



Australia's National Science Agency

Do multi-purpose biofuel crops have a place in Australian farming systems?

Anthony van Herwaarden and Allan Green



Key messages

- Yes !

BUT

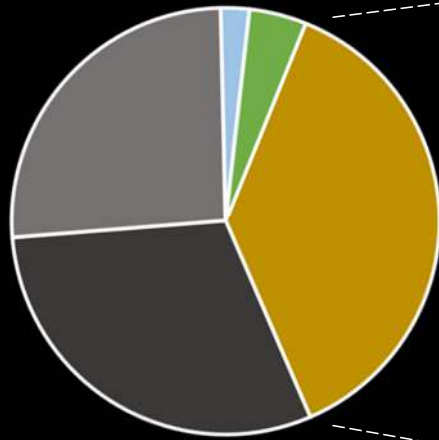
- Australia's Agriculture sector needs to get involved in development of sustainability criteria for biofuel production that is fit for purpose for Australian farming systems.
- Alternative is to have regulation developed overseas in high-input, irrigated agriculture imposed on the farming systems of the worlds driest continent !

AUSTRALIA USES 50 M MT/yr OF PETROLEUM

AUSTRALIA

139 M MT

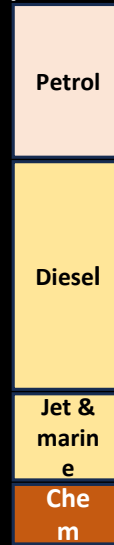
- Oil
- Coal
- Gas
- Hydro
- Nuclear
- Wind/Solar



37%

Energy consumption
(MT oil equivalent)

50 M MT
oil
equivalent

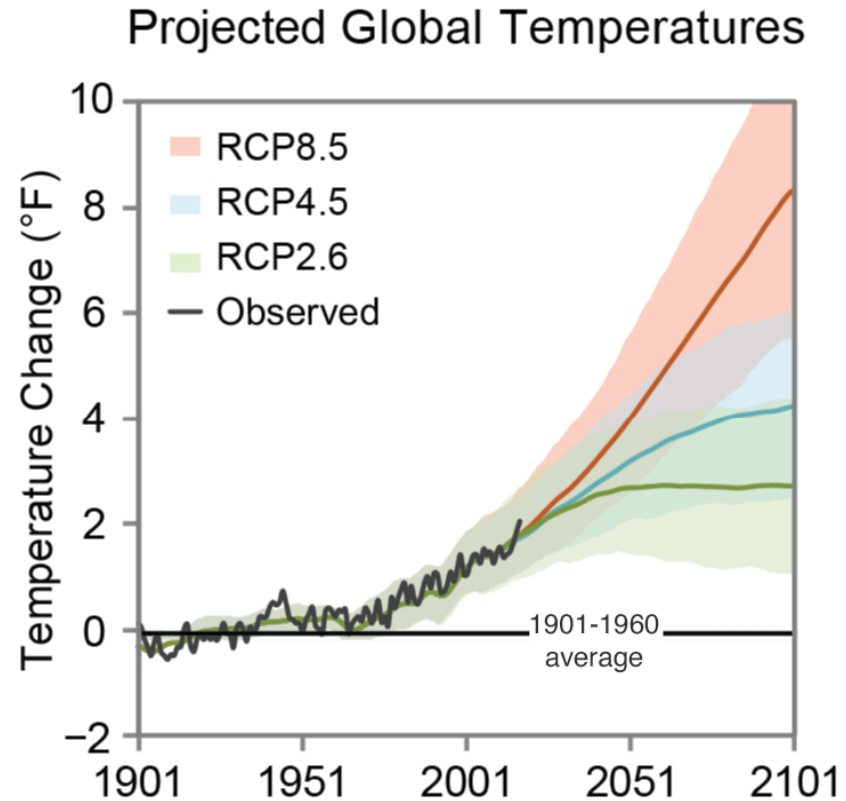
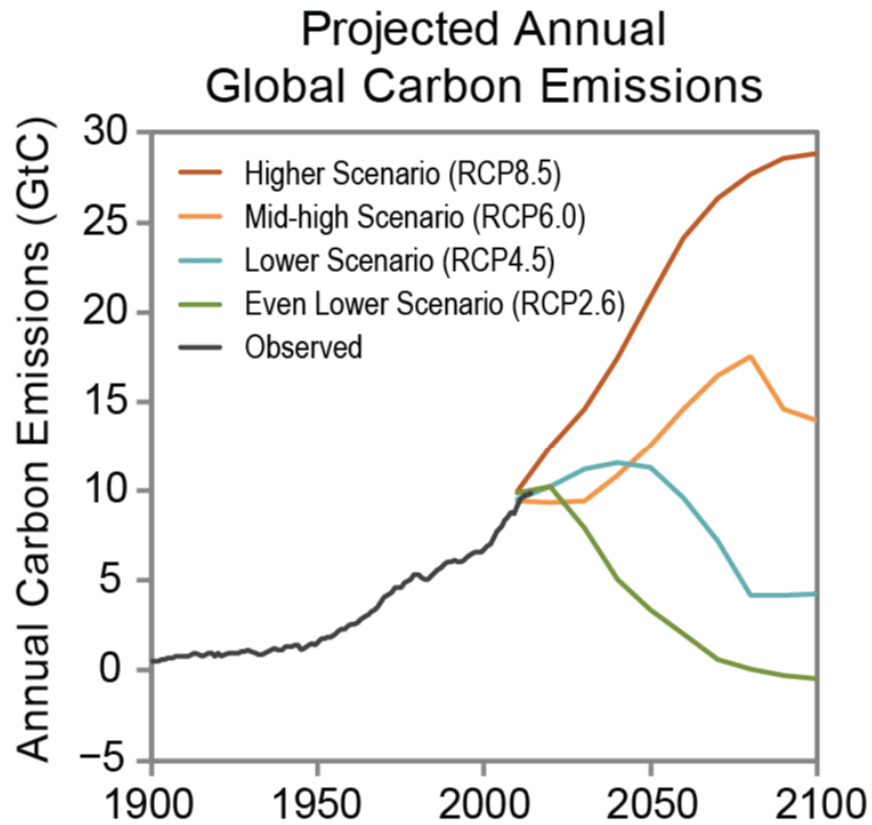


