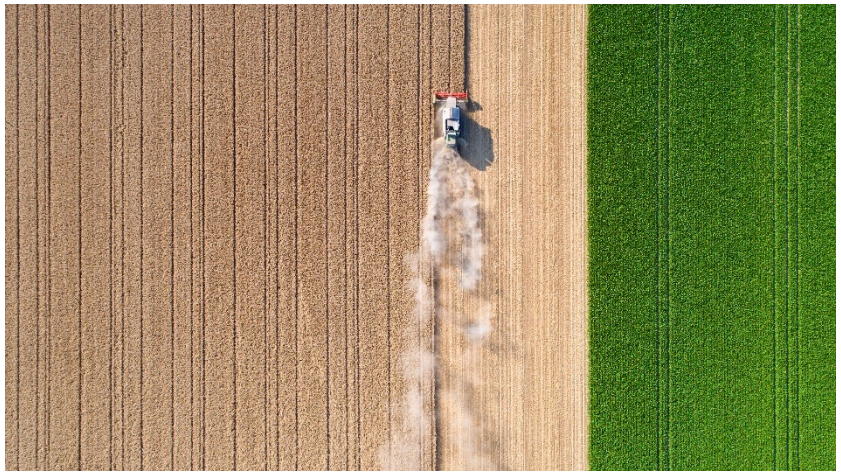

Clean Energy Transition in Ag

Resources Energy & Industry Forum
Dubbo
June 6 2023

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https://www.dpi.nsw.gov.au/dpi/climate/energy

The Situation

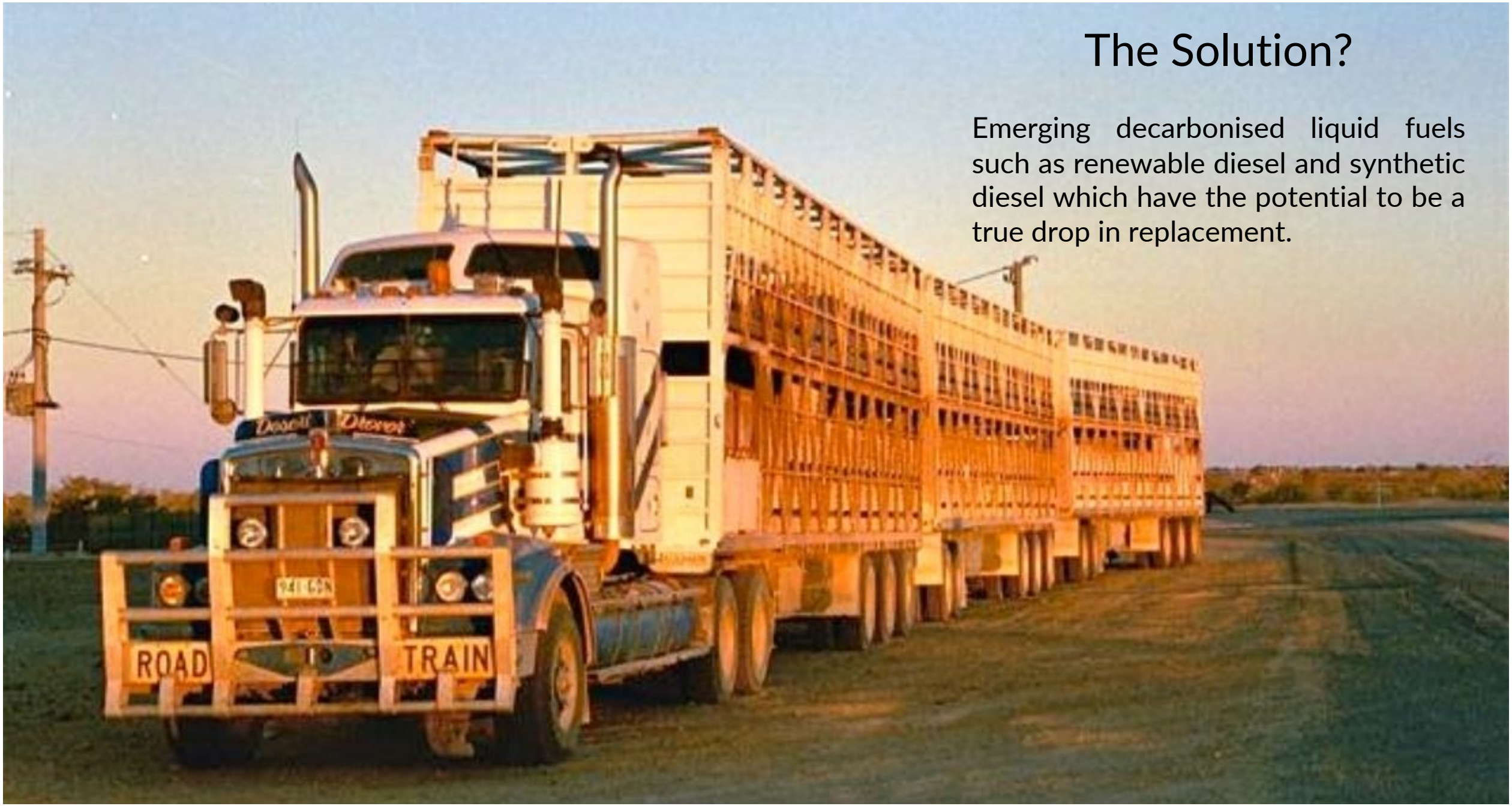
Australian primary industries and construction are dependant on diesel which is energy dense, transports readily, stores well and provides fuel efficiency and desirable torque characteristics. 84% of total energy consumption for the sector comes from diesel (DCCEW,2022d) and 90% of Australia liquid fuels are imported (DCCEW, 2022B). Fuel security, price volatility and the countries legislated emission reduction target of 43% and net zero emissions by 2030 (Law council of Australia, 2022) are drivers to begin transition away from fossil fuels.

