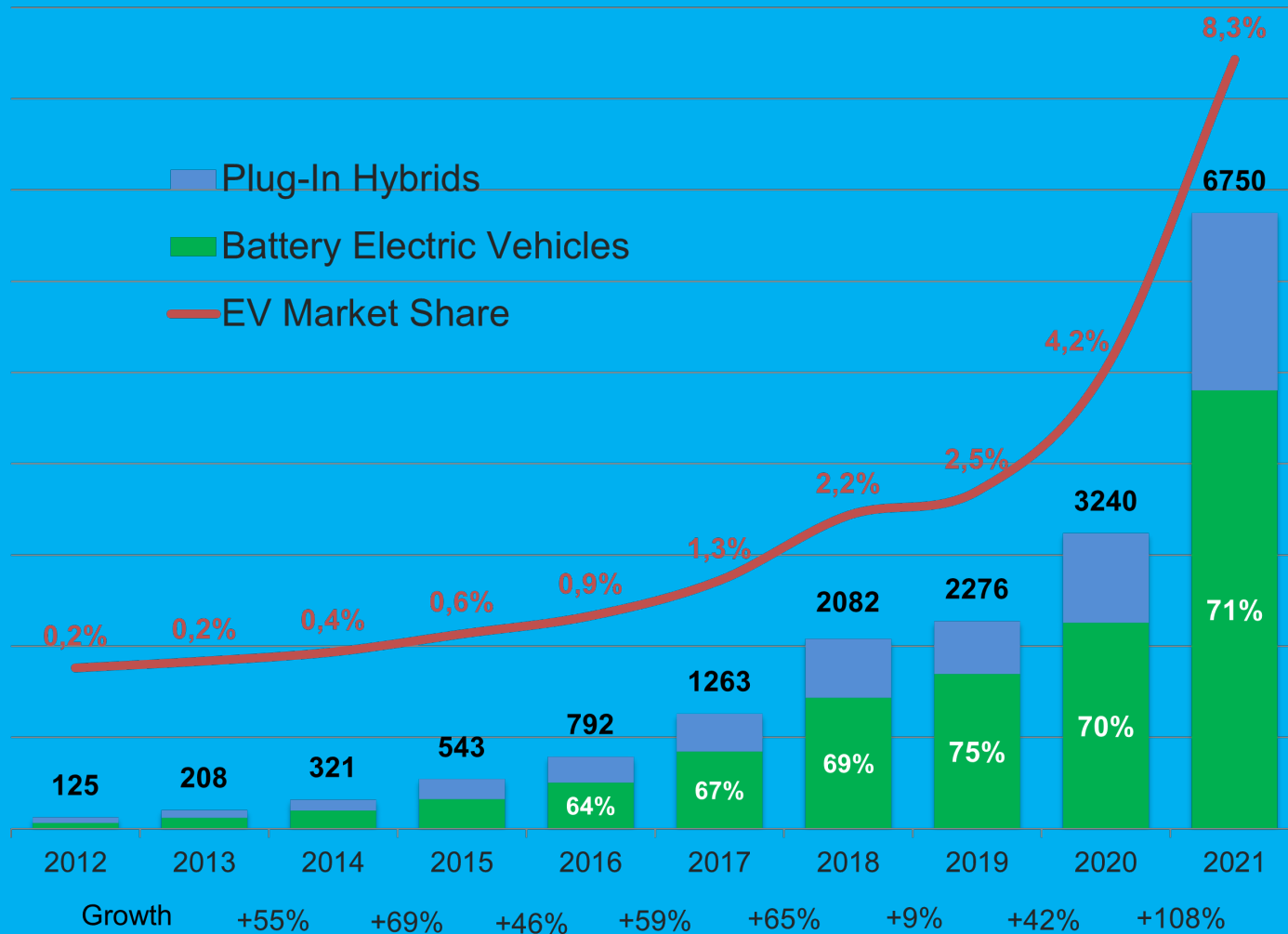
East Village, Fremantle



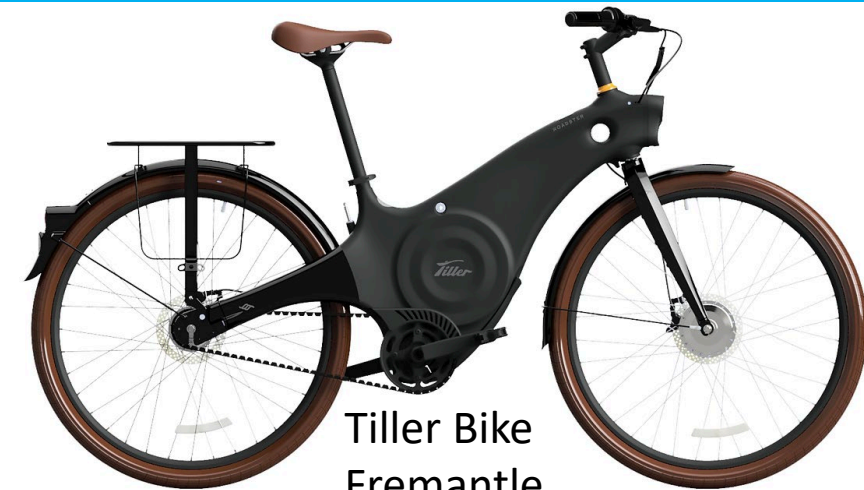
Batteries have dropped in cost 85% in 2010-19

GLOBAL BEV & PHEV SALES ('000s)