30 M
MT

95% of petroleum
products are
imported



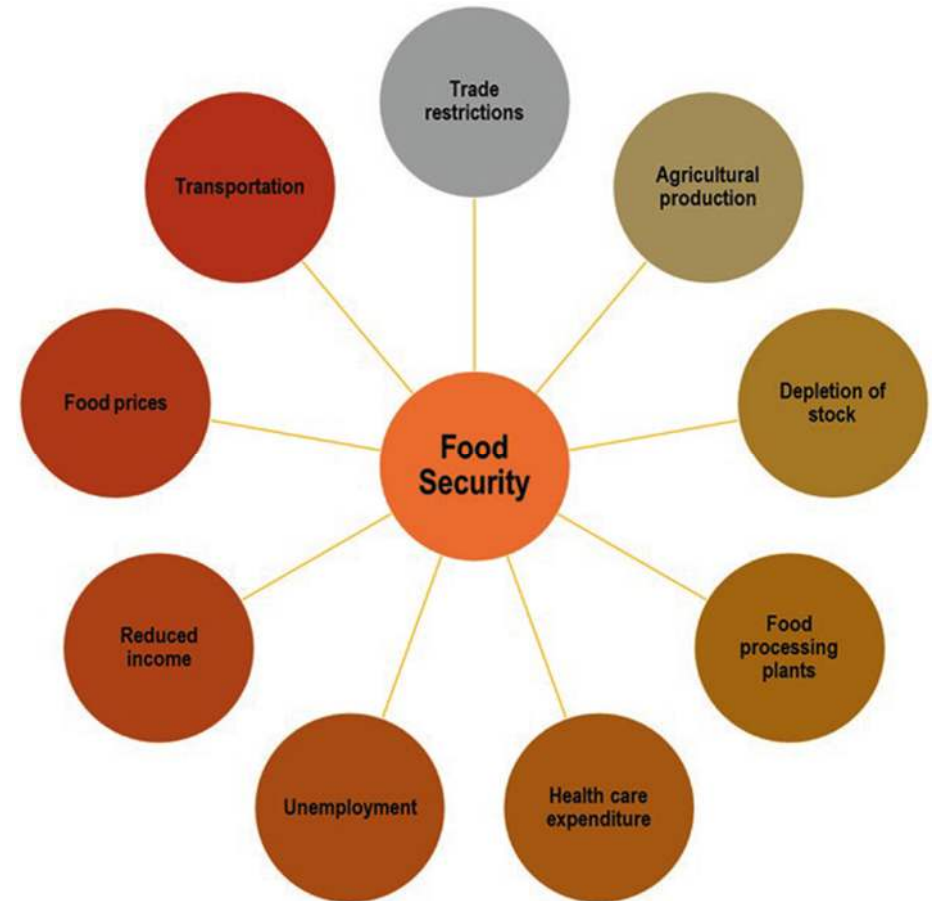
Why we need to reduce CO₂ emissions



2017 Climate Science Special Report, Figure ES-3

Global food security

- World population 8.2 billion in 2024
- Expected to peak around 10.3 billion people in mid-2080s
- Increased affluence, per capita food consumption and dietary trends, will require a 70–100% increase in crop production
- Together with 50% reduction of food waste at the retail, consumer, production and supply chain levels by 2030



Parmeshwar et al., 2020

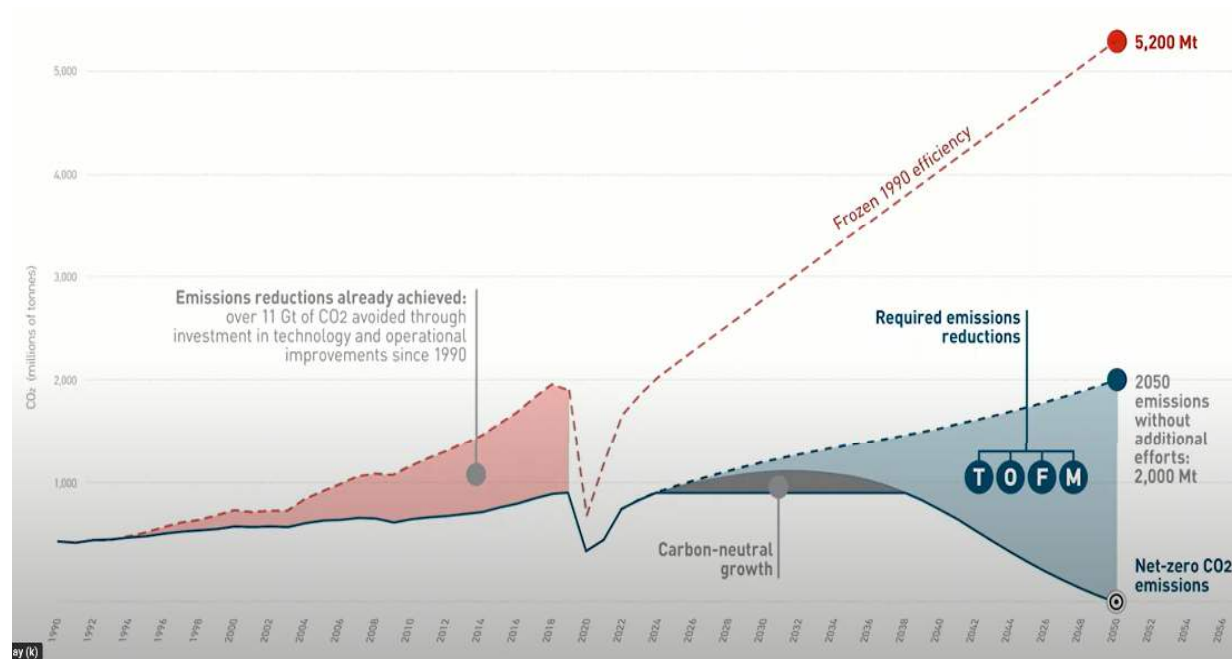
Liquid fuels for hard to abate transport sectors

- Parallel to food challenge, governments and industries need to supply sufficient volumes of sustainably sourced feedstock to produce biofuels
- Globally accepted regulations around Indirect Land Use Change (ILUC) play an important role in ensuring that biofuel crops are produced sustainably and do not compete with crops grown for food.
- Focus on liquid fuels for hard to abate sectors



Global aviation industry continues to grow

- Despite COVID demand doubles by 2020
- Post-COVID commitment to grow sustainably
- IATA and ICAO commitments
- Carbon neutral by 2050

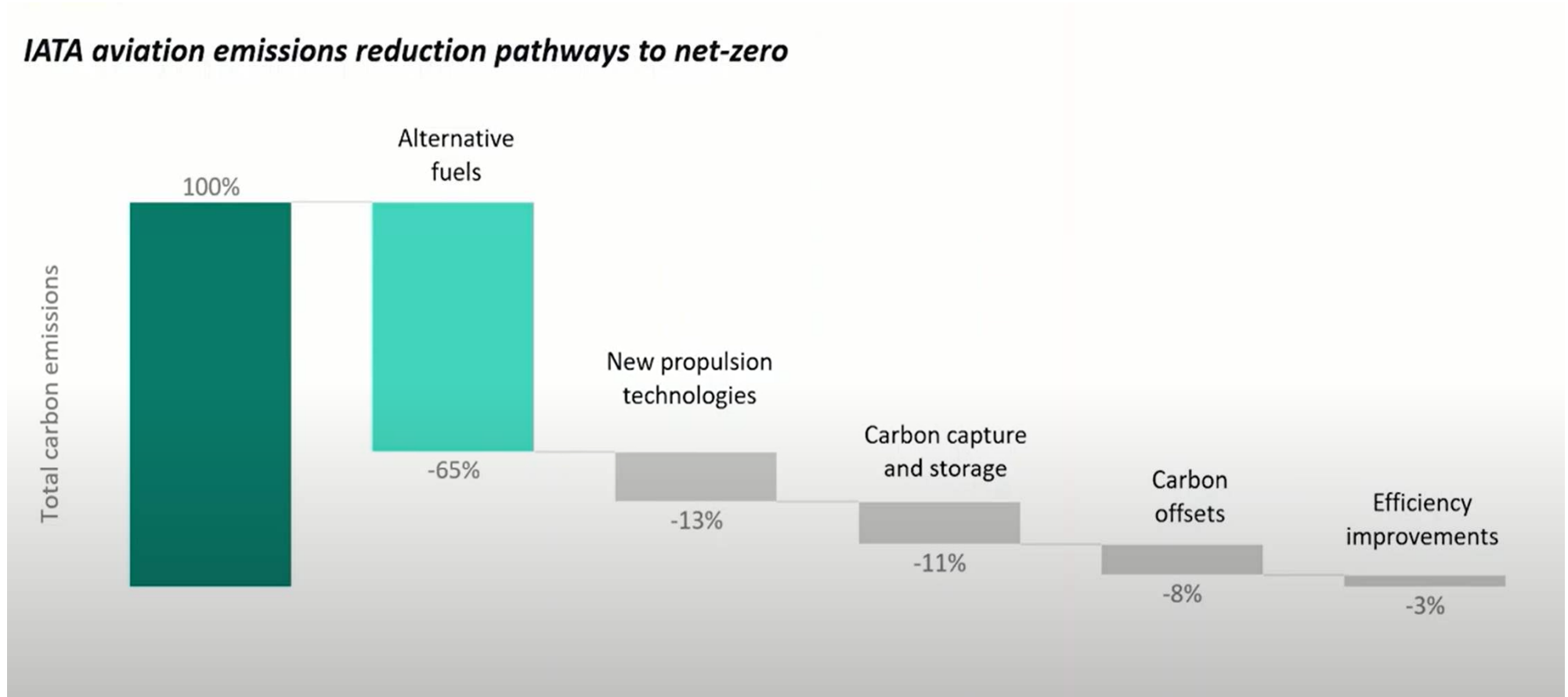


Global aviation industry continues to grow

- No alternatives to Jet fuel?
- Electric for short flights in 20-40yrs
- Current annual shortfall in SAF supply
- All solutions needed, all players welcome
- Currently no sustainability certification for SAF in Australia
- Carbon Offsetting and Reduction Scheme for International Aviation (CORSA), cross jurisdictional enabler