The Problem

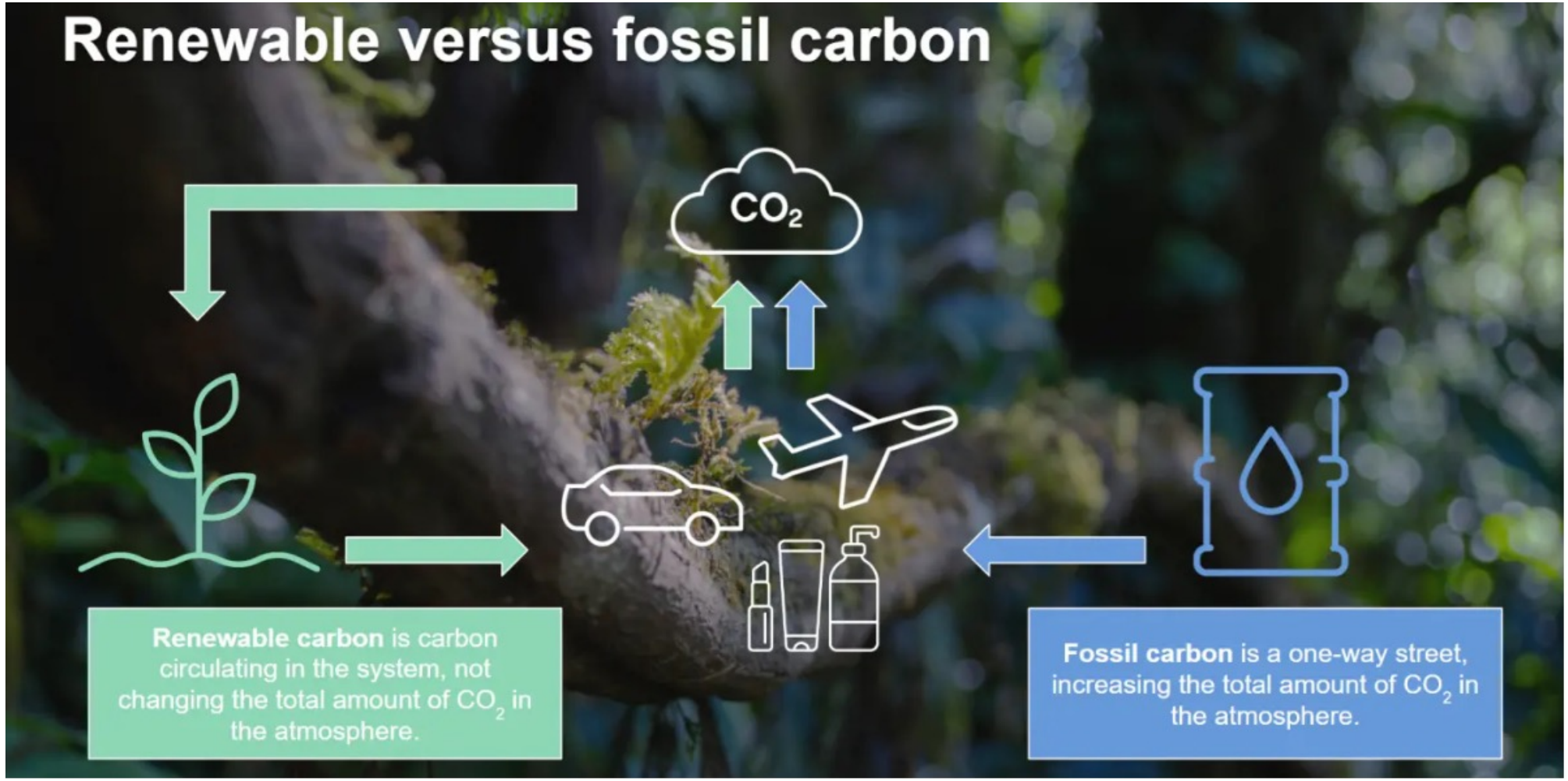
Whilst there is significant political and technical development enabling electrification or partial electrification of the small and medium Australian fleet there are growing concerns about the practicality of this approach through BEV and FCEV technology for heavy off road remote applications with typical long duty cycles and a long lived asset base.

The Solution?

Emerging decarbonised liquid fuels such as renewable diesel and synthetic diesel which have the potential to be a true drop in replacement.

