Evaluation frameworks for Alternative Fuels in Australia.

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Scope for the Alternative Fuels Project

Evaluation framework being proposed.

CSIRO alternative fuels LCA research

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Light Vehicles Study 2003

Appropriateness of the 350 ML Biofuels Target

Technology specific studies

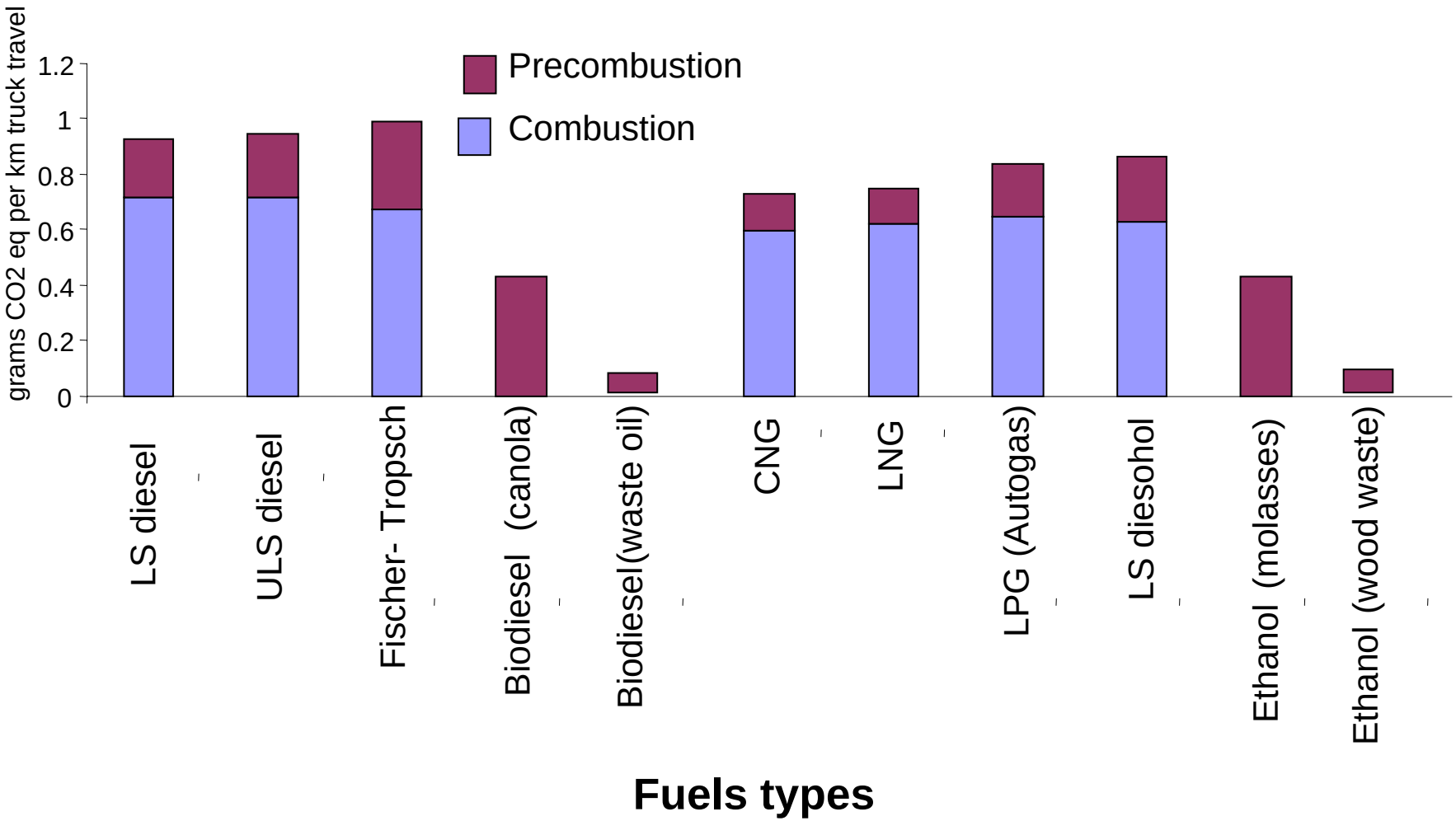
Comparison of Transport Fuels

Focused on Heavy Vehicles

15 fuels from 43 pathways

Evaluated for greenhouse, urban air pollutants, toxics emissions and vehicle compatibility.