EV VOLUMES



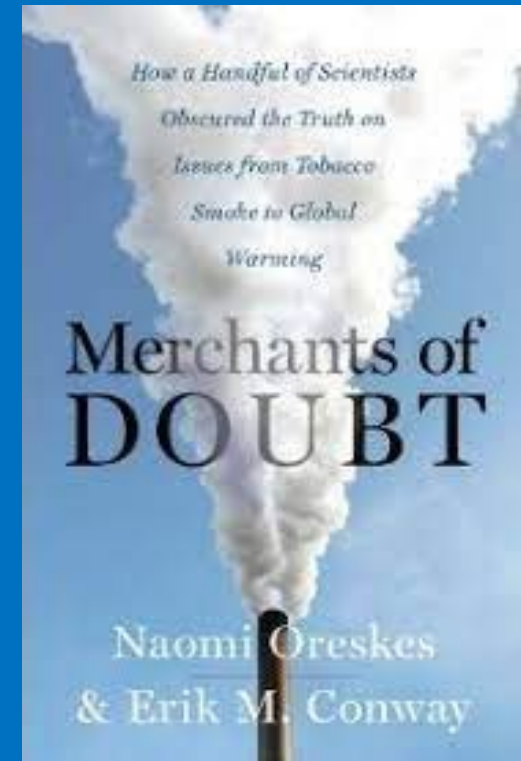
“Electric vehicles powered by low-emissions electricity offer the largest decarbonisation potential for land-based transport,” IPCC SPM C8



Electrified transport will not only be better transport it will:

1. Reduce air pollution–related deaths (10,000 per day across the world; 10 per day in Australia);
2. End energy security problems replacing oil with sunshine (Australia imports 90% of its oil); and
3. Contribute 23% to the climate mitigation requirement.

INSTEAD WE GET FEAR OVER BATTERY MINERALS.....





Proud Aussie Matt Canavan ✓

@mattjcan

I have nothing against electric cars but let's not pretend they are God's gift to the environment



Wall Street Silver ✓ @WallStreetSilv · Mar 15

To manufacture each EV auto battery, you must process 25,000 pounds of brine for the lithium, 30,000 pounds of ore for the cobalt, 5,000 pounds of ore for the nickel, and 25,000 pounds of ore for copper.

All told, you dig up 500,000 pounds of the earth's crust for one battery."

[Show this thread](#)



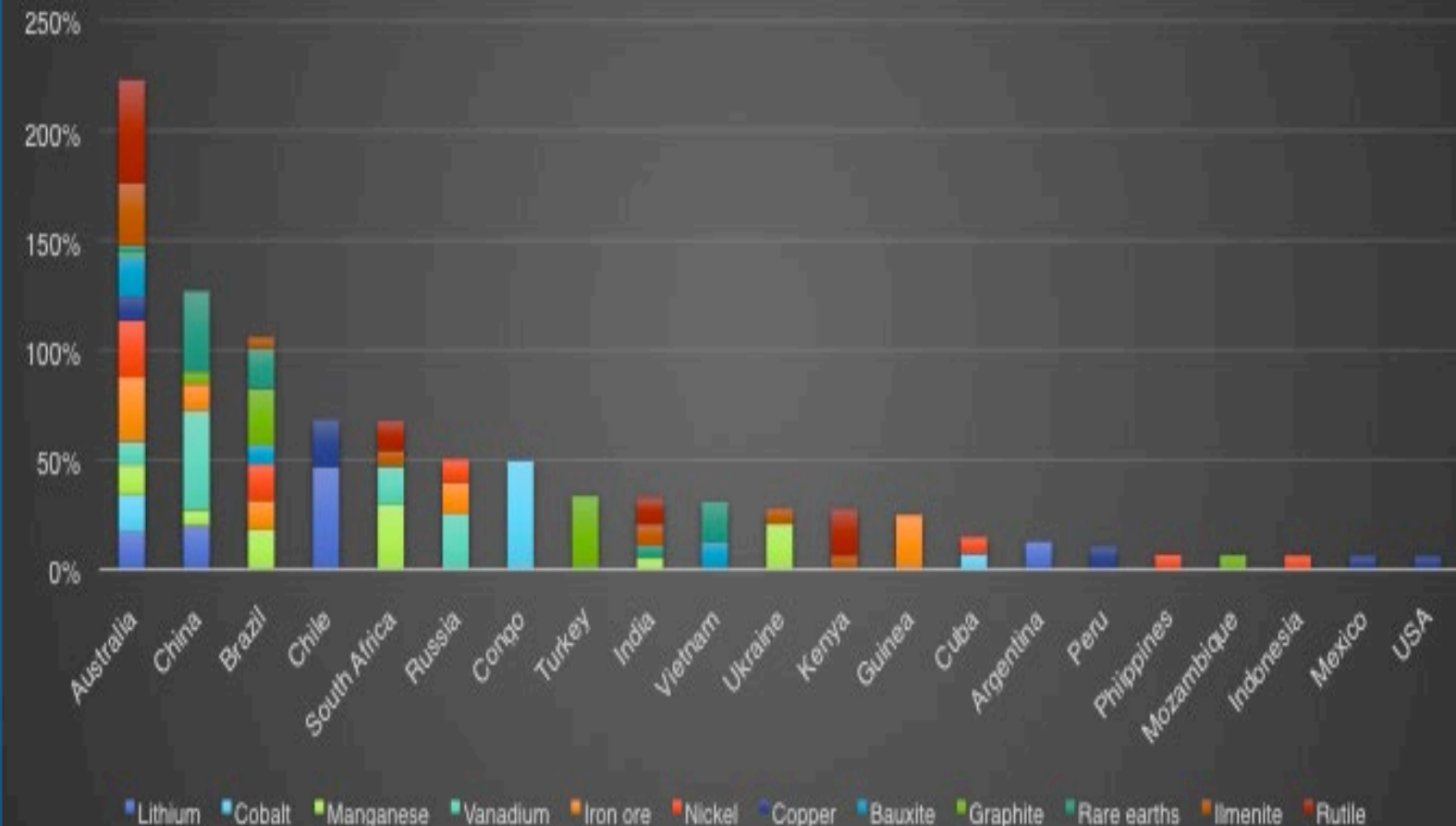
Are all battery minerals from Chile Brine....?



Is all Cobalt from DCR using child labour?

Western Australia has most of the Lithium and battery minerals...ethical and sustainable mining?