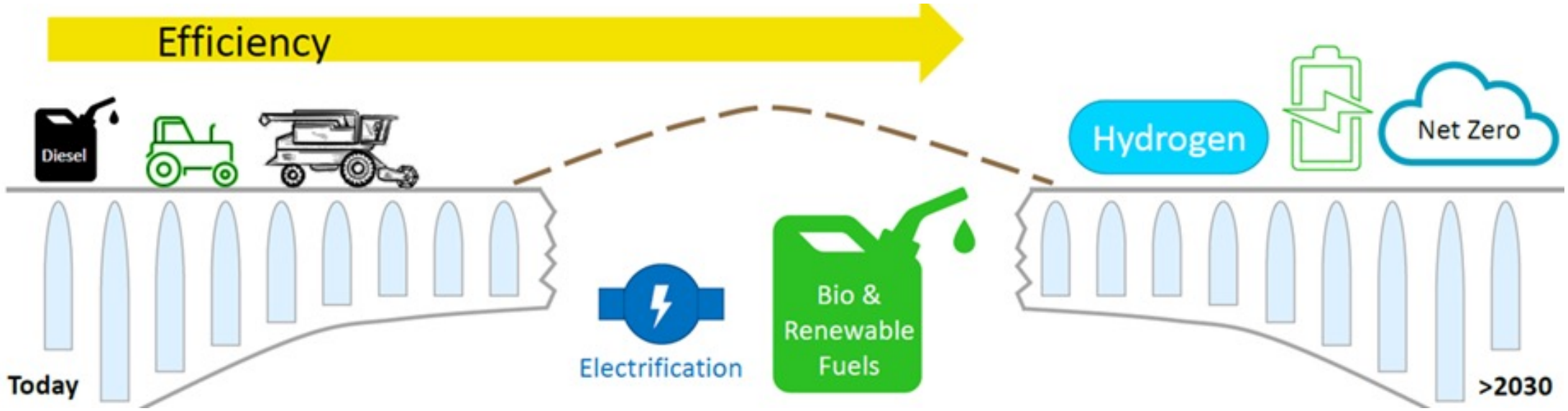


Renewable fuels vrs fossil fuels .... (SAF)



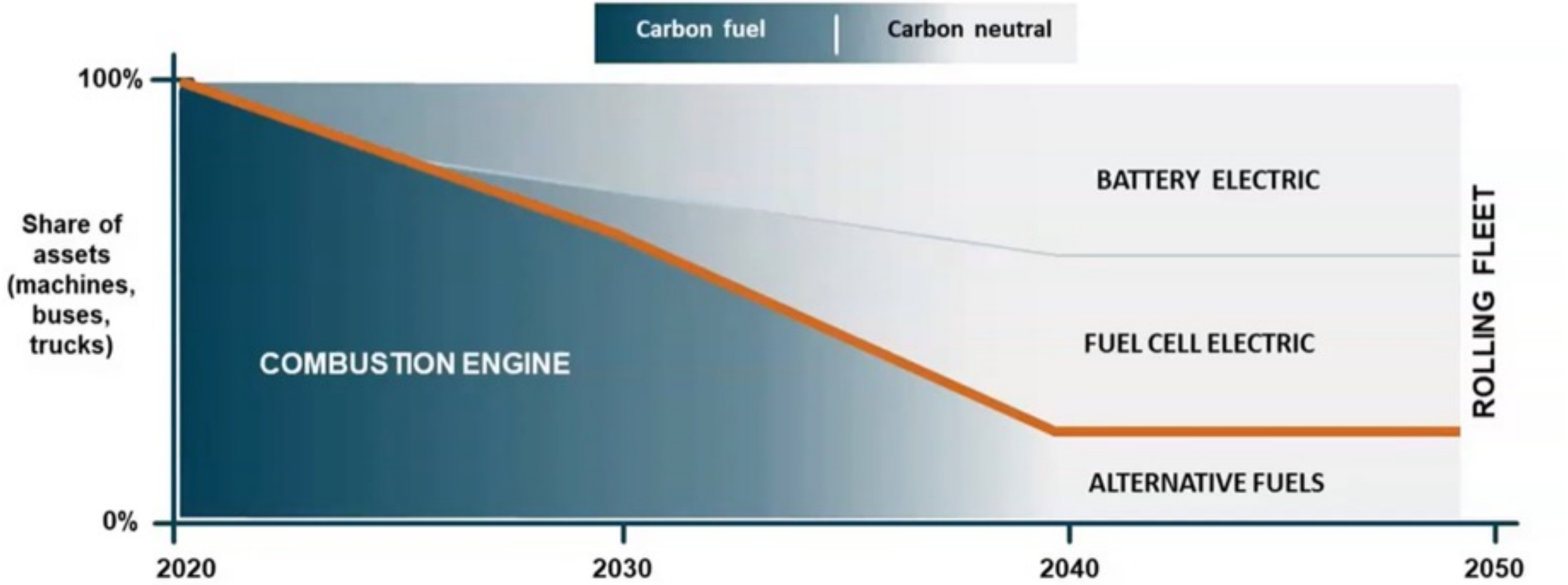
https://journeytozerostories.neste.com/renewable-carbon-cycles#9819afe9

Transition issue = crossing the chasm – with existing machinery…
due to long life of assets and no viable replacement



From Mov3ment report for NSW DPI

VOLVO



Volvo Construction Equipment: Ray Gallant, Vice President, Product Management
Diesel transition… showing multiple pathways

What is low/no carbon fuel & where's it coming from?