Results - Greenhouse



Key lessons

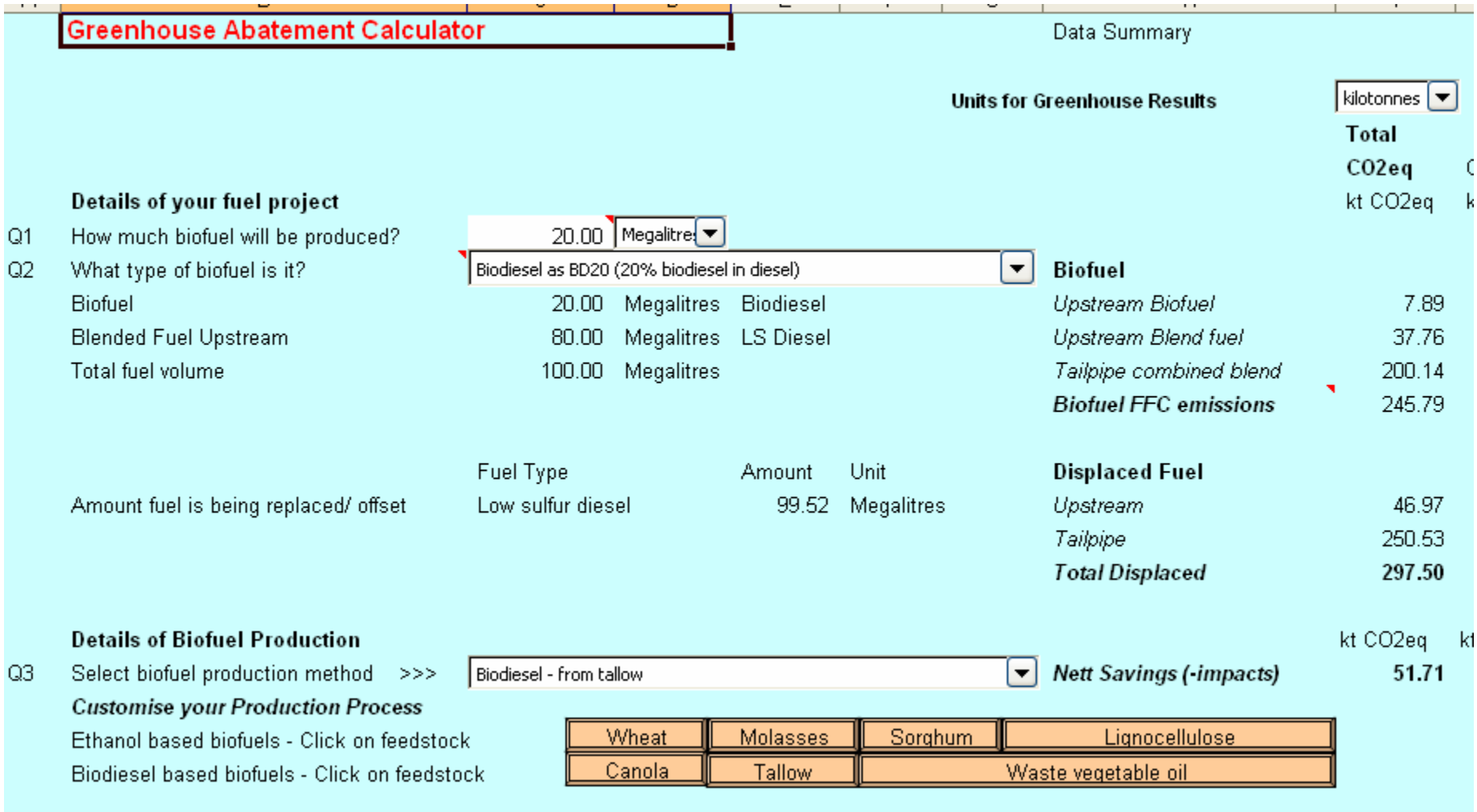
There is no free lunch – all feedstocks come with some baggage.

Energy sources and co-products have a big influence biofuels results.

High variability in tailpipe emissions data.

No consensus of emission weighting approaches.

