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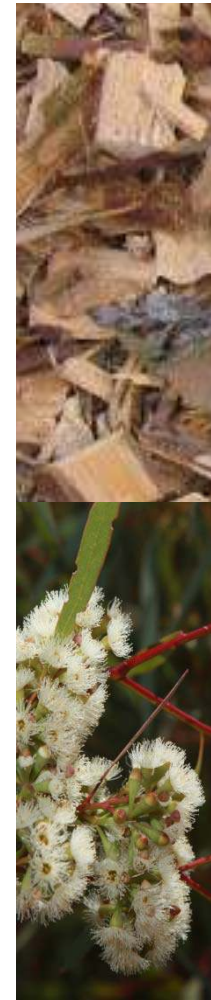
Sustainable mallee jet fuel: Supply chain development & sustainability

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Future Farm Industries CRC
Australia

A project commissioned by Airbus in collaboration with
Virgin Australia, Renewable Oil Corp., Dynamotive and IFPE

CRCA - Innovating with Asia
Perth, Western Australia
May 21, 2014





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Why this project?



Opportunity for WA/Australia

- * Proximity to Asia
- * Potential for large scale production

Technological development

- * Interactive opportunity (Biomass, processing)

Delivering the opportunity

- * Demonstrate sustainable supply chain
- * Fuel certification
- * Economic large scale supply





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Brief (very) history of mallees in WA

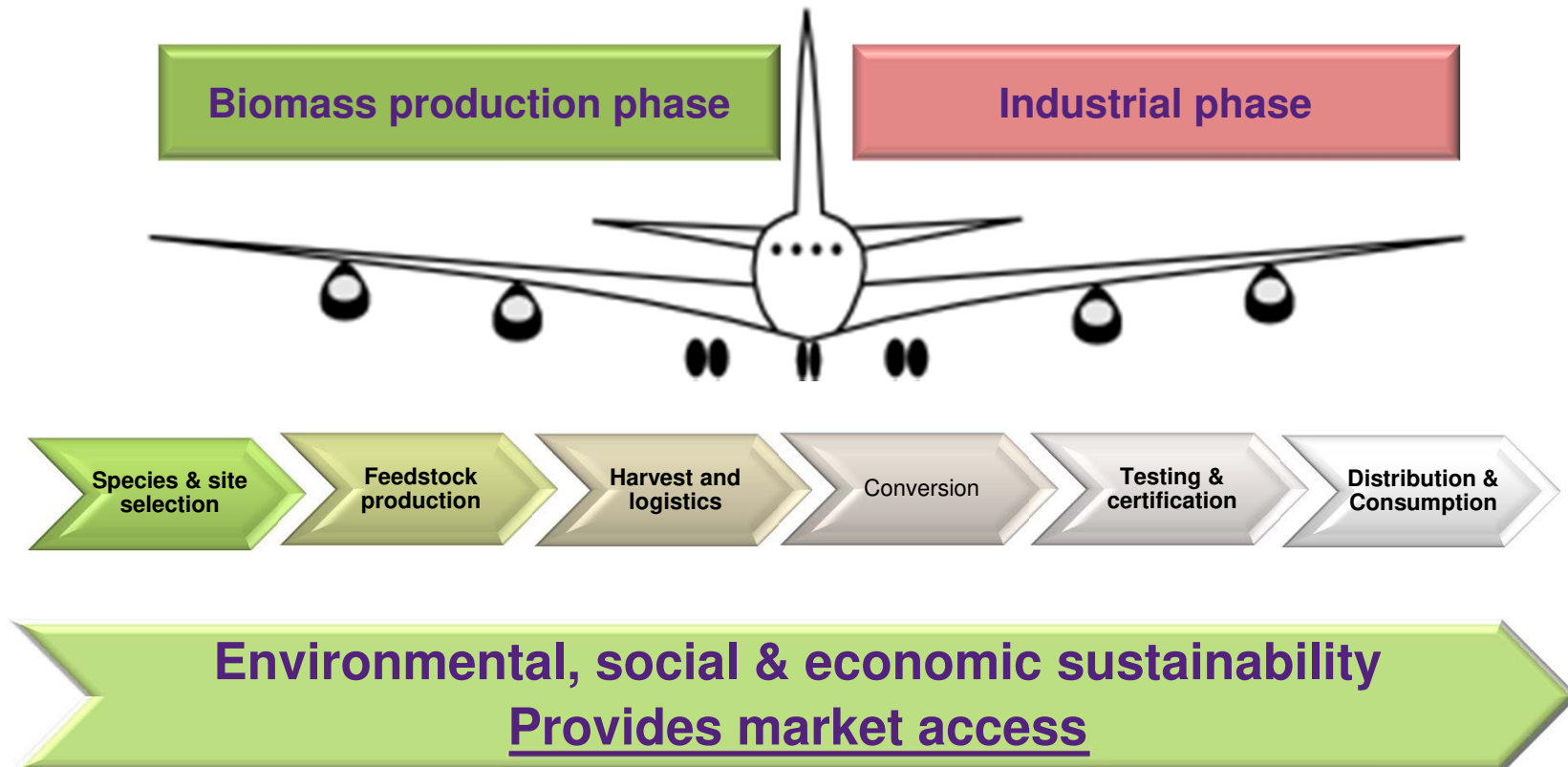
- * **Supply chain development**
20 + year investment, WA Govt & Farmers
- * **Salinity CRC**
 - Deep rooted perennials can manage salinity
 - Extensive areas required to have impact
- * **Future Farm Industries CRC**
 - Need economic options to achieve scale
 - Developed profitable perennial systems
- * **Mallees are a prospective option**
 - Develop new regional industries
 - Reduce the risk of natural resource degradation