Biodiesel (***additive)*** vrs Renewable Diesel (***replacement***)

Renewable diesel sources e.g.

Green Hydrogen - P2X (+ Carbon)

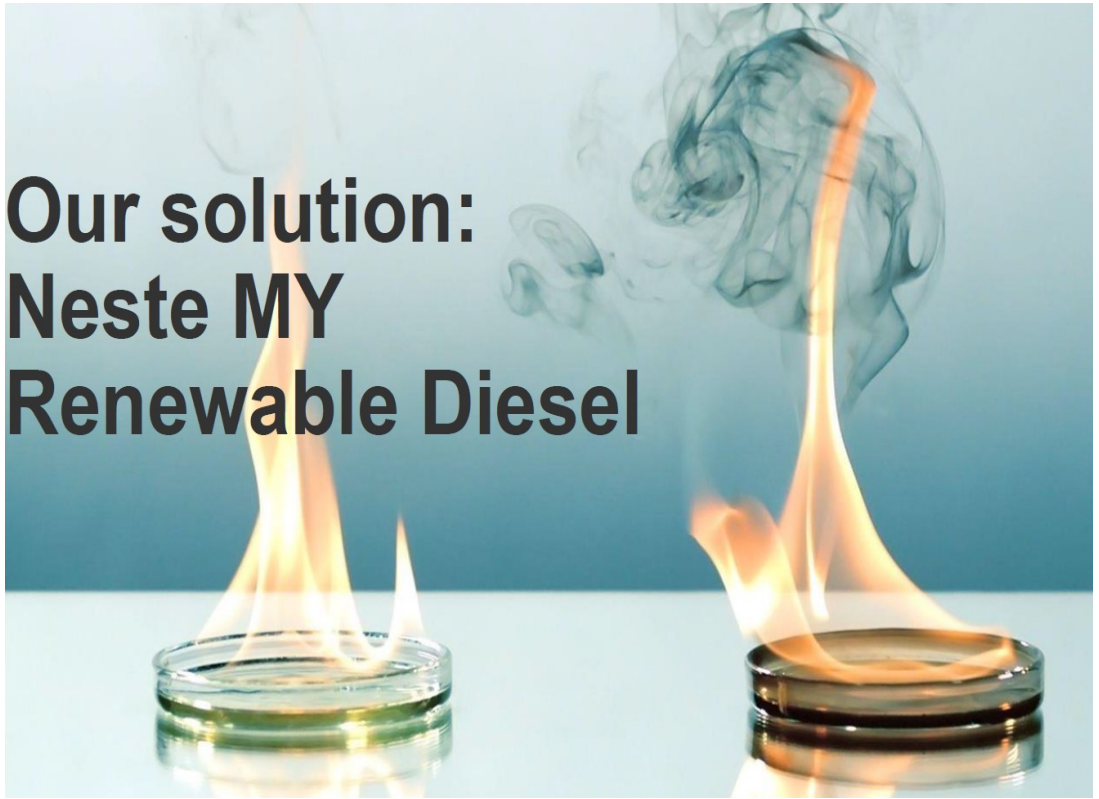
Renuleum - high-temperature pyrolysis + non-catalytic distillation converts waste and biomass to produce renewable diesel, **biochar** and wood vinegar

Southern Oil - reuses waste oil & biomass

Licella - biomass & plastic (high temp water process)

Neste - refines & exports from Singapore (gasification)

Initial fuel- HVO100 then synthetic diesel (e-diesel)