Country reserves of key battery materials as a percentage of known global reserves



LITHIUM production 2020

W.AUSTRALIA	49%	(4 mines, 8 new ones...)
CHILE	22%	
CHINA	17%	
ARGENTINA	8%	

Greenbushes – 4mT/yr; Iron ore 800mT



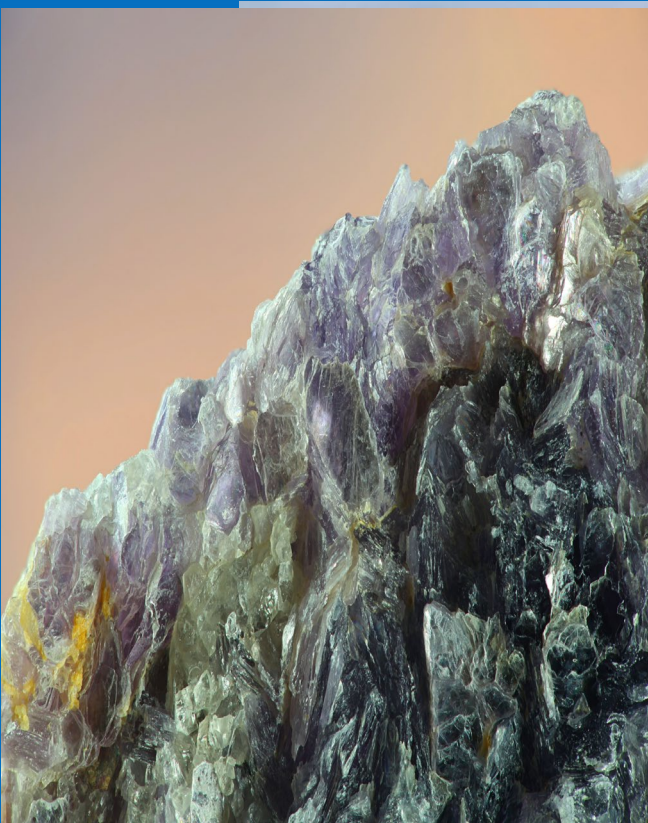
Li processing.....soon to become 2nd largest provider of LiOH in the world

3 new processing plants LOCALLY

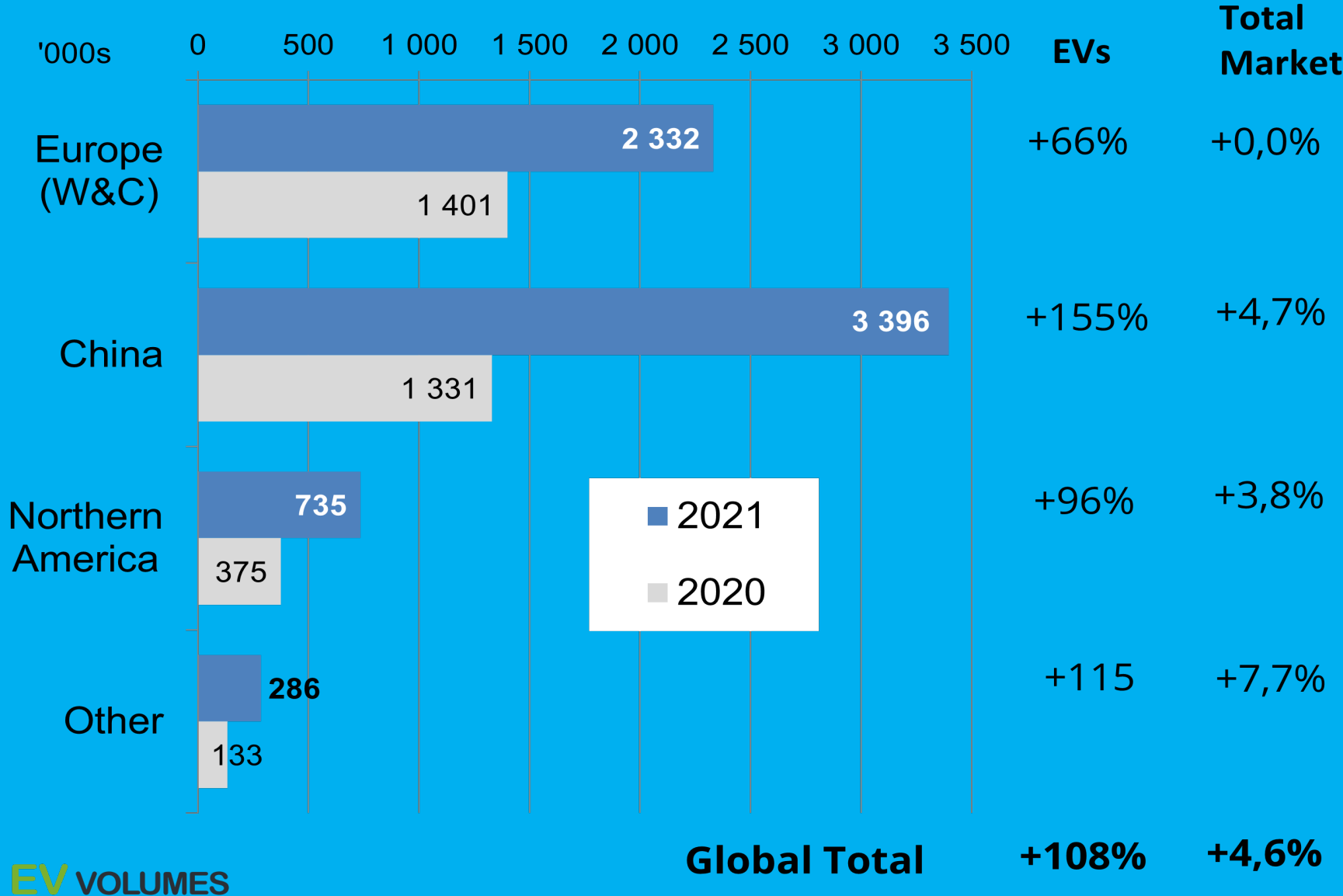
Li-Spodumene
\$2500/T

Li Hydroxide
\$8,400/T

Tianqi and SQM/Covalent at Kwinana and
Albermarle at Kemerton



BEV+PHEV SALES AND % GROWTH



Australia is a laggard on adopting EV's

Though 100% growth in past year and 50% want one...