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Sustainable Aviation Fuel

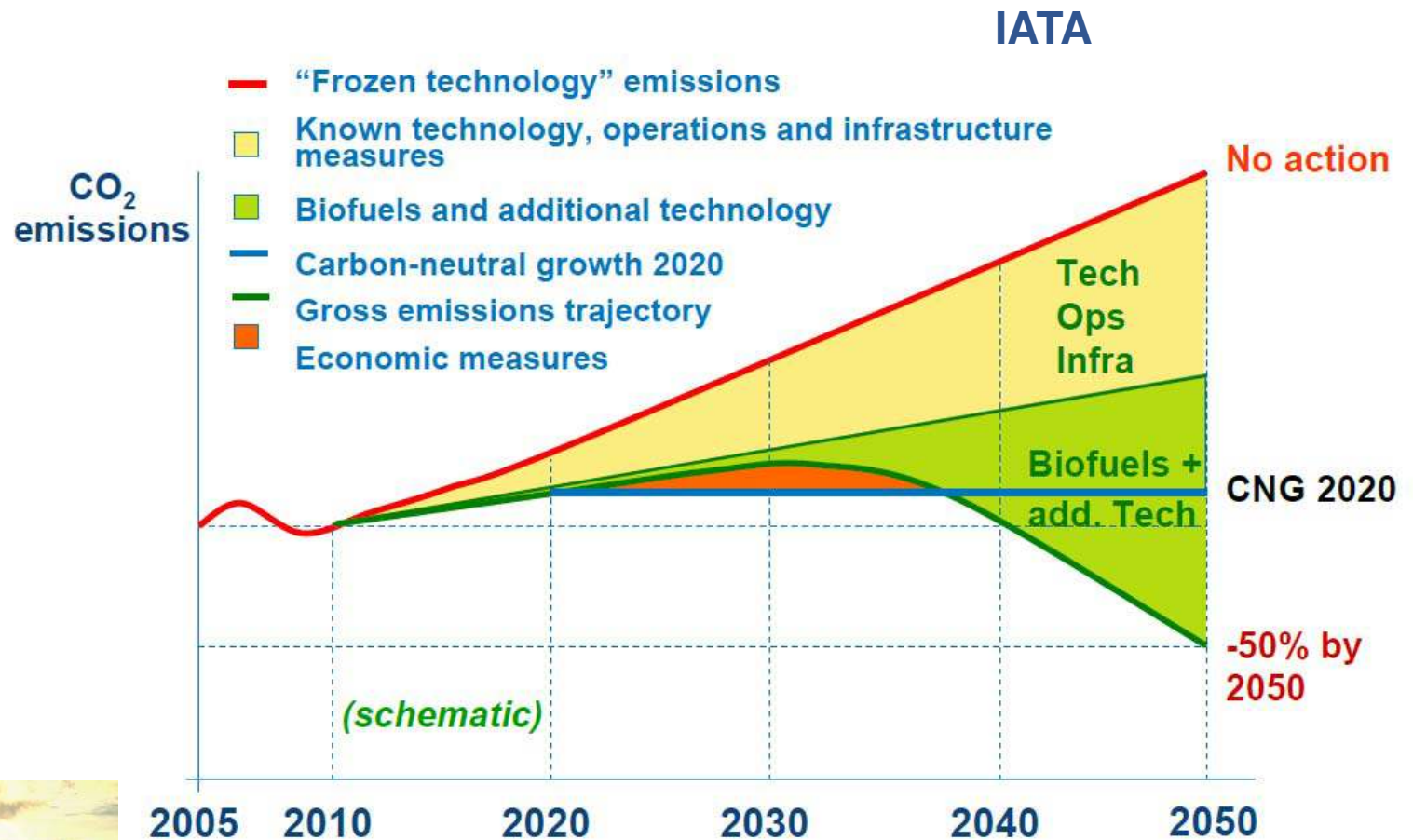
Farm to Fly





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Emissions reduction roadmap



Airbus concept plane



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Why focus on aviation fuel?

* **Aviation industry perspective:**

- Need a high energy density fuel
- No alternative energy sources,
- International and national support for industry targets
- Carbon neutral growth beyond 2020 (IATA 2009)

* **Aust. Aviation:**

- By 2020 need 8B l,
- Target 5% renewable = 400M l
= 4-5 M tonnes dry biomass





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First step sustainability assessment

- ✦ **Round Table for Sustainable Biomaterials (RSB)**
- ✦ **12 Criteria covering issues related to**
 - Environment (5),
(including Life Cycle Analysis for GHG)
 - Social and equity issues (7)
 - Economic (3)