Biofuels Greenhouse Gas Abatement Calculator



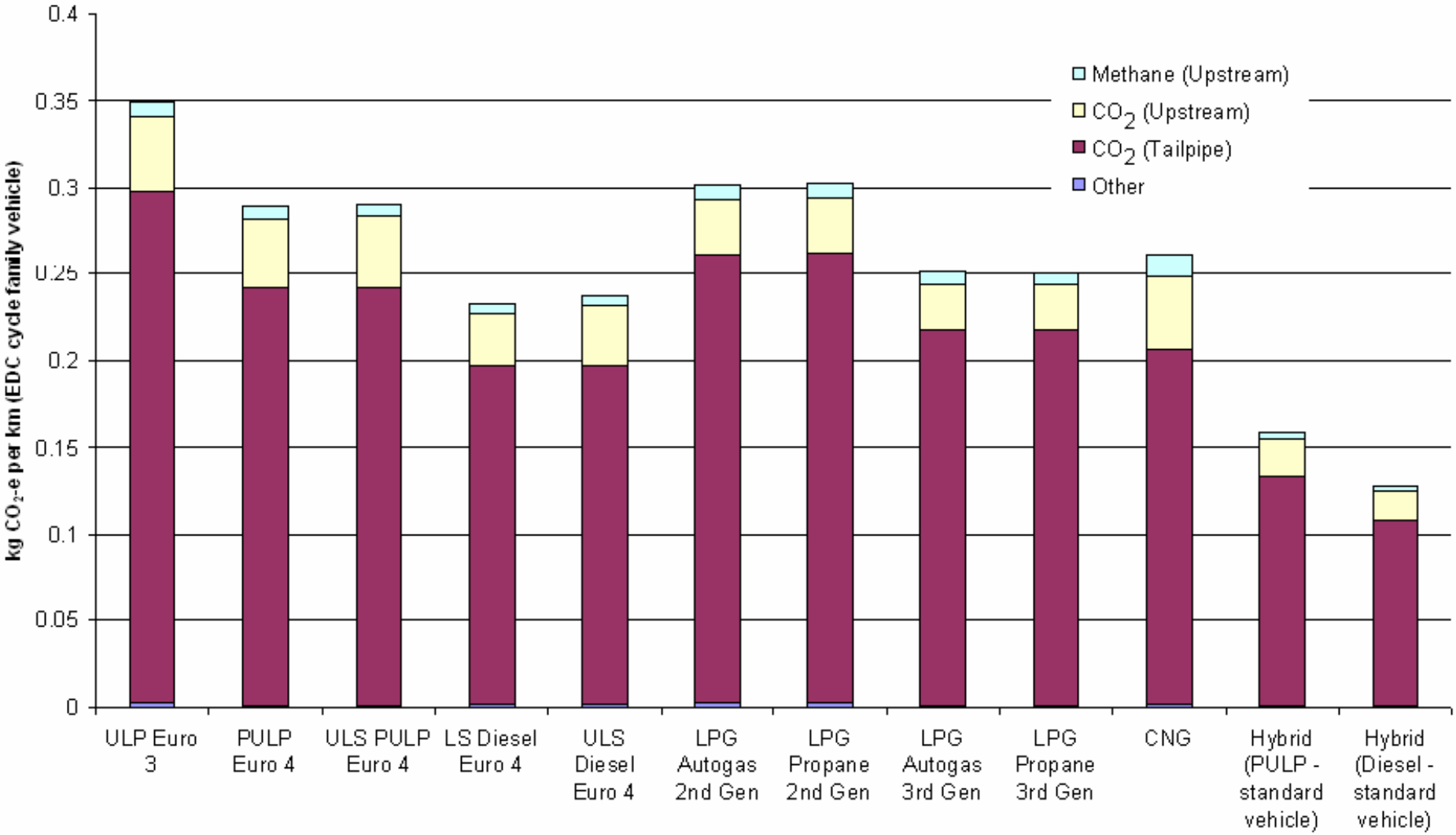
Biofuels calculator

- Implementation of Comparison of Transport Fuels method for biofuels into calculator.
- Used internally for AGO and by applicants for Greenhouse Gas Abatement Program (GGAP) funding.
- Focus on greenhouse gas emissions and total greenhouse savings per project.

Light Vehicles Study

- **For Victoria government and Australian Greenhouse office.**
- **Looked at range of fuels based on oil and gas. (ULP, PULP, Diesel, LS Diesel, ULS Diesel, LPG, CNG)**
- **Looked at different vehicles – euro3- euro4 vehicles as well as hybrids.**
- **Focus on GHGs, urban air pollutants and fuel vehicle combinations.**

Summary results from LV study



Key messages

- **New vehicle technologies were providing improvements similar to fuel substitutions although relativities between fuels were being maintained.**
- **Mass matters – for all vehicles the relationship between mass and fuel use was clear.**