Sustainable aviation fuels are focus of net zero pathway



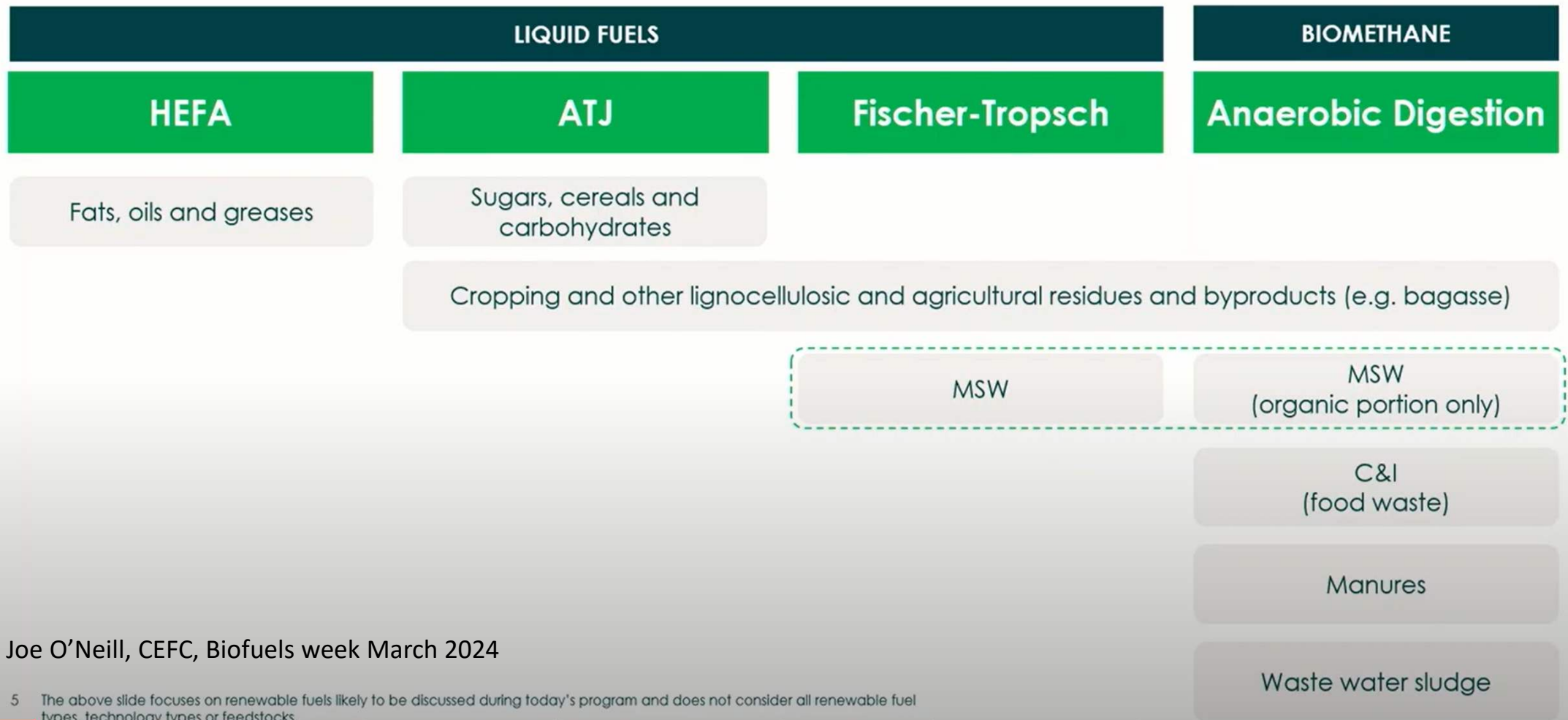
Jack Shepherd Blunomy





Technologies and feedstocks

Conversion technologies can transform a wide range of biomass and waste feedstocks into renewable fuels



Joe O'Neill, CEFC, Biofuels week March 2024

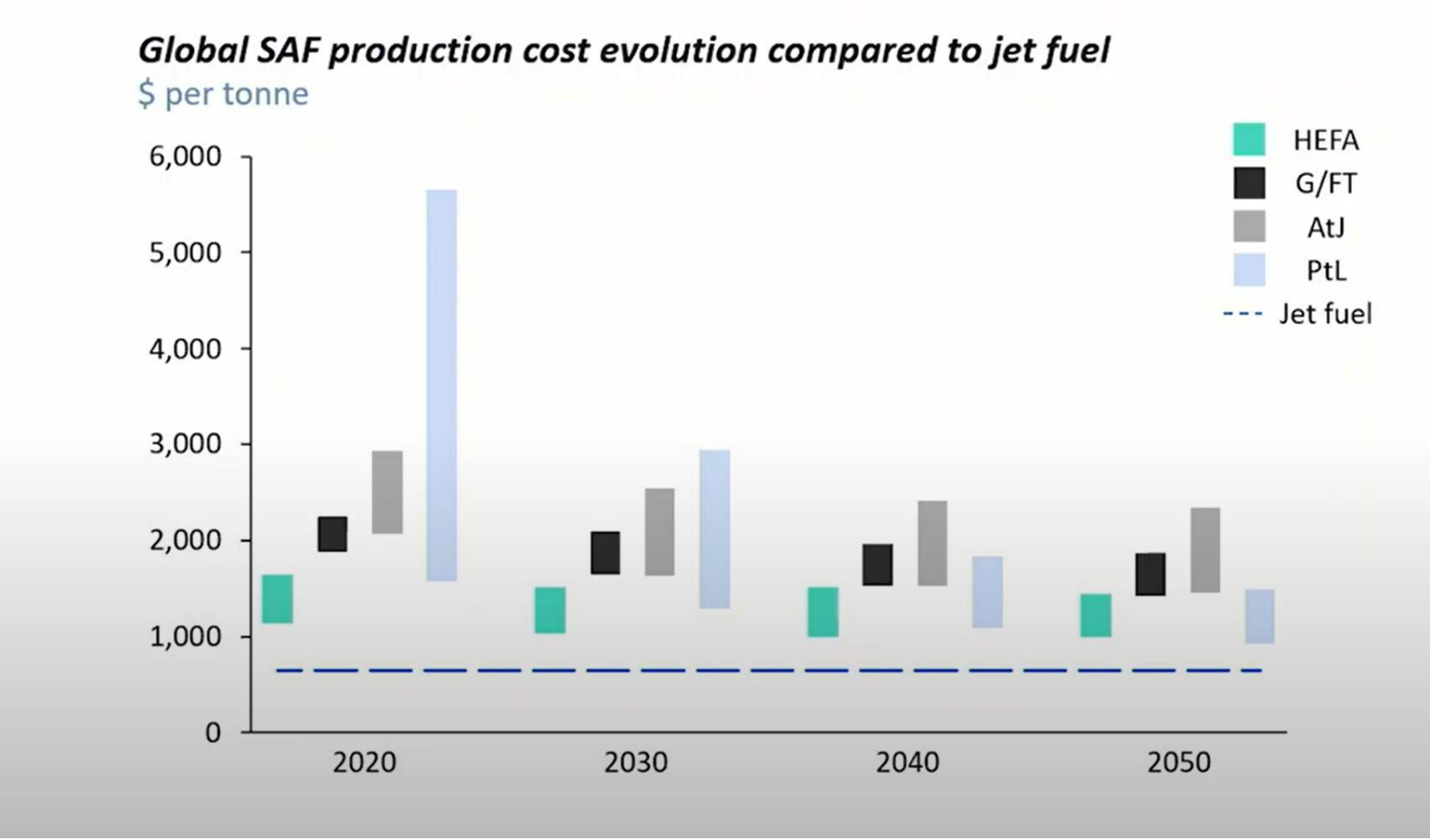
5 The above slide focuses on renewable fuels likely to be discussed during today's program and does not consider all renewable fuel types, technology types or feedstocks.