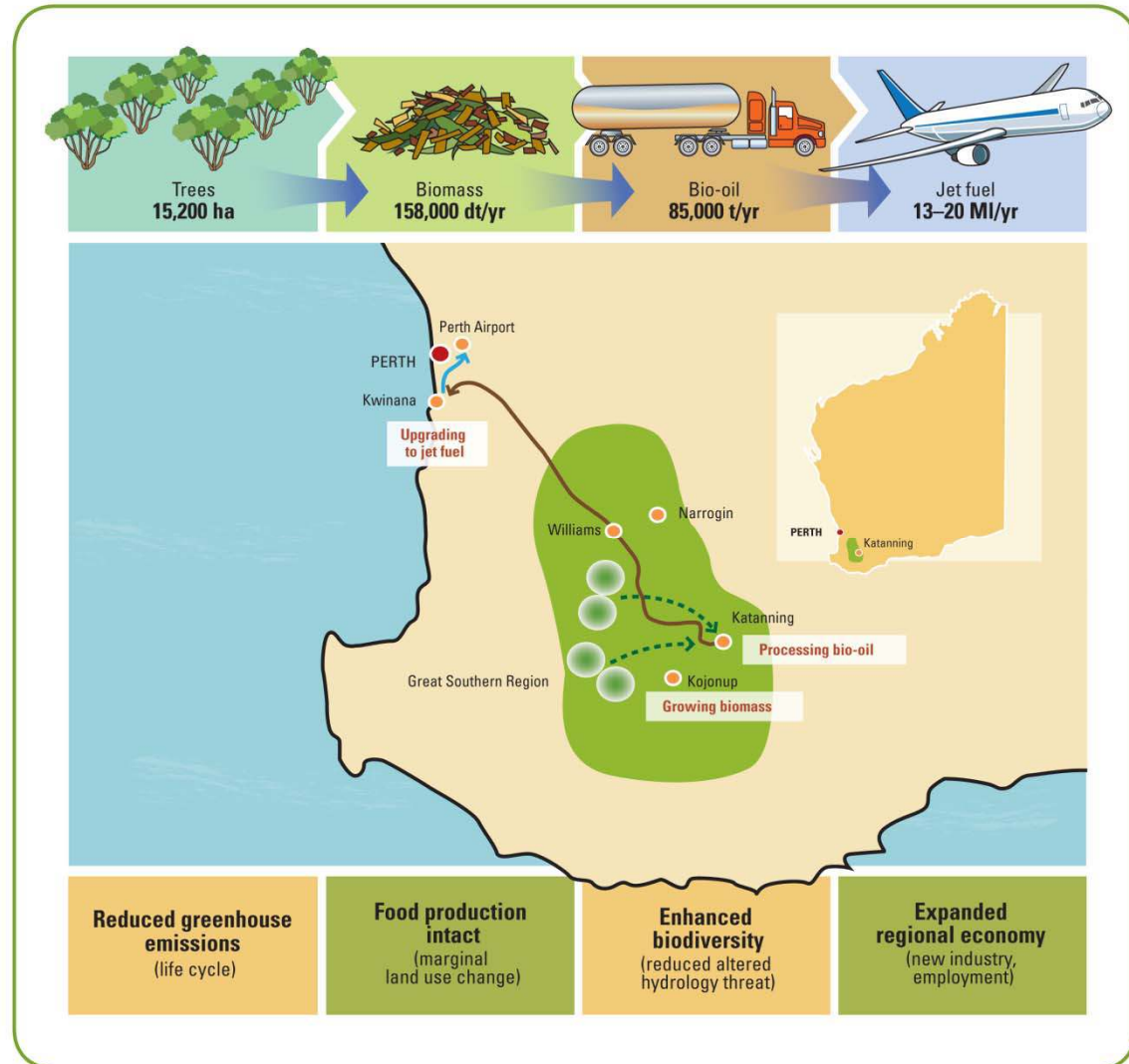




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The sustainability and life-cycle analysis

- * Covers growing & harvesting of mallees
- * Conversion into aviation grade biofuel via pyrolysis
- * Fuel upgrading





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Sustainability assessment: Outcomes

* Environment

- Most RSB criteria would be met
(*water, biodiversity, weeds, land conservation*)
- RSB target for GHG is a 50% reduction
- Assessed GHG saving of 40%
- Additional work required to meet this target

* Social and equity

- Land use change/food production (Small footprint)
- Regional employment
- Governance and legal

* Economic

- Regional economic development
- Increased farm viability
- Business case required



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Path to certification & commercial production

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Airbus Mallee Jet Fuel Sustainability Study 2013		IFPEn R&D and process LCA on Australian feedstock		IFPEn Scaled up demonstration of upgrading system		ASTM and RSB Certified fast pyrolysis biojet fuel			Certified bio-jet flights Perth
		ROC Biofuels rebate confirmed		ROC Fuel off-take agreements		ROC Feedstock secured			Biofuels plant Collie
Economic analyses for business case		ROC Business case		ROC Capital raising			ROC Plant construction		
First step RSB assessment of farm impacts		MOU Partners RSB accreditation and revised code of practice							Sustainable biomass South-west WA
Delivered cost of biomass		MOU Partners R&D optimising supply chain							
Greenhouse gas emissions		MOU Partners Additional detailed LCA							Society benefits WA and Australia
Equity and social impacts		MOU Partners Regional benefits study							