EV VOLUMES



WE HAVE THE BEST FAST CHARGERS
Qld's Tritium is biggest producer of fast chargers in the world....

WHY ARE OUR EV's EXPENSIVE AND HARD TO GET?

By contrast to almost all developed countries, Australia doesn't have a fuel efficiency target, or plans to end new sales of petrol vehicles. The government has no proposal to address this, while Labor offers a minor tax concession on electric vehicles and a fuel efficiency information website.

John Quiggan, The Conversation, 7th April



Biden launches new Tritium factory in Texas

The big mining companies are *getting on with it...*
Electric freight trucks and trains with battery replacing
diesel in diesel-electric motors...

FMG Infinity Train – regenerative braking



\$68 trillion for Net Zero projects
Climate 100+



Australia's first electric prime mover fleet unveiled, with swap and go batteries

APRIL 5, 2022

RENEW

GILES PARKINSON



Cost to retrofit a semi trailer as an EV is \$150,000.

Can payback in 3 years of diesel if use sunshine to recharge.

‘Batteries provide 85 per cent efficiency, compared to around 30 per cent for diesel and 28 per cent for hydrogen’.



Regenerative braking a big plus...



NET ZERO CITIES

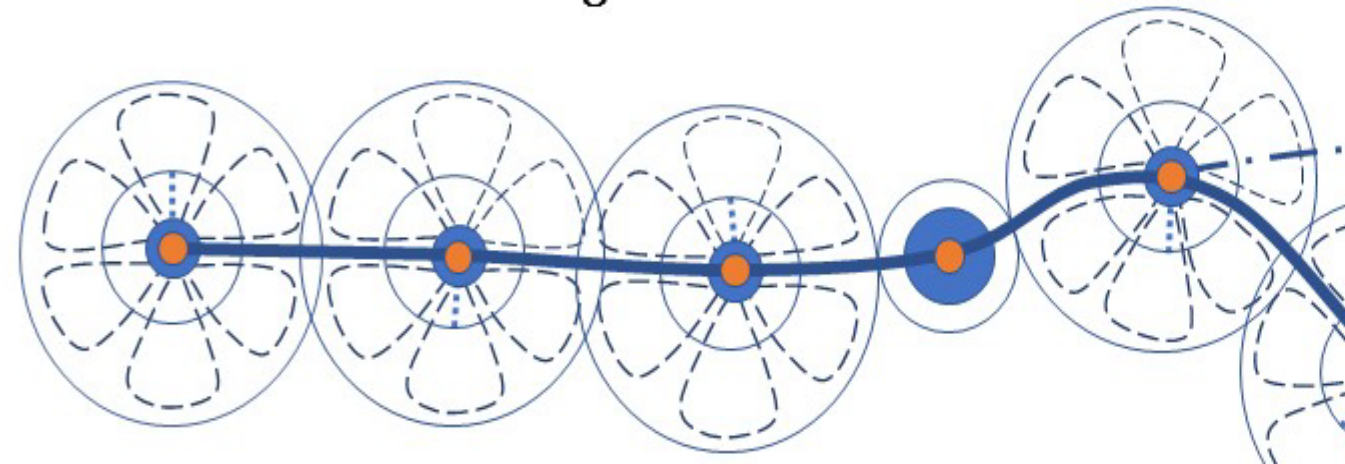
E-transit, micromobility in net zero boulevards

THE TRACKLESS TRAM.....