Feedstock Supply | HEFA requires a portfolio of feedstocks across crop oil and wastes & residues, with crop oil providing majority of growth potential

Availability	Feedstock Type	Production Path	Global availability (Mtpa)	APAC Mtpa (% Share)
Currently available feedstocks	1st gen / crop-based Canola / Rapeseed, Soybean, Sunflower, Palm oil, etc	HEFA	192	98 (51%)
Widely available and traded today	Advanced Tall Oil, Technical Corn Oil & Fish Oil	HEFA	7	3 (34%)
	Waste Used Cooking Oil & Tallow	HEFA	27	16 (60%)
Novel feedstocks <i>New or experimental feedstocks that have not been commercialized or proven on an industrial scale</i>	Advanced Cover / Novel Crops & Oil Trees	A2J / HEFA	120	54 (45%)
	Waste Agricultural Residues, Forestry Residues, Wood Processing Waste, etc	A2J / Gasification	150	36 (24%)
	Municipal Solid Waste City Waste	Gasification	92	41 (44%)
	Recycled Carbon CCS, Industrial Waste Gas, Reusable Plastic Waste	Power-to-liquid	336	81 (24%)



Price profiles for different technologies



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Grow more oilseed crops



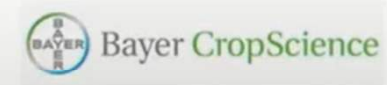
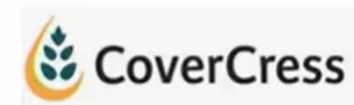
Carinata



Camelina



PennyCress



Grow more oilseeds

Australian agriculture covers a wide range of environments suitable for various oilseed crops



MORE canola



HEAR Juncea



Carinata



Soybean



Safflower



Linseed/Linola

Sustainable intensification

Brassica carinata yield trials in 2018

- 48 carinata lines, 26 Aust. selections, 22 advanced breeding lines
- 5-8 Aust. commercial canola varieties as benchmarks
- Identify high yielding carinata and comparative physiology
- Diverse locations, sown by collaborators and contractors
- Managed to control insects and weeds
- Score establishment, vigour, flowering dates, height, lodging, shattering
- Harvest yield and seed quality

2018 York yield trial



2018 Cunderdin yield trial



2018 Birchip yield trial



2018 trials highlights

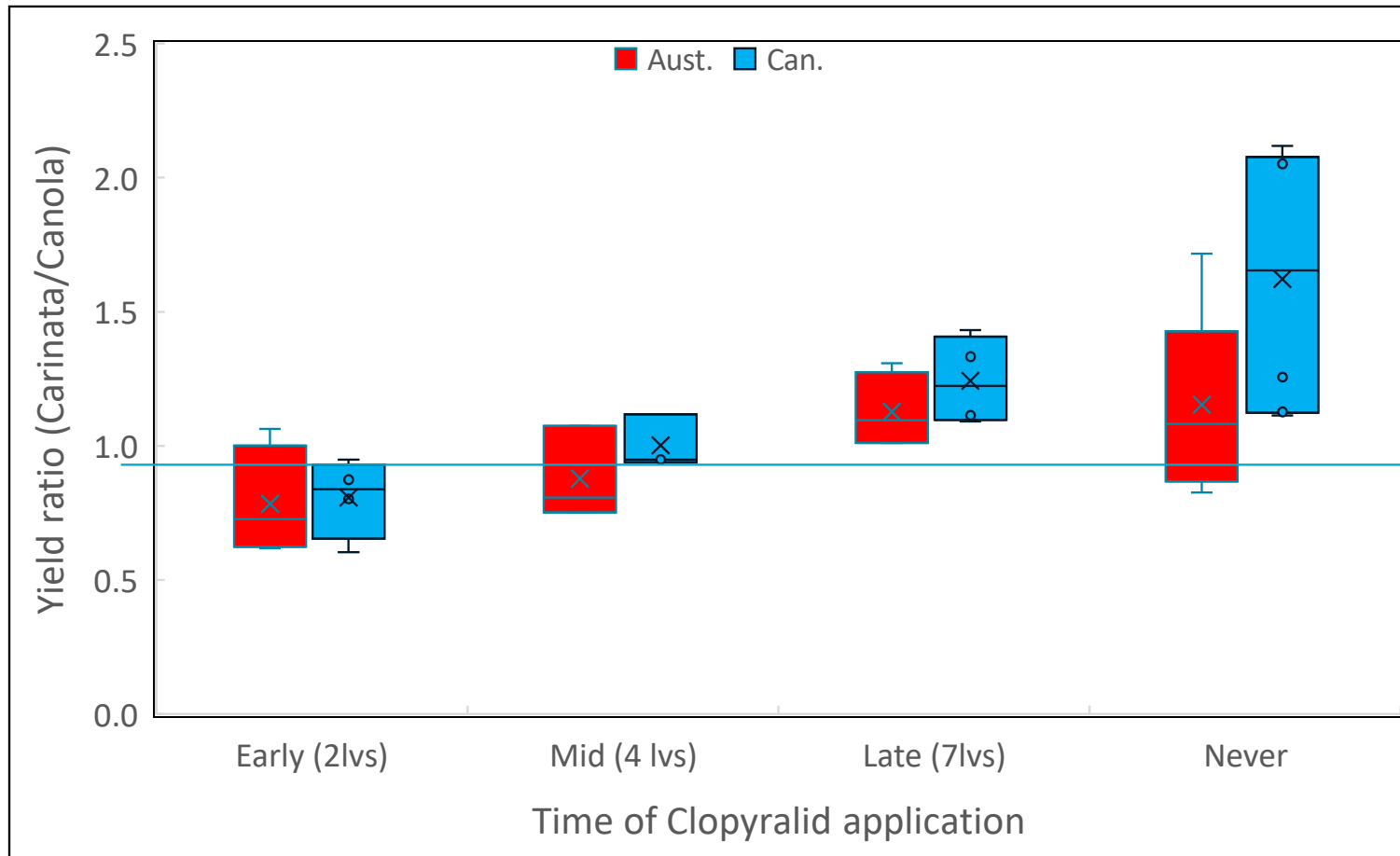
	Canola		Carinata	
	TT	OP/Hyb	DH	Hybrid
DTF (d)	103	100	108	112
Height (cm)	101	112	111	129
Yield (t/ha)	1.07	1.32	1.33	1.42
Oil (%)	43.0	43.6	43.1	41.3
Protein (%)	26.5	25.4	29.5	29.7
GSL (mg/kg)	27.6	27.0	90.7	102.2
N-upt (kg/ha)	68.0	80.5	94.2	101.2