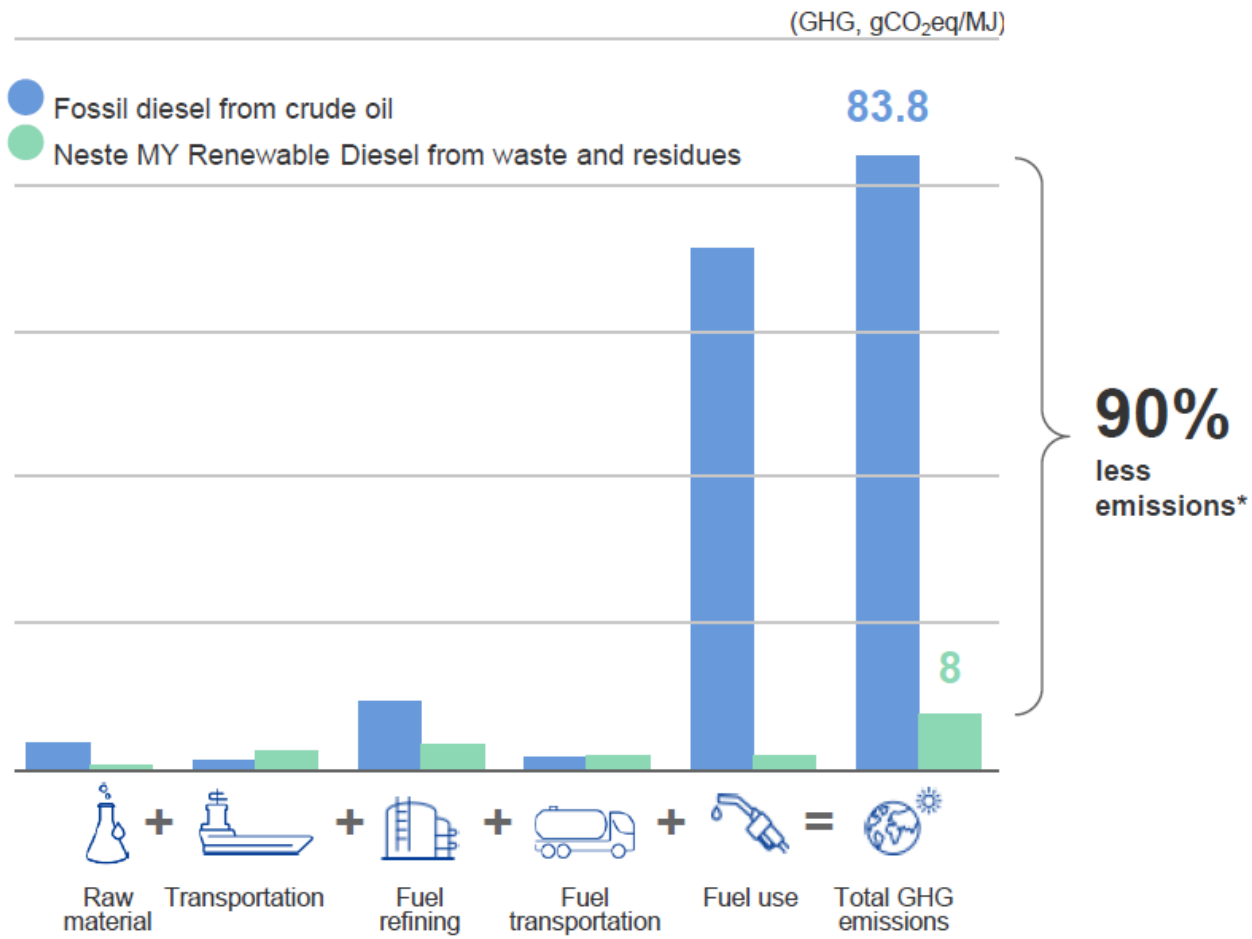
	Conventional fossil diesel	Renewable Diesel HVO100	Biodiesel (FAME / RME / UCOME)
Raw material	Crude oil	Waste and residue vegetable oil	Waste and residue vegetable oil
Chemical composition	C_nH_{2n+2} + aromatics	C_nH_{2n+2}	O II H_3C-O-C-R
Oxygen (wt-%)	≈ 1 (in B7)	0	≈ 11