Battery Electric. 70 kph. 300-500 people capacity



Corridor Transit Commuting



Aviation and shipping...international

NO ELECTRIC OPTION

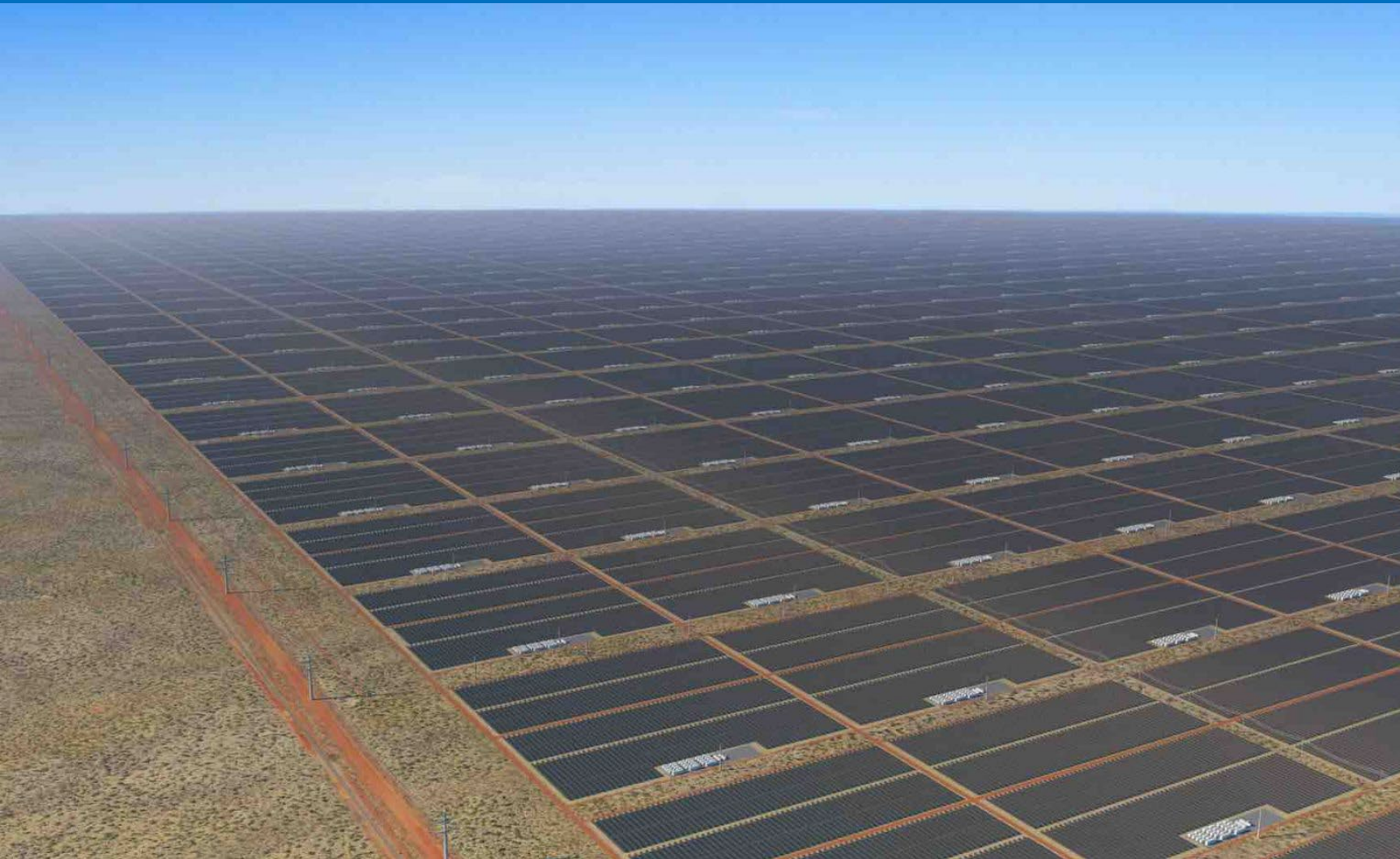
Ammonia in ships –
GREEN CORRIDOR...BHP/Rio
Synthetic Jet Fuel in planes

Made from Hydrogen...
will make international travel very
expensive. FAVOURS LOCAL!



'Cannon-Brookes, Forrest pour more money into world's biggest solar and battery project'

Giles Parkinson Renew 13 March 2022



Sun Cable, 20,000 MW

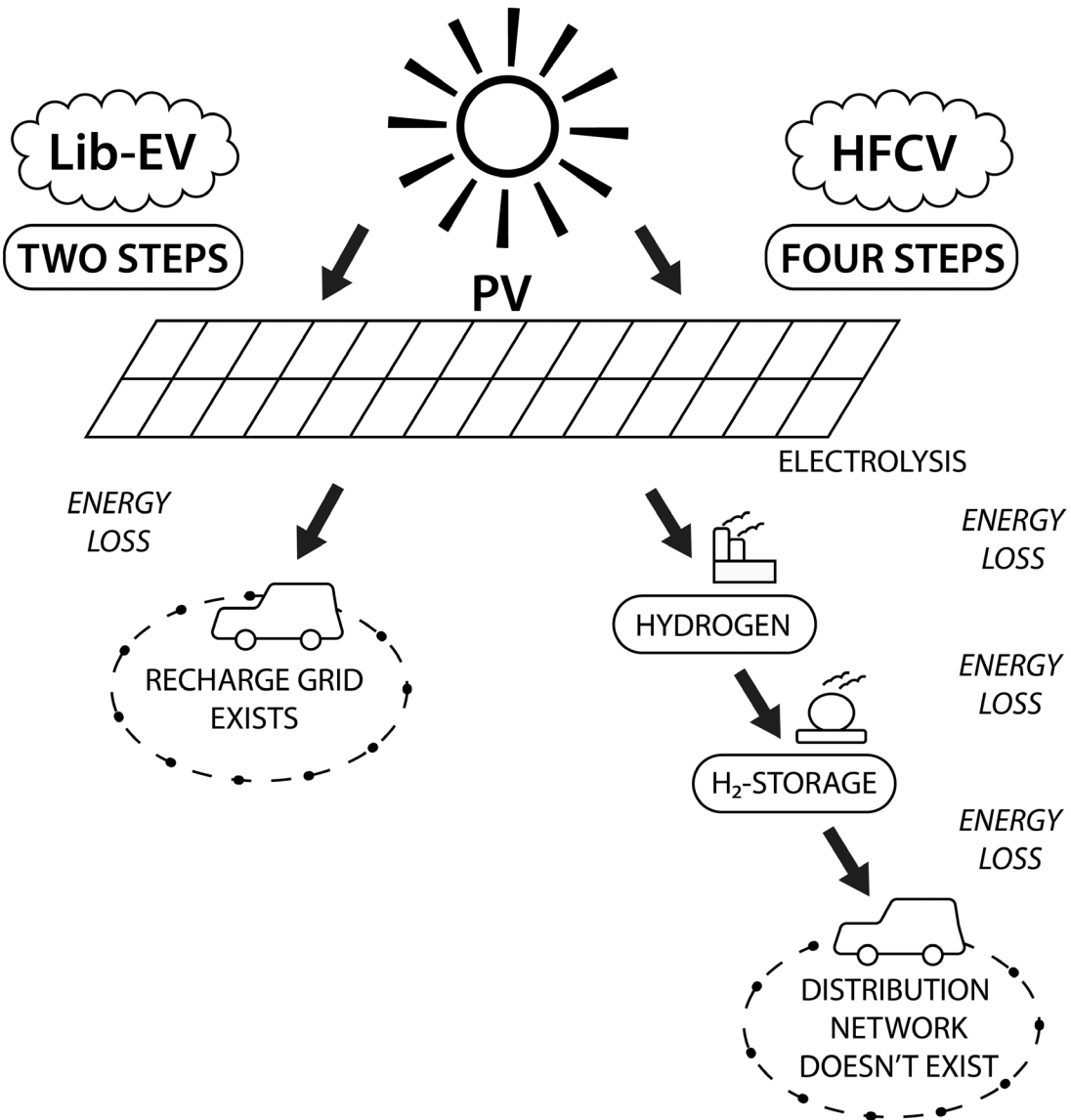
Export 2000 MW power to Singapore, via a 4,200km sub-sea cable.