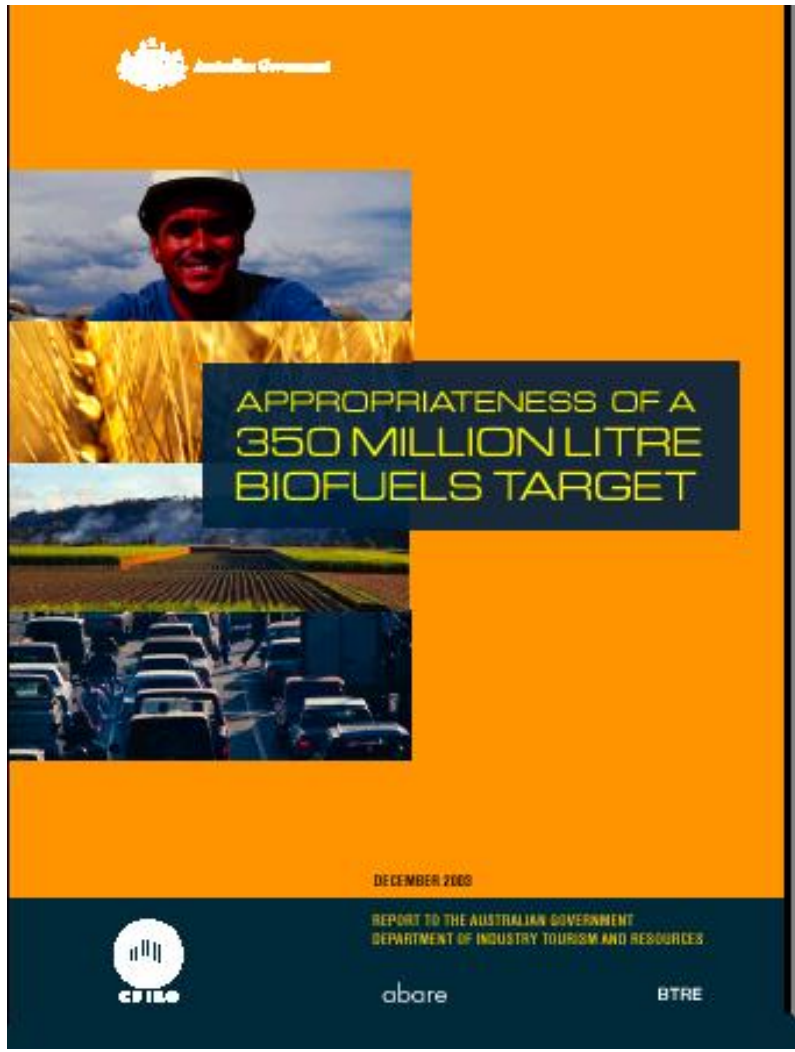
“Appropriateness of a 350ML Biofuels Target”

A joint study with ABARE (Australian Bureau of Agricultural Research and Economics and BTRE. (Bureau of Transport Research Economics)

Environmental focus on GHG and urban air pollutants

Included economic modelling and regional development objectives from ABARE and BTRE

On balance, positive environmental benefits associated with usage of biofuels, such as E10.



Technology specific studies

Variation in biofuels production impacts in highly dependant on:

- **Feedstock**
- **Co-products**
- **Production energy source**

- **Not possible to generalize about "ethanol" or "biodiesel"**

Aim of the project

To provide an evaluation framework and calculation tool for all current and future fuel options.

To examine fuels both comparatively and fuel mixes in the national and international context

To look beyond greenhouse to suite of sustainability indicators and other relevant criteria.

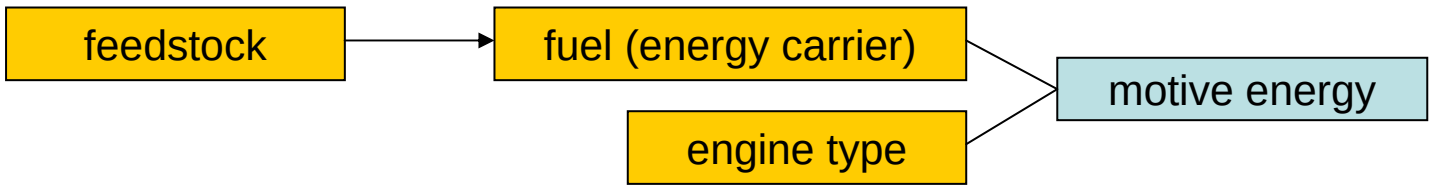
To identify promising pathways and research opportunities.

To contextualize new fuel proposals.