2018 trial highlights

- Establishment and agronomy similar to canola
- Carinata 5-16 cm taller than canola
- Carinata flowered 4-12 days later than canola
- Best carinatas yielded as well, or better, than best canolas
- Yield driven by vigour and N-uptake
- Evidence that very early applications of Clopyralid disadvantaged carinata

Effect of Clopyralid applications on relative performance



Carinata – Multi-purpose oilseed crop

- A “drop in” crop to existing farm operations capable of growing small seeded crops, no new equipment or special requirements needed
- It offers an opportunity for growers to diversify their cropping operations and spread risk
- Brassica break-crop with shatter tolerance and enhanced biofumigation effect
- Graze and grain option for longer season types?
- Carinata is reputed to perform well compared to related Brassica species in environments with stress factors such as drought, high temperatures, and hard frost events.
- High protein seed meal for inclusion in animal rations and possible human consumption
- Additional feedstock to tallow and used cooking oil for biorefining

New Product Lines – New Revenue



1000 Liters Oil
High Erucic acid

Bio-Jet: 380 Litres
Bio-Diesel: 730 Litres

Bioplastics



Sustainable Aviation Fuel



Renewable Diesel



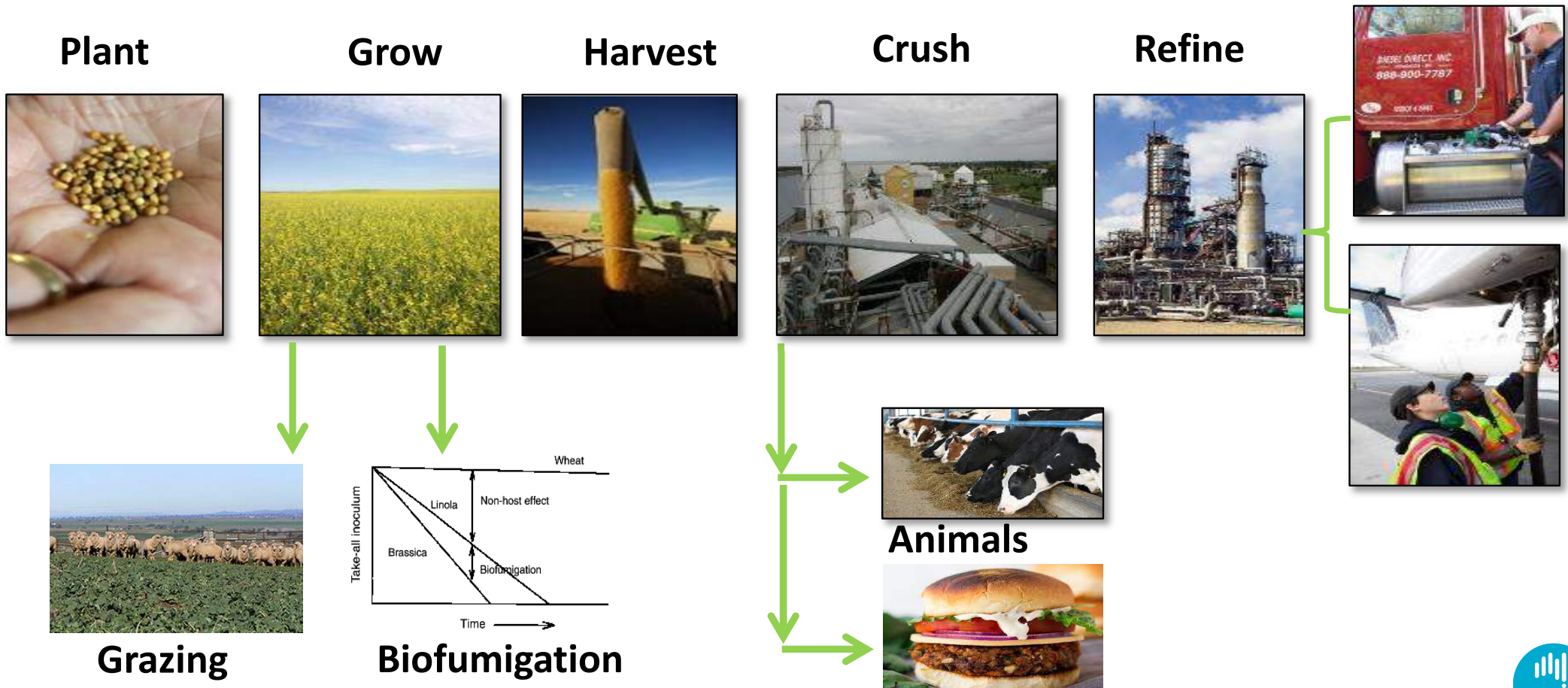
Non-GMO,
Animal Feed



45% Protein
Human cons.