The rest to support industry in Pilbara

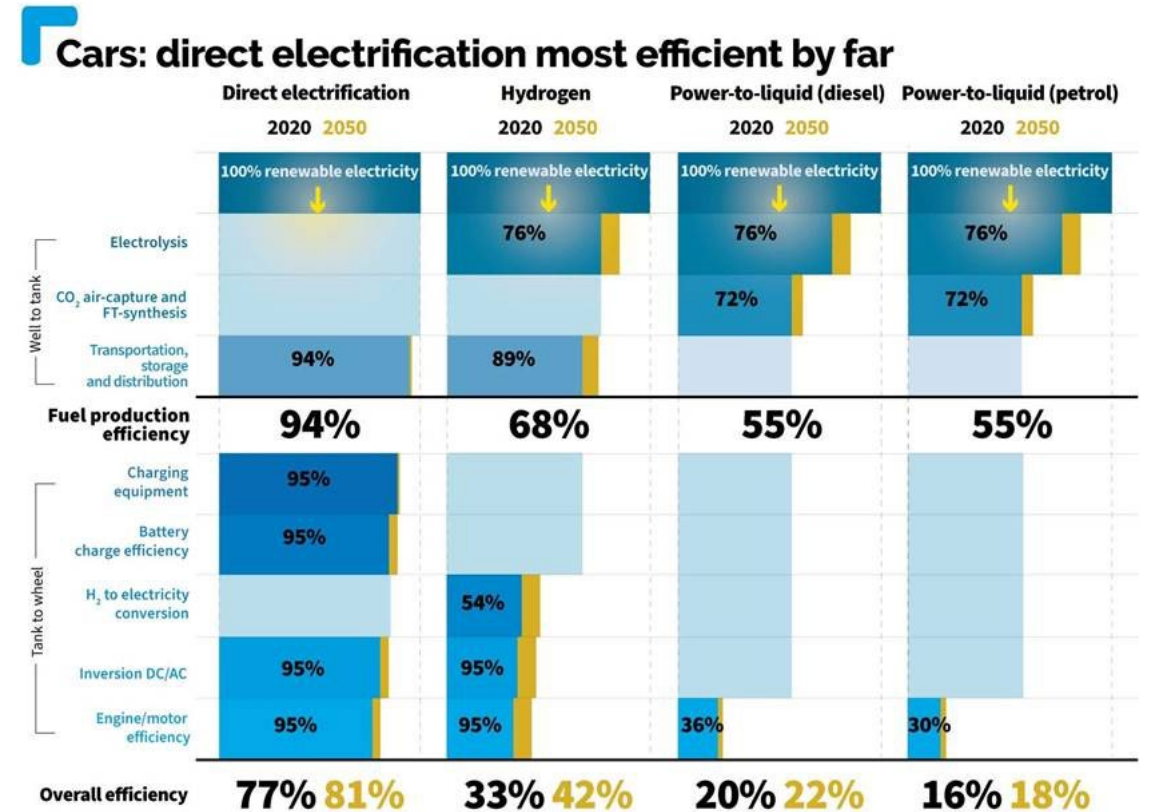
HYDROGEN

Export or
local for
Green Steel?

ELECTROMOBILITY and HYDROGEN-MOBILITY



Hydrogen's problem: thermodynamics and LCA's



Notes: To be understood as approximate mean values taking into account different production methods. Hydrogen includes onboard fuel compression. Excluding mechanical losses.

Liquid Hydrogen ship



The LH2 cargo is cooled to -253°C

Ammonia -30°C

But lose energy at every step...

New zero-carbon **export** model for Australia — based on hydrogen

Marion Rae AAP Thu, 17 March 2022 from Crawford School Report



2% of
land
area

Sensible?

Shipping sunshine: Germany emerges as big customer for Australia's bottled solar.

17 March 2022 Renew Economy



Turned into
Ammonia at
 -30°C

Hydrogen is the necessary option for industrial processing but should be used near to where it is made.

This changes the whole geopolitics of decarbonizing industry.

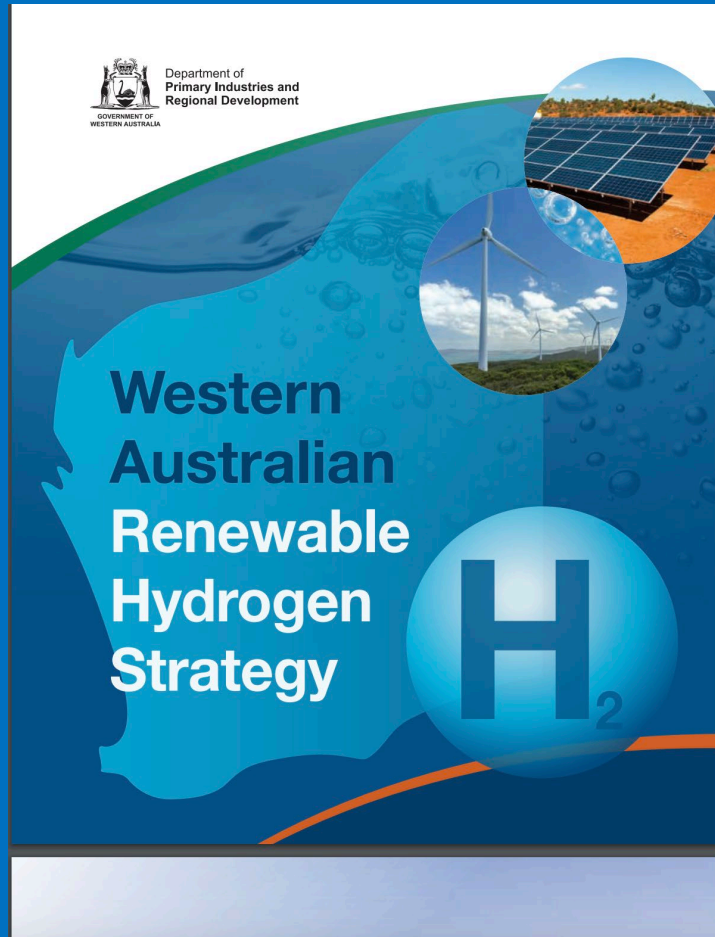
WA has sunshine, space and primary products needed for net zero industry through hydrogen...