Alternative Transport Fuels Scoping Study

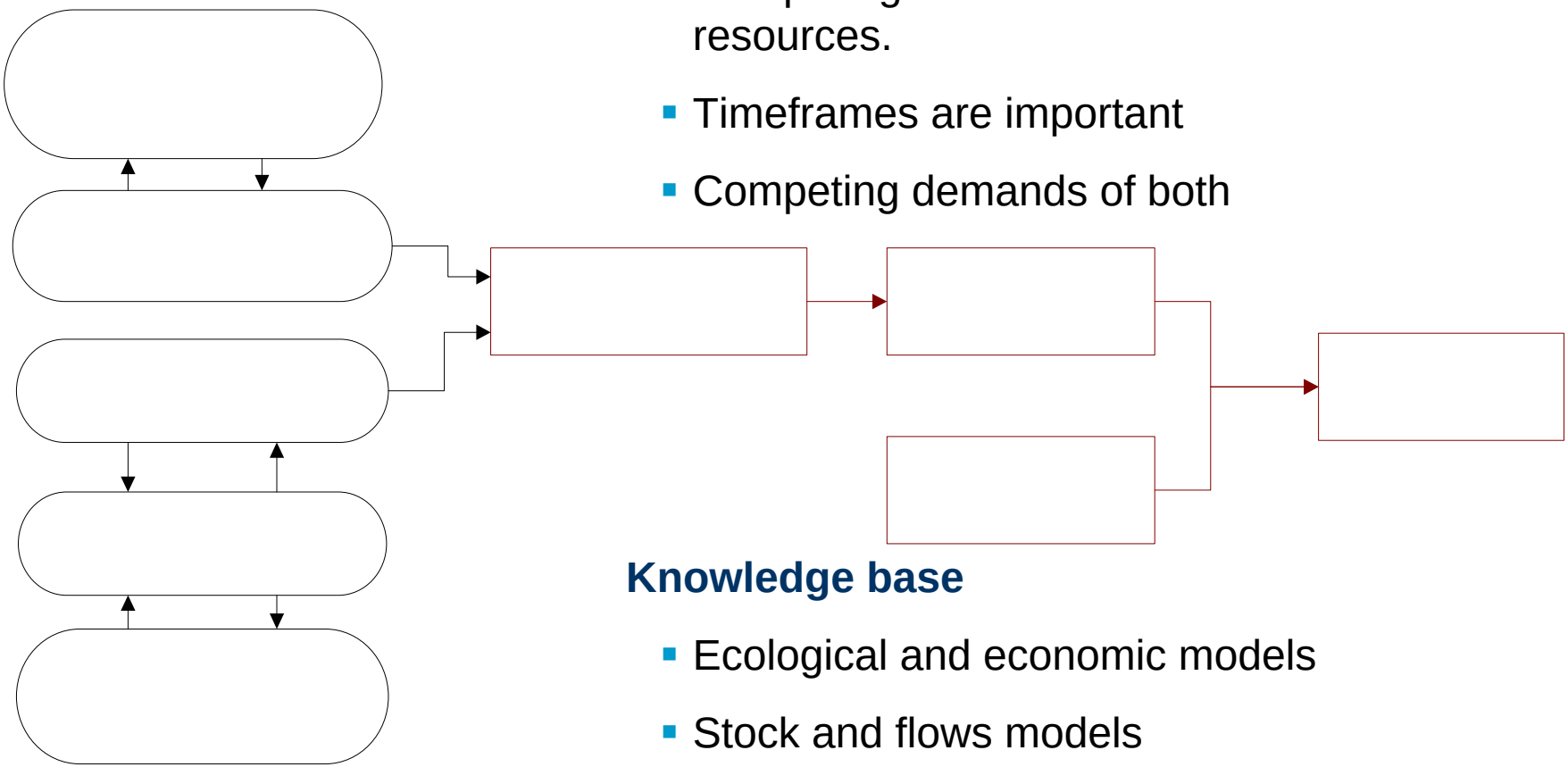
What do we need to make an informed decision about alternative transport fuels?

1. Background knowledge about the range of possible fuel systems
   - A fuel system has 3 major components



   - Consider current and possible future technologies
2. A framework for assessing and comparing different options within this range of possibilities.
   - In a form which can be easily communicated to policy makers.
3. Data to enable this framework to be populated.

Feedstocks



Key questions:

- Comparing renewable and non renewable resources.
- Timeframes are important
- Competing demands of both

Knowledge base

- Ecological and economic models
- Stock and flows models
- Impact assessment methods

Fuel Options

Fuel options Feedstock (energy sources)

Coal
Crude oil (heavy)
Crude oil (light)
Natural gas (on pipe network)
Gas (stranded from pipe network)
Shale oil

Oil seed
Woody material
Coconuts
Palm oil
Biogas
Sugar/Molasses
Grains (various)
Algae
Stubble residue
Waste oil
Tallow