Cetane number	> 46	> 70	> 51
Aromatics (vol-%)	< 4.8	0	0

FAME /RME /UCOME Methyl Ester = Fatty Acid Methyl Ester/Rapeseed Methyl Ester/Used-cooking-oil

Well-to-Wheel GHG emissions

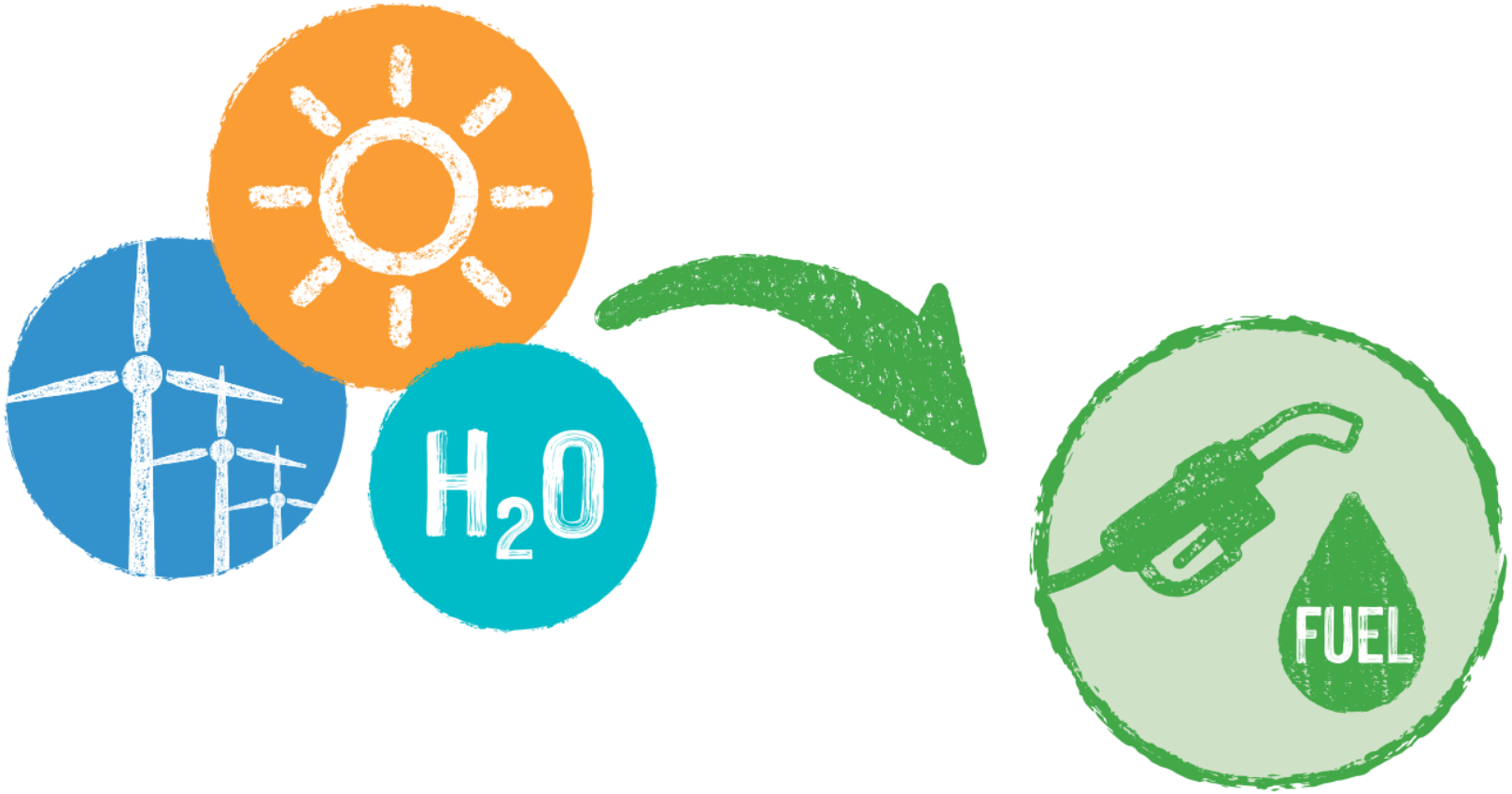
Comparison between Fossil diesel and Neste Renewable Diesel