Green Steel

Iron ore to green steel 400,000 jobs if all ore processed here...

\$140/T is good while we produce 60% of world's iron ore.

Green Steel Value Chain Assessment
- Involves all mining co's

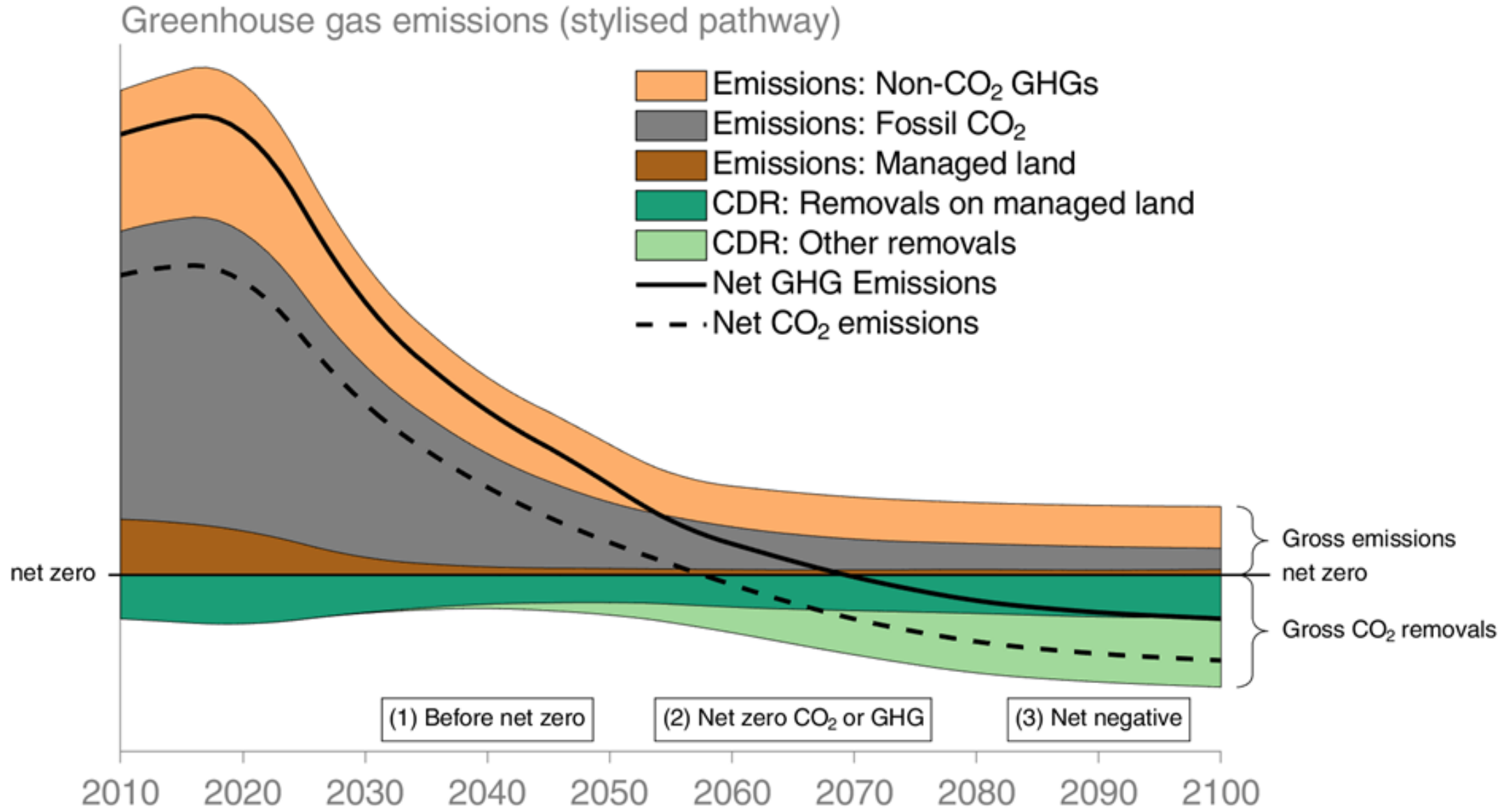


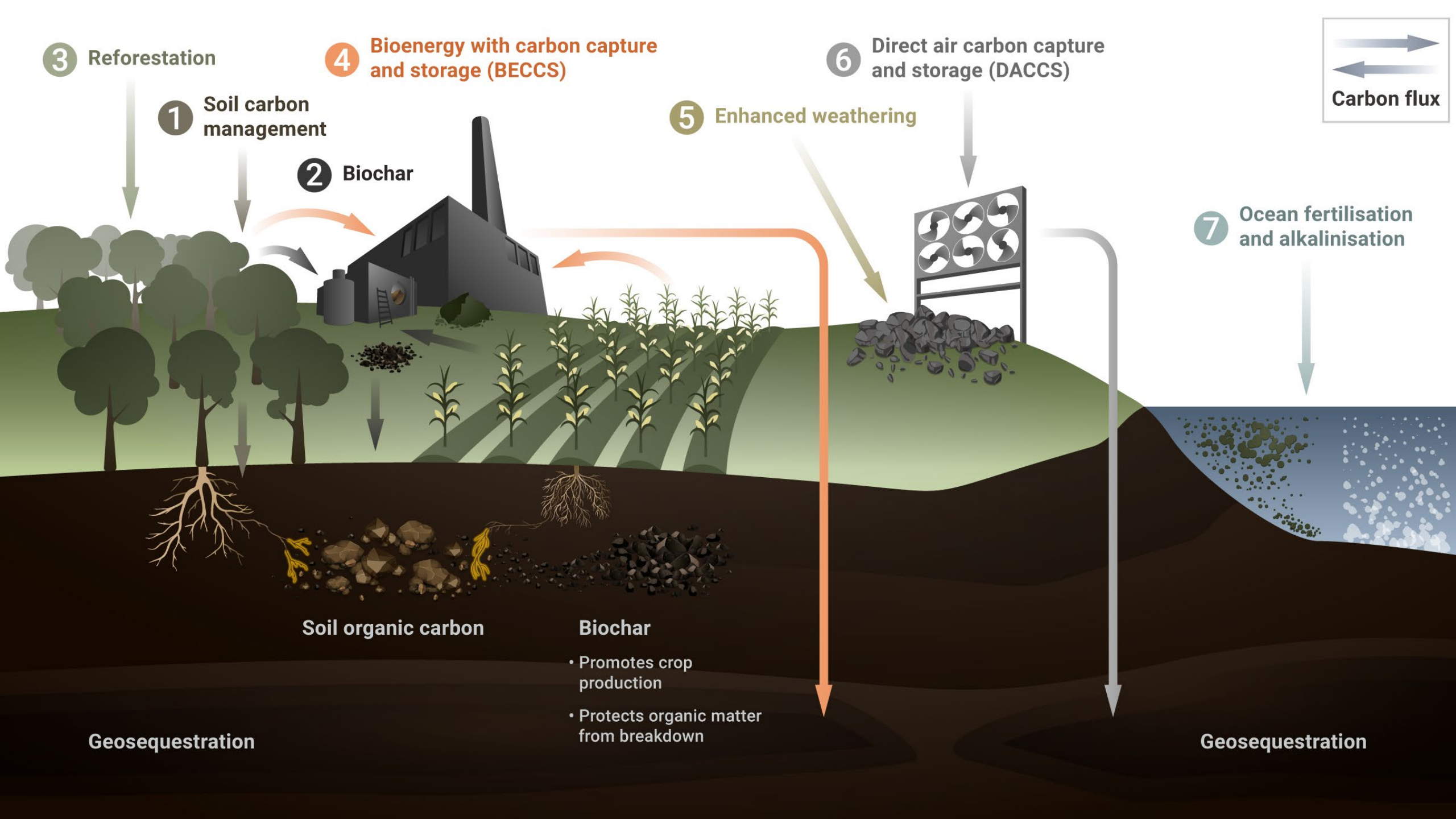
What about LAND?

The 'Net' part of Net Zero GHG



Trajectory to net zero – offsets with integrity





Saving forests and saving carbon...



Tourism WA



WildWesternAustralia.com

Oil Mallees – burying carbon and rebuilding the landscape...improves agricultural productivity



Gondwana Links Project – carbon offsets 50% up in 6 mths



Inspiration spreads.... Africa's Great Green Wall