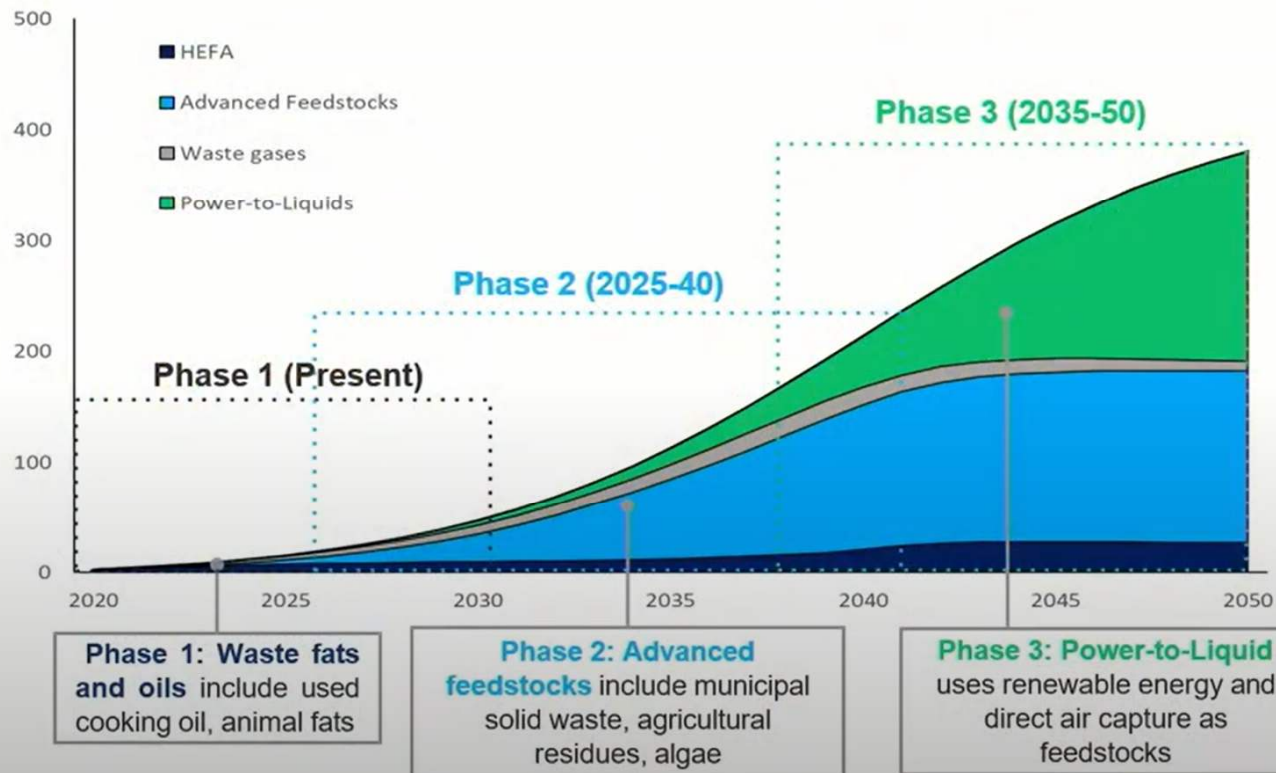


Good fit into existing Supply Chains



Expected development phases of biofuels

SAF industry likely to follow three phases of deployment

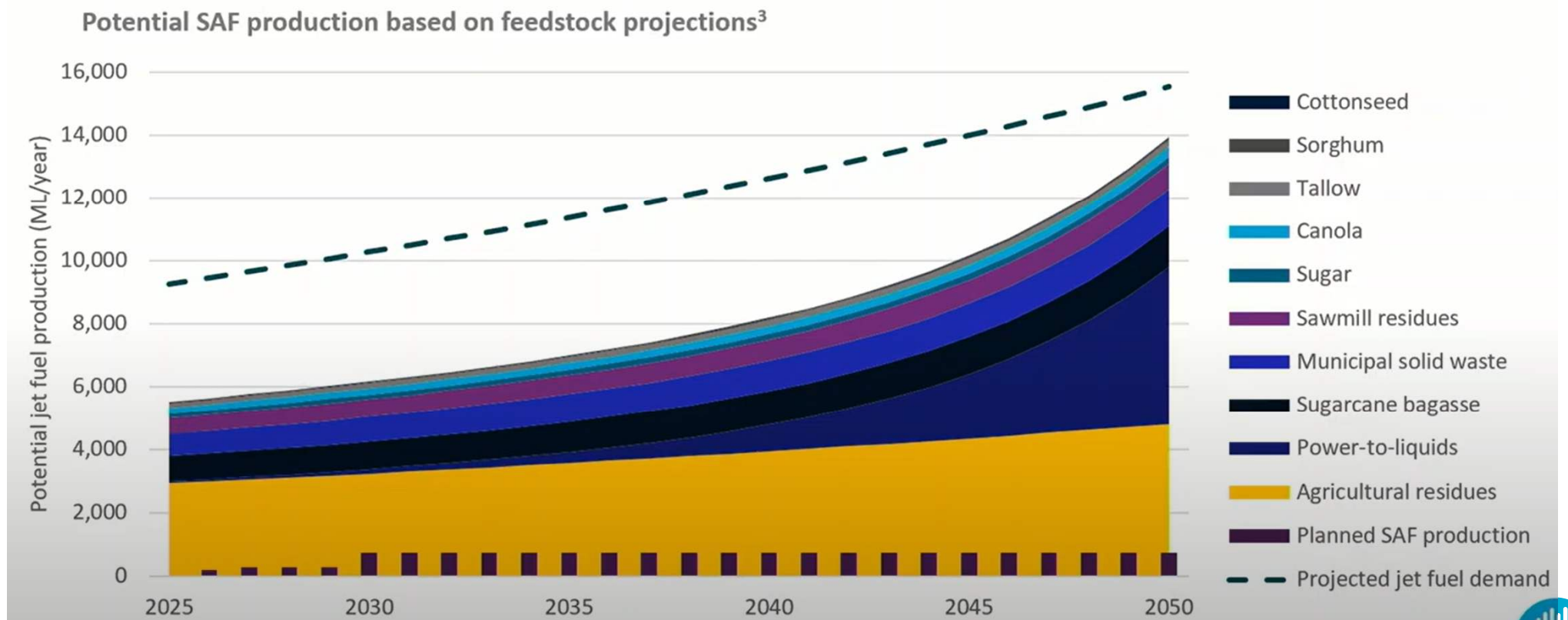


Considerations

- Each phase of SAF deployment will require **tailored investment approach** to accelerate
- **Phase 1:** Less investment focus on waste fats/oils given technological readiness
- **Phase 2:** Strong focus to unlock advanced feedstocks and support developing technology
- **Phase 3:** Focus on developing next-generation technologies for Power-to-Liquids in third phase (e.g., Direct Air Capture, renewable power generation)