- In the case of fossil fuels, majority of the carbon footprint is caused during fuel consumption
- For Neste renewable diesel, as a biofuel, the fuel use equals 0 GHG emissions because carbon keeps circulating in the ecosystem (please see next slide)



*Calculation method complies with the EU Renewable Energy Directive (2009/28/EC)

Renewable fuels eg SAF (sustainable aviation fuel) & P2X *(Power to X)*



Green H_2 + C source can be made into long chain Hydrocarbons (fuels)

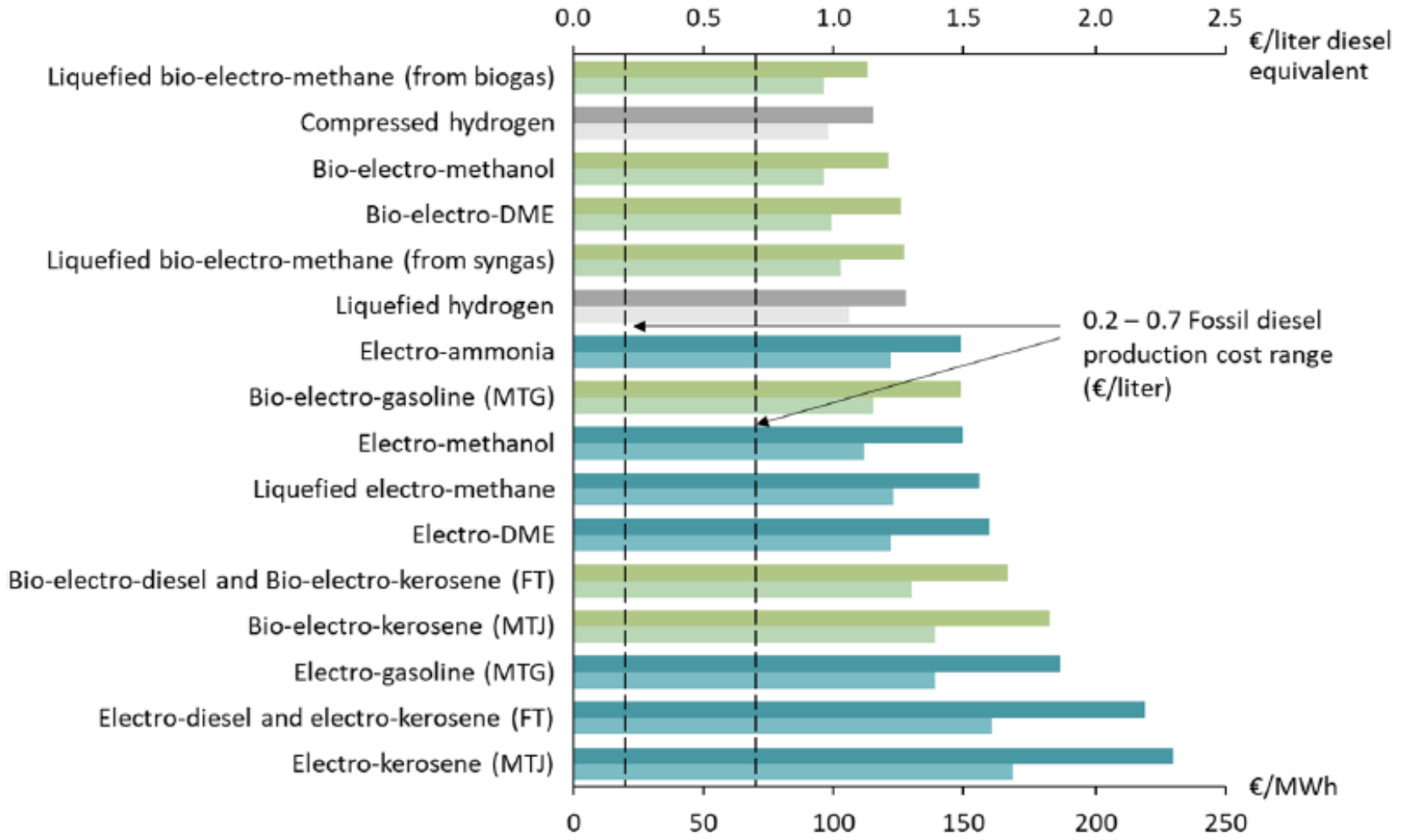


Figure 5. Production costs for electrolytic hydrogen, bio-e-fuels, and e-fuels using base values from the literature review (see table 7). Costs include factors presented in figure 4 except for the potential revenues. The near-term costs, approx. 5–10 years in future, are the dark-colored bars and long-term costs, approx. 20–30 years in future, are the light-colored bars. The black dotted lines show production costs of fossil gasoline/diesel/kerosene for an oil price of $30–$100/barrel [69]. Acronyms used: DME, dimethyl ether; MTG, methanol-to-gasoline; MTJ, methanol-to-jet; FT, Fischer–Tropsch.

TOPICAL REVIEW – **OPEN ACCESS**

Review of electrofuel feasability – cost and environmental impact.

Maria Grahn et al 2022 Prog. Energy 4 *032010*

Summary

- Diesel fuel are vital to ag production. (as are fertiliser and chemicals)
- Fuel will be needed for many years to power current and new machines
- Fossil Diesel Alternatives all come with increased cost.
- Ag is a price taker in global commodity markets.
- The CHALLENGE is to remain VIABLE and successfully TRANSITION to low emissions production.
- Domestic production of renewable fuels,(& fert and chemicals) using renewables energy may allow us to meet that challenge.
- *(& improve fuel security)*

- How do we build awareness of these issues…….

Beyond Fossil Diesel Project

Electrification and Energy System Network
NSW Decarbonisation Hub

May 2023-June 2024

Lead = Michael Cashen
Research Officer- EES NSW DPI
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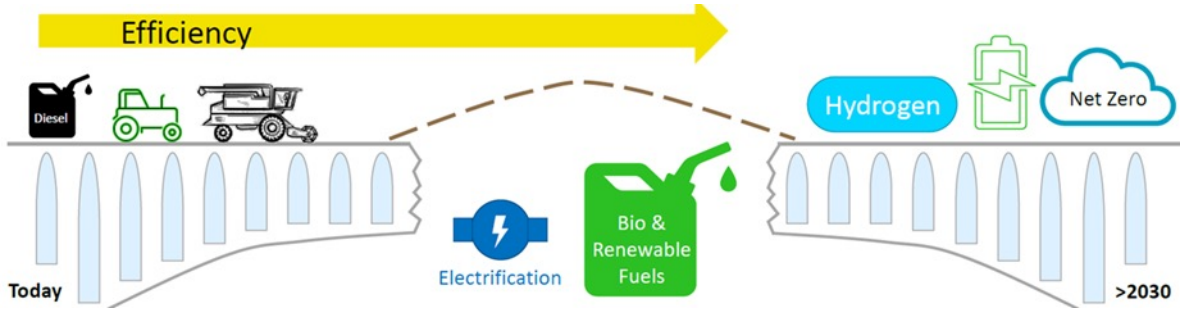
https://www.dpi.nsw.gov.au/dpi/climate/energy