Why not make cities into carbon sinks...and build songlines into and through cities? INTEGRITY GUARANTEED



Graham Lloyd, *The Australian*, 6th April, 2022

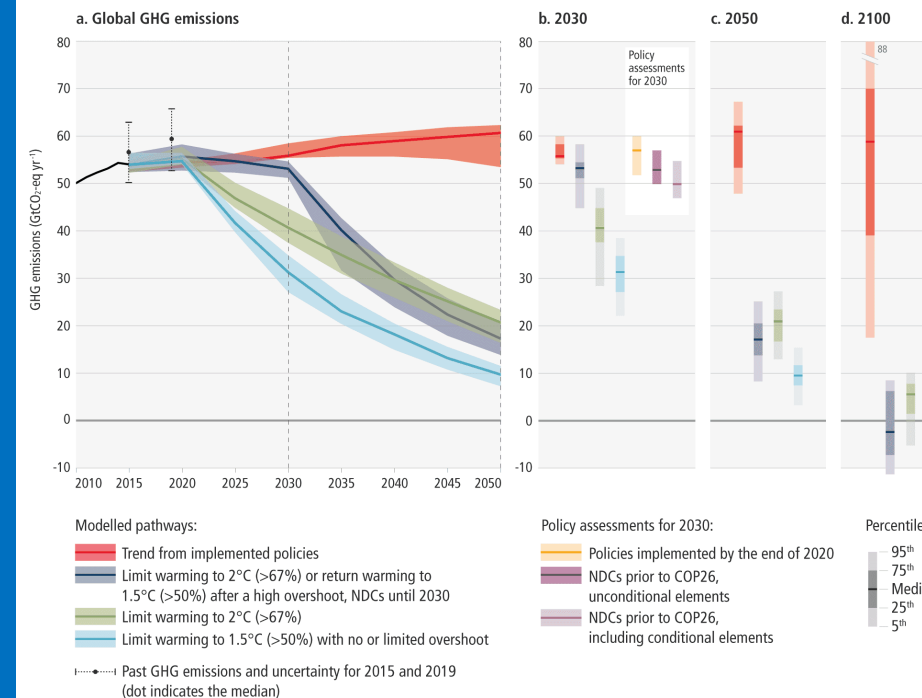
‘Grand climate narrative limits our solutions’.

‘Is the response being advocated through the IPCC process capable of delivering?’

Peaking and rapid decline is better understood now...post-Covid.

‘One lesson from history is that paradigm shifts are possible and can sweep away generations of incremental technological change.’

Projected global GHG emissions from NDCs announced prior to COP26 would make it likely that warming will exceed 1.5°C and also make it harder after 2030 to limit warming to below 2°C.



Its been a privilege...

Peter Newman 0407935133



[Credit: Teekay.]