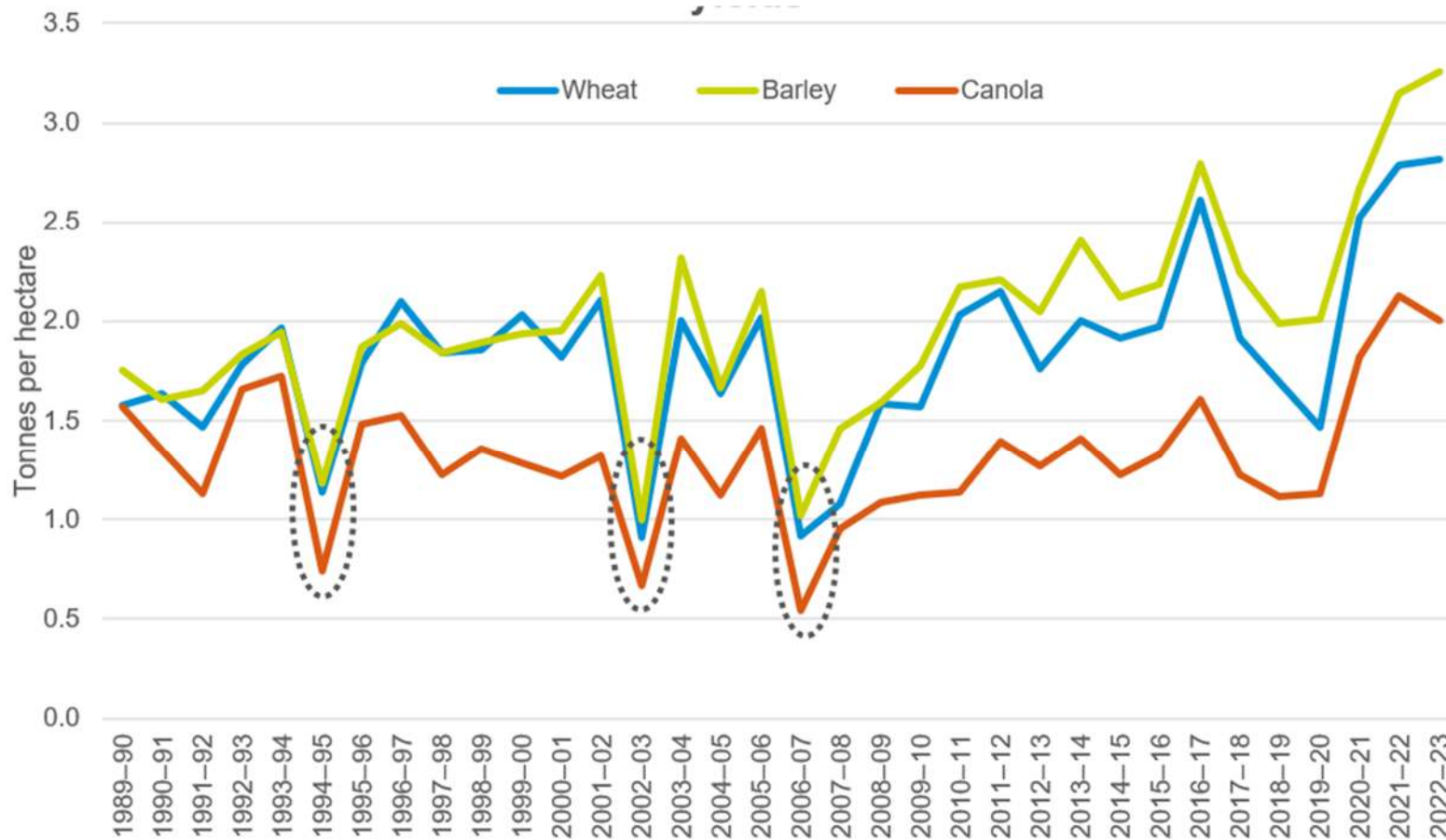
- QANTAS Group

Australian SAF supply expected to be met with local feedstocks



³CSIRO 2023 Sustainable aviation fuel roadmap

Year to year variation in crop yields

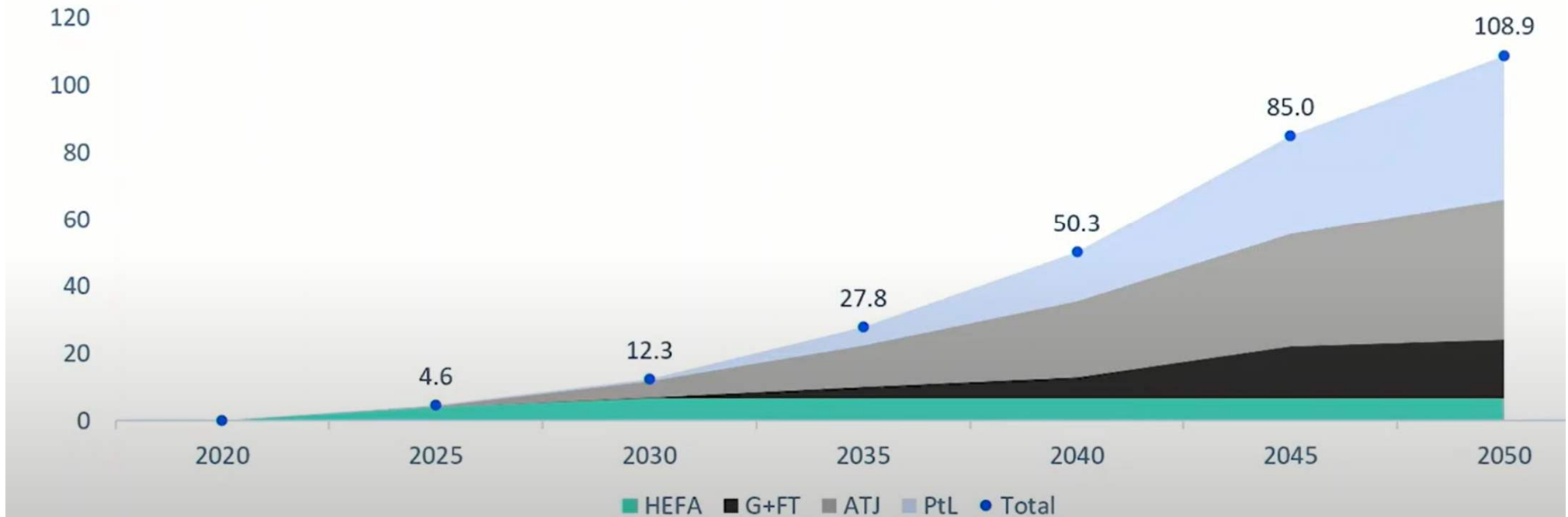


Source: Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)

The need to diversify SAF production

Forecasted capacities in Europe and the US

Billion L per year



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Globally accepted ILUC regulation

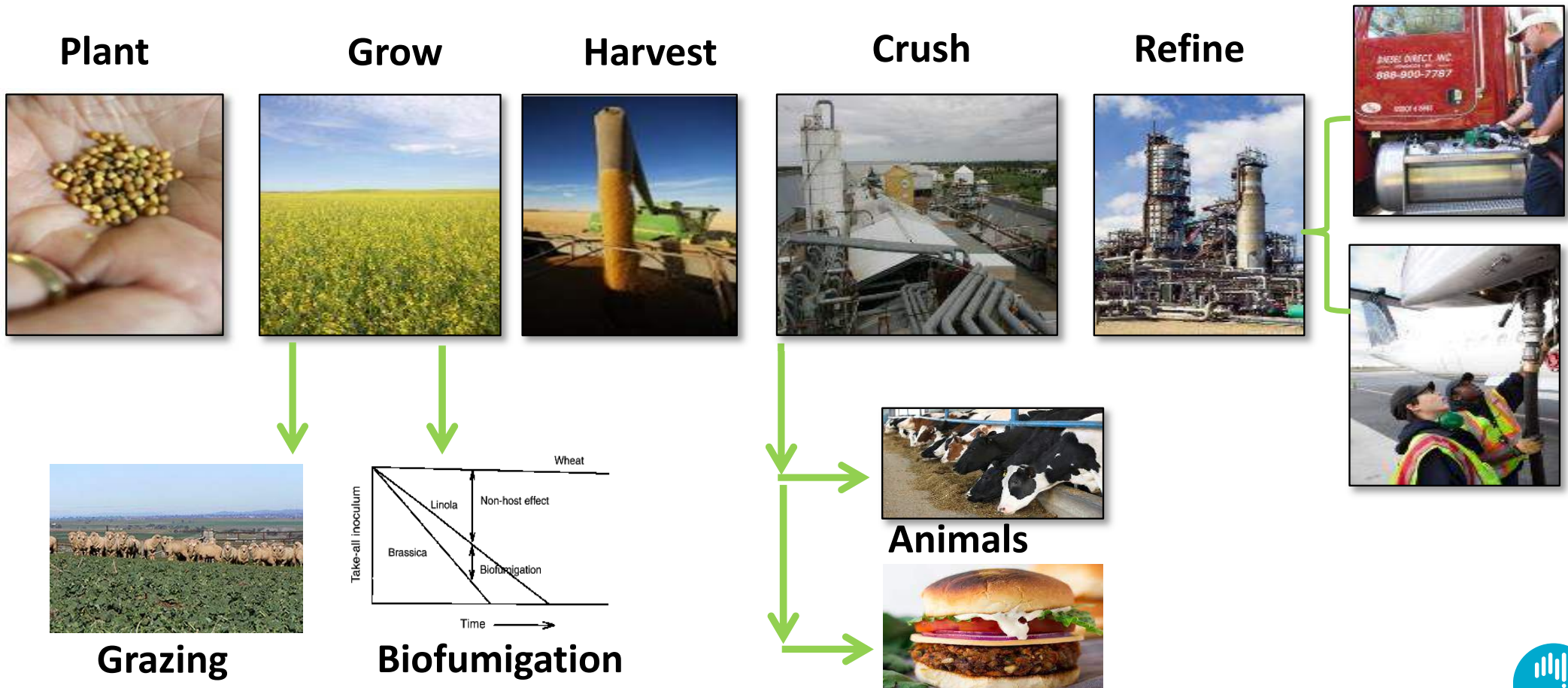
- Food or fuel crop classification
- Biofuel production cannot compete with food production to protect food security
- Globally accepted ILUC regulation is not compatible with Australia's rainfed farming systems
- If we do nothing these regulations will be applied to Australia
- Essentially exclude Australia from producing oilseed biofuel crops