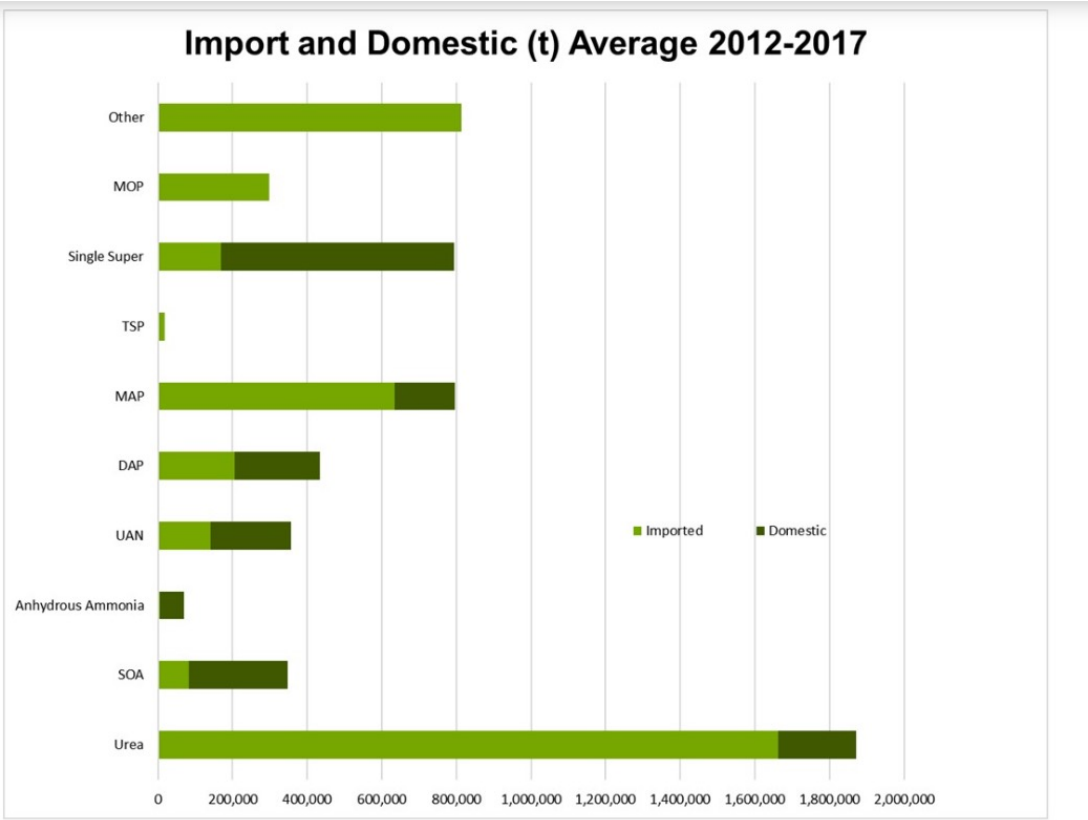

H2 CUTS
POWERING THE FUTURE SUSTAINABLY
NSW Department of Primary Industries
SUSTAINABLE SALONS
NEXT HAIRCUT AVAILABLE
MIPRO
HYDROGEN
METALS
PLASTIC
HAIR
Exploring Beyond Diesel webinars
Low and zero carbon alternatives to diesel, including hydrogen, biofuels and electrification for agricultural applications.

The P2X EXPRESS - will spread the word !!

Thank you for your time.

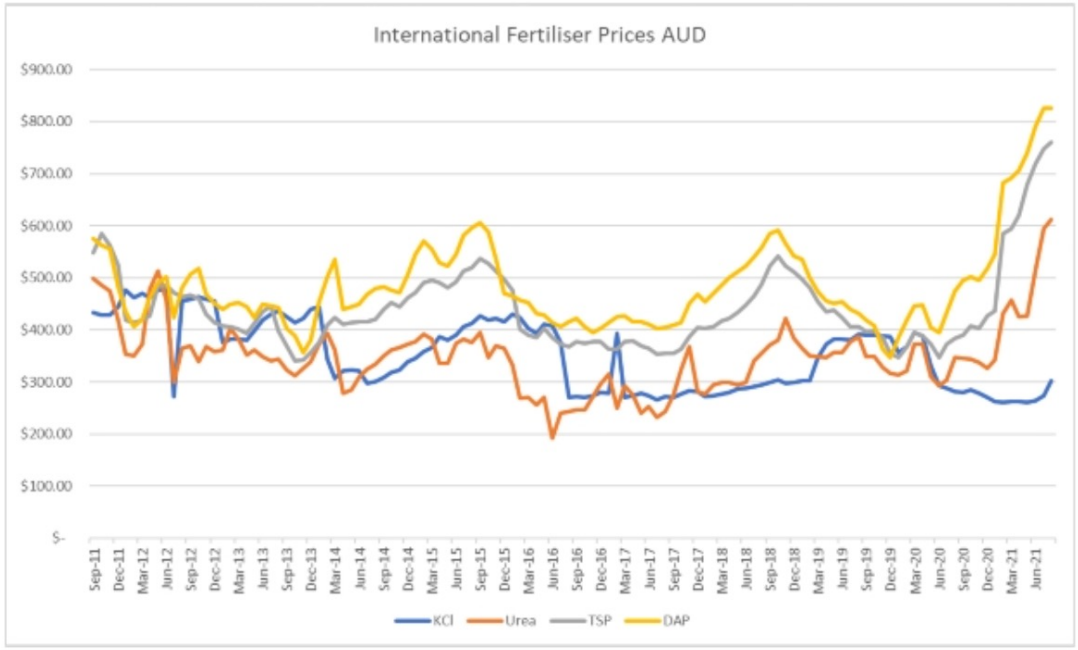


Fertiliser (source and cost)



*The graph shows average fertilizer sales in Australia for the calendar years 2012 to 2017. *Domestic single super is manufactured from imported phosphate rock.*

Source: https://fertilizer.org.au/Fertilizer-Industry/Australian-Fertilizer-Market



Source: https://fertilizer.org.au/Fertilizer-Industry/Global-Fertilizer-Prices

- A series of regional symposiums exploring viable solution pathways with the heavy off road diesel industry
- Industry surveys and benchmarking to support capacity building of the hub
- Development and publication of knowledge sharing materials
- Future ~Stage 2- partial electrification (4-6yrs) and Stage 3 full electrification (7yrs+)