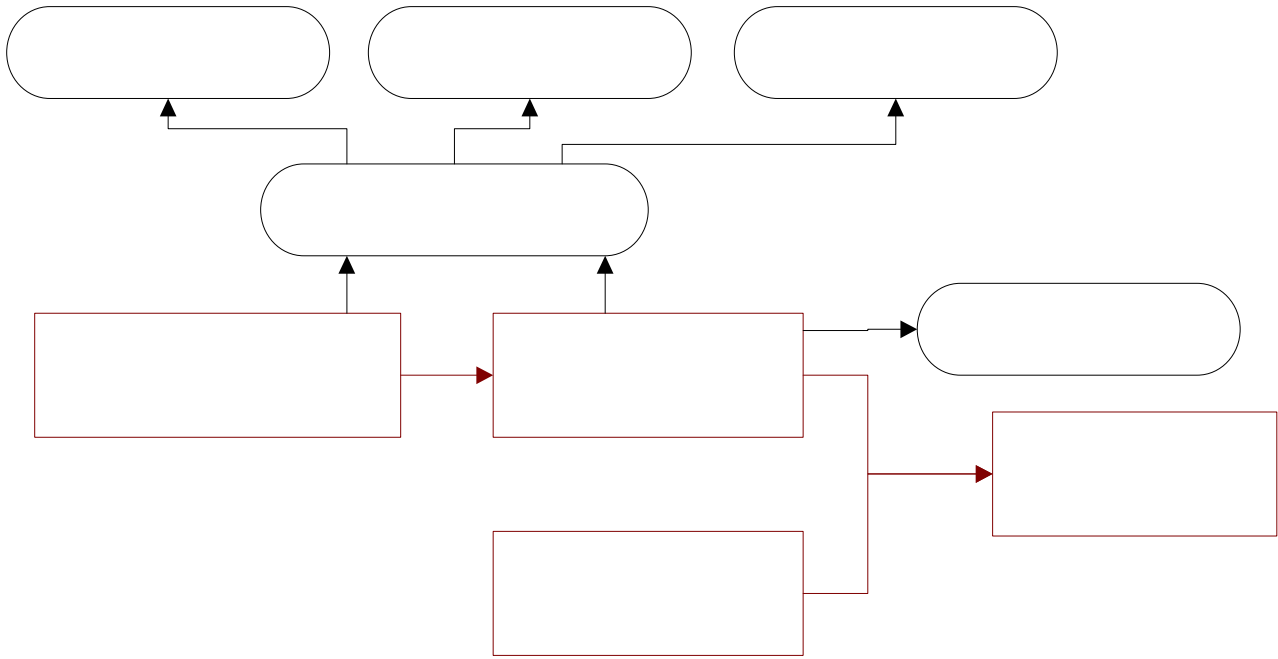
Flue gas
Methane hydrates
Oil Mallee
Waste plastics

Electricity fuel sources

Production impacts

Key questions

- Energy ratio
- Cogeneration and co production



Knowledge base

- Life cycle assessment models and data
- Economic optimisation models

Processes

Fuel options processes (energy transformation)

Refinery
Gas processing centralised
Electrolysis
Bacterial production
Gas processing distributed
Onsite compression
Liquefaction
Gas shift

Fermentation/distillation
Transesterification
Enzyme process
Flash pyrolysis
Refinery/emulsion
Electricity supply
Algae growth
Enzyme treat/Fermentation/distillation

Fuel options Fuel (stored energy)

Gasoline, ULP
Gasoline, PULP
Gasoline, PULP ULS
Diesel low sulphur
Diesel ultra low sulphur

LPG
Hydrogen
CNG
LNG

Butenol
Methanol
Ethanol
DME
Biodiesel
Vegetable oil
Stored electricity

Fuel options Blends (fuel combinations)