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Concept for biomass production for SAF production in Australia

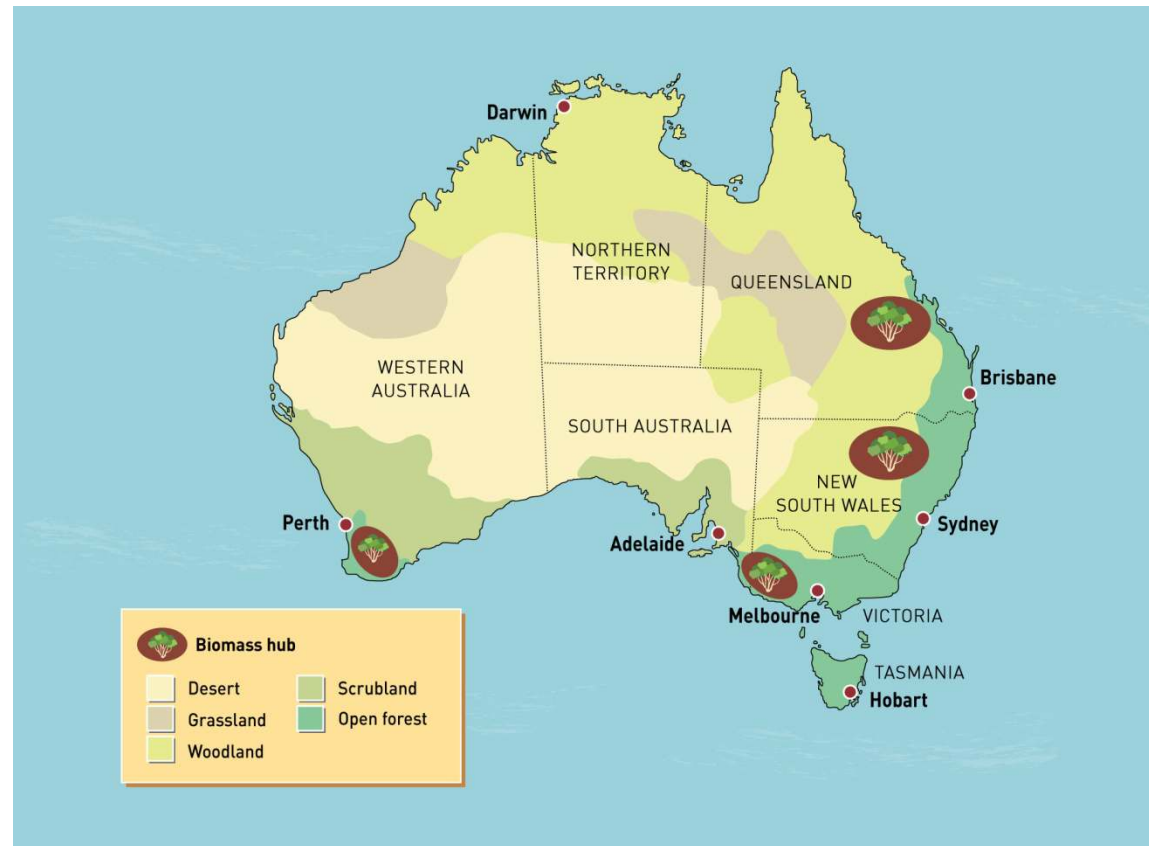
The objective

5% SAF/400 MI =

4-5 M t dry biomass

How do we achieve this?

- Multiple biomass sources
- Multiple locations to achieve targets and manage risk
- Develop sustainable and economic systems
- Combine the technological and commercial skills





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