European Union RED III comes into effect in 2030

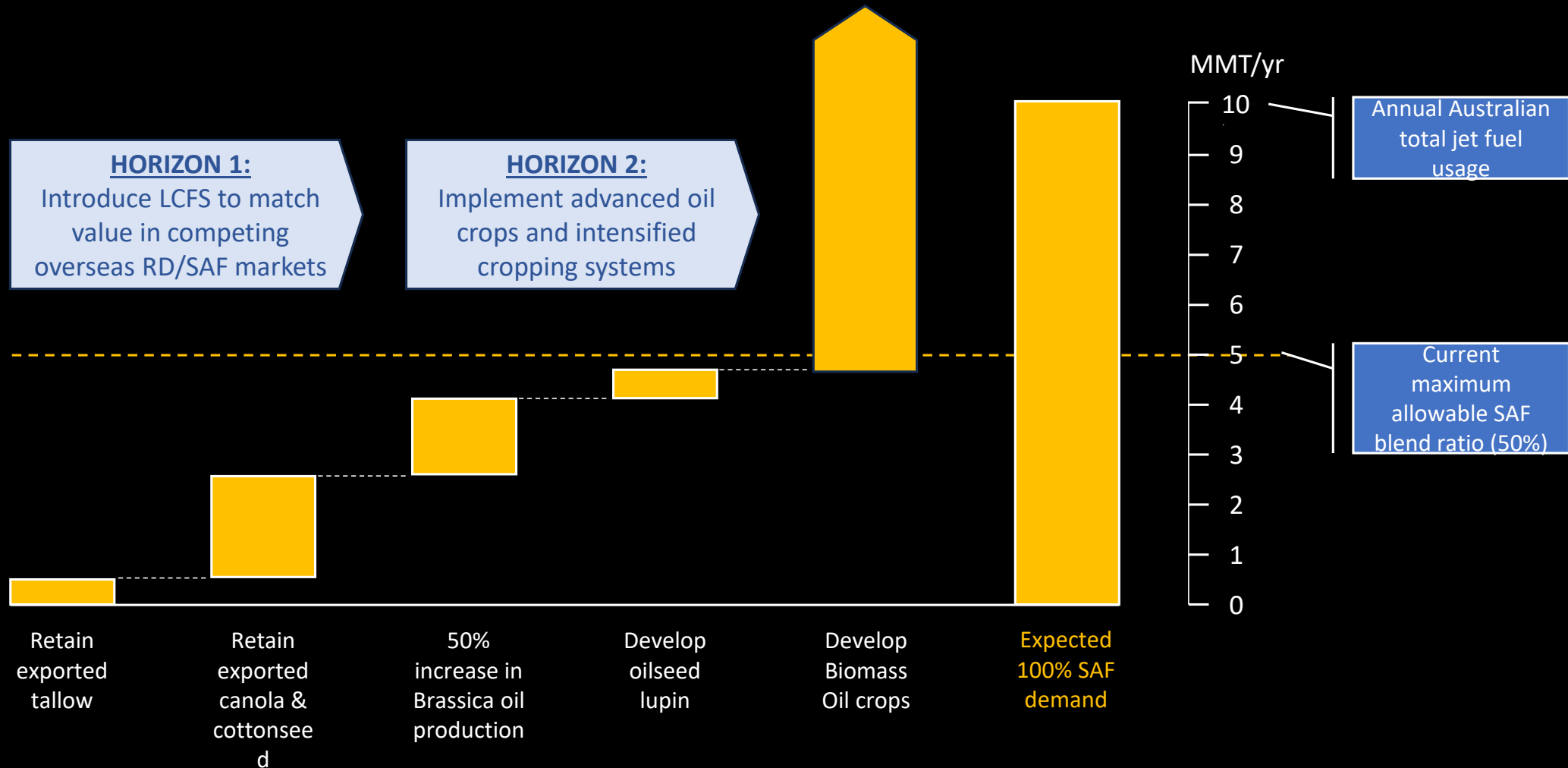
- Under EU RED III Aust canola will no longer be accepted into EU for biofuel
- Deemed high-risk ILUC
- Replacement crops or new markets
- BP announced new biorefinery and Graincorp new crush facility at Kwinana WA
- Domestic use only?



Good fit into existing Supply Chains



A PATHWAY TO AN AUSTRALIAN SAF INDUSTRY



A way forward?

- Avoid dual domestic and international regulation
- Australia needs to argue the case internationally for regulation that fits our farming systems
- Time for a food and fuel classification
- A critical challenge is the lack of enabling policy and legislation in Australia establishing carbon credits or mandates for biofuels.
- CORSIA
- Agriculture sector must get involved in development of biofuel sustainability certification



Thank you

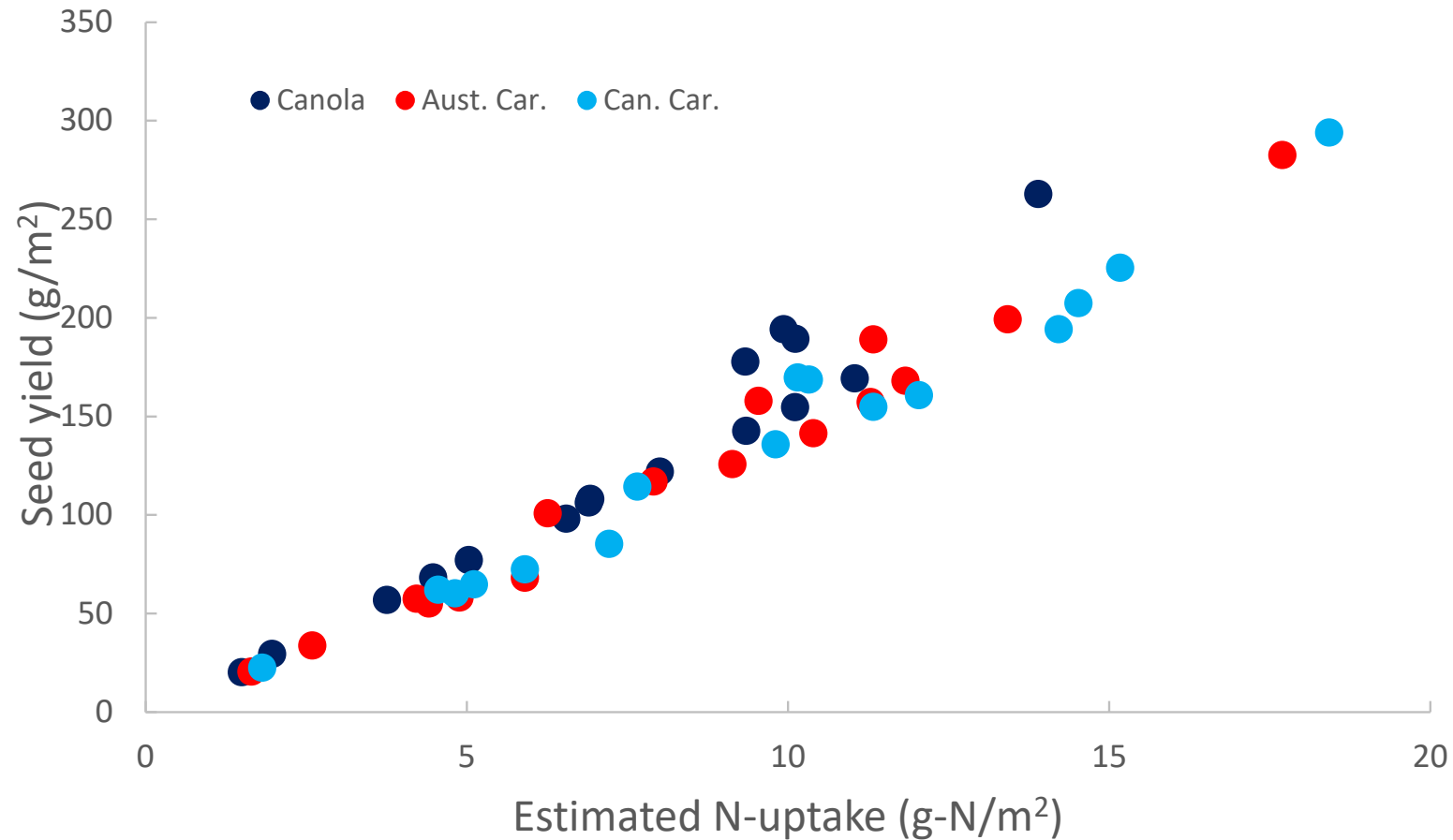
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Associations with seed yield - N-uptake



Associations with seed yield – early vigour