E5	B5	Hythane
E10	B20	Diesohol (15%)
E20	B100	Aquadiesel
E85		

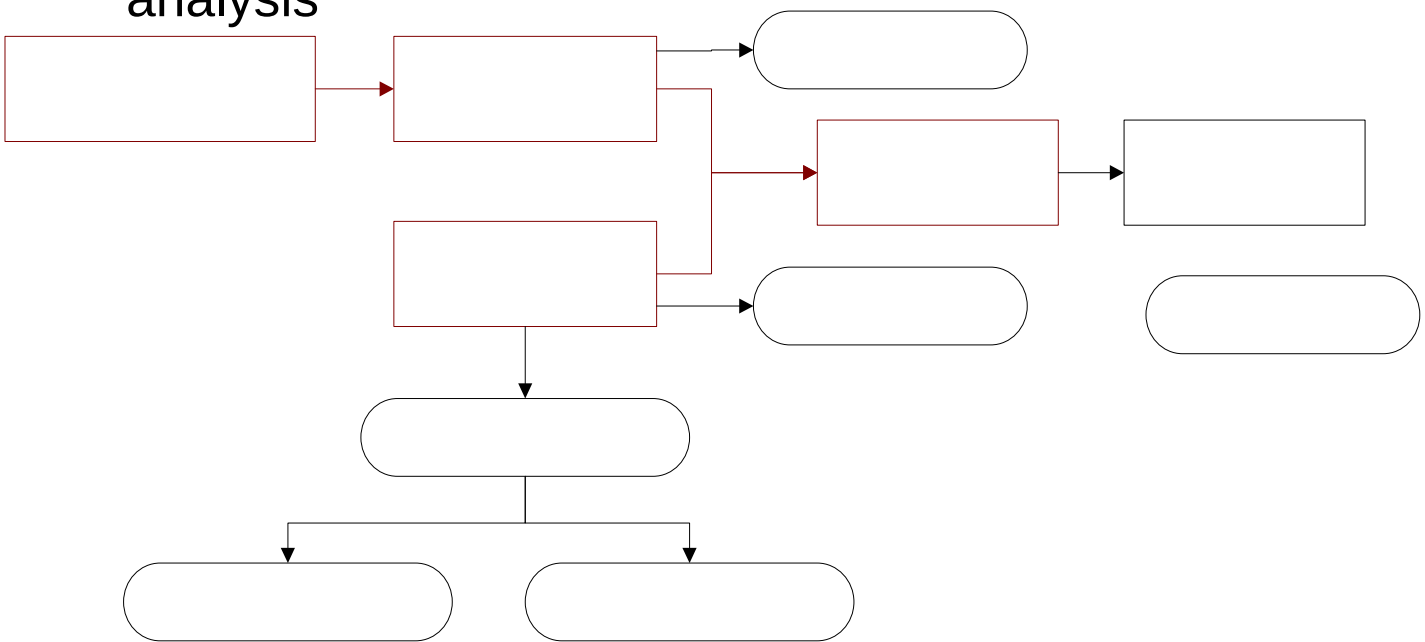
Engine types

Key questions

- Air quality outcomes
- Carbon source in tailpipe
- Engine fuel optimisation

Knowledge base

- Tailpipe data studies, normalisation techniques and uncertainty analysis



Fuel options Utilisation (energy use)

Spark ignition

Hybrid

Fuel cell

H2 in ICE

Compression Ignition

Flexi-fuel vehicles E0 – E85

Direct use vegetable oil

Electric vehicles

Pneumatic vehicles

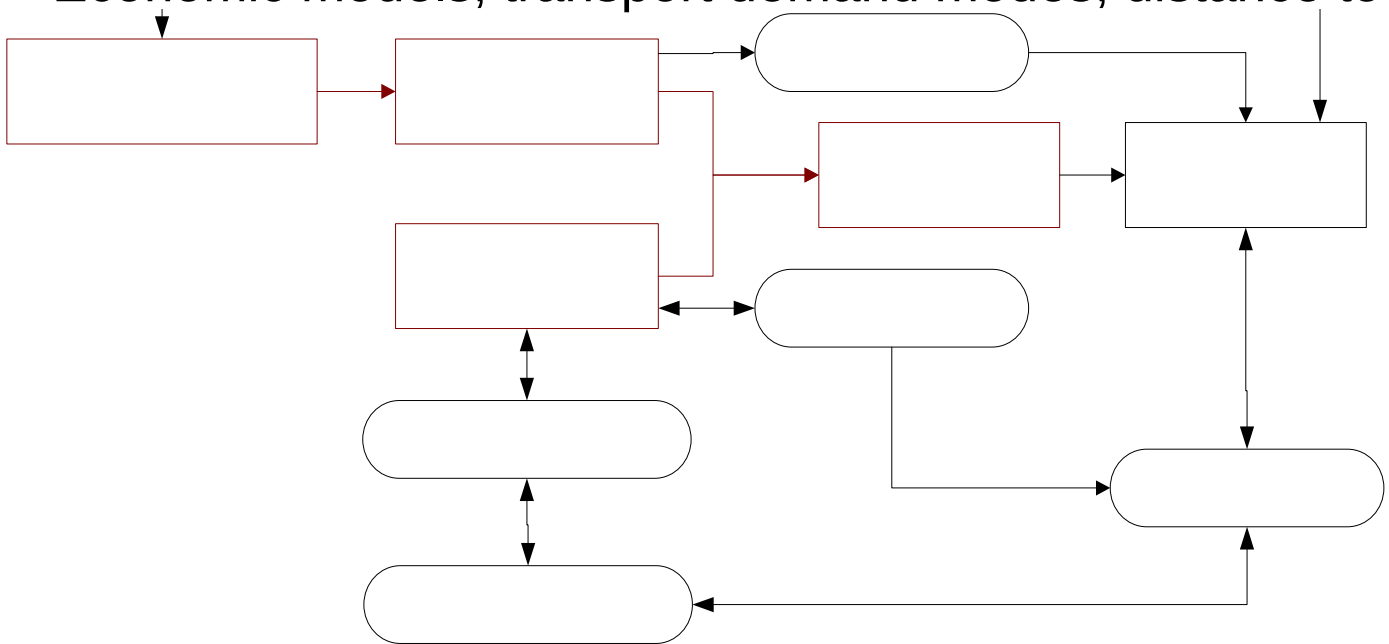
Transport task

Key questions

- What are the key constraints and influences on the transport task into the future
- How will fuel and vehicle technologies meet the requirements of the transport task or will they constrain and change the transport task

Knowledge base

- Economic models, transport demand modes, distance to target



Assessment Criteria

Top level criterion	2nd level criteria
1. Security of supply	a. Percent market share potential b. Longevity of supply c. Risk to supply
2. Sustainability	a. Greenhouse gas and energy balance b. Air quality c. Land and water quality d. Biodiversity e. Social

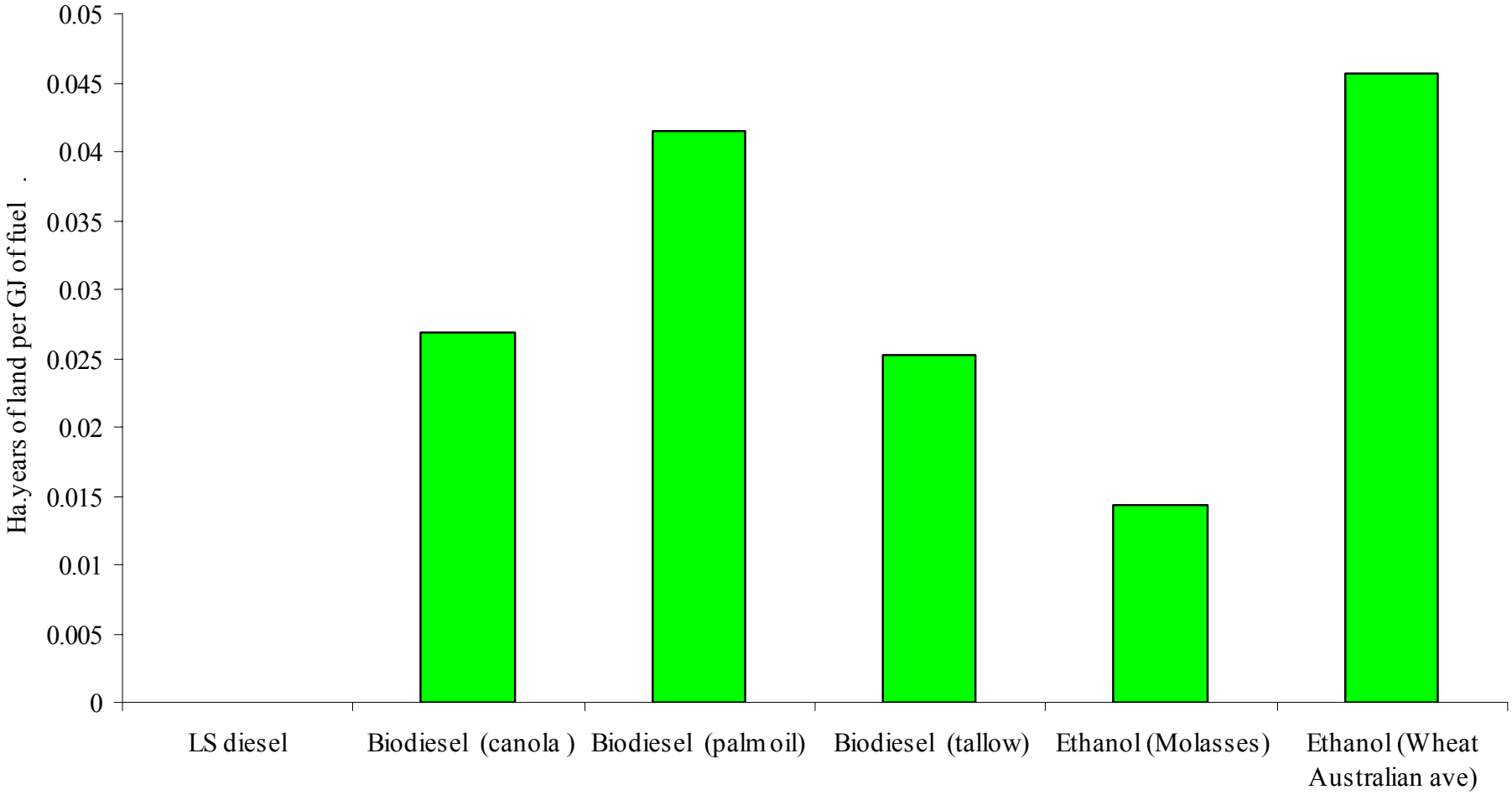
Assessment criteria continued

3. Cost of supply	a. Supply of feedstock
	b. Transformation of feedstock to fuel and supply to consumer.
	c. Capital costs associated with b.
4. Safety	a. In use b. In distribution and filling
5. Consumer acceptance	

Rankings for security of supply

Component	Units	Low	Medium	High	Weighting
% of current transport fuel market which can be supplied	%	0-10%	10-50%	50-100%	1/3
Likely duration of supply at this annual rate	years	0-20	20-50	more than 50 years	1/3
Uncertainty associated with supply (e.g. political, seasonal)	%	≥30%	≥5% ≤30%	≤5%	1/3

Results for land use - unweighted



Path forward

Current development underway with 4 CSIRO divisions.

The first stage of the project is due for completion by next July.

Looking to input into fuels policy agenda at a state, national and international level.

People interested in the project should email

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