



Life Cycle Energy and GHGs Balance during Mallee Biomass Production

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Background

- **Depletion of finite fossil fuel reserve**
- **Growing energy demand**
- **A carbon-constrained world and sustainable development**
- **Impacts of such developments on WA being significant due to our**
 - large area
 - small but dispersed population
 - heavy reliance on energy-intensive industries including mining and agriculture
- **A Challenge but also an opportunity**

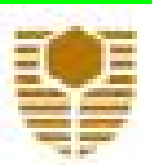
Biomass

- **Energy security**
- **Biomass being the only sustainable source of carbon-based materials in the future**
- **Environmental benefits**
 - Biomass being an important source of renewable energy (?)
 - Lower emissions of GHG and other pollutants (?)
 - Potential integration with a sustainable agriculture
- **Economic considerations (?)**
 - reducing impact of energy (esp. oil) imports
 - adding value to low-value products

The Big Questions Are...



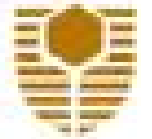
- **What options do we have in WA?**
- **How should we do strategically to establish a sustainable biomass and biofuels industry for future sustainable development of WA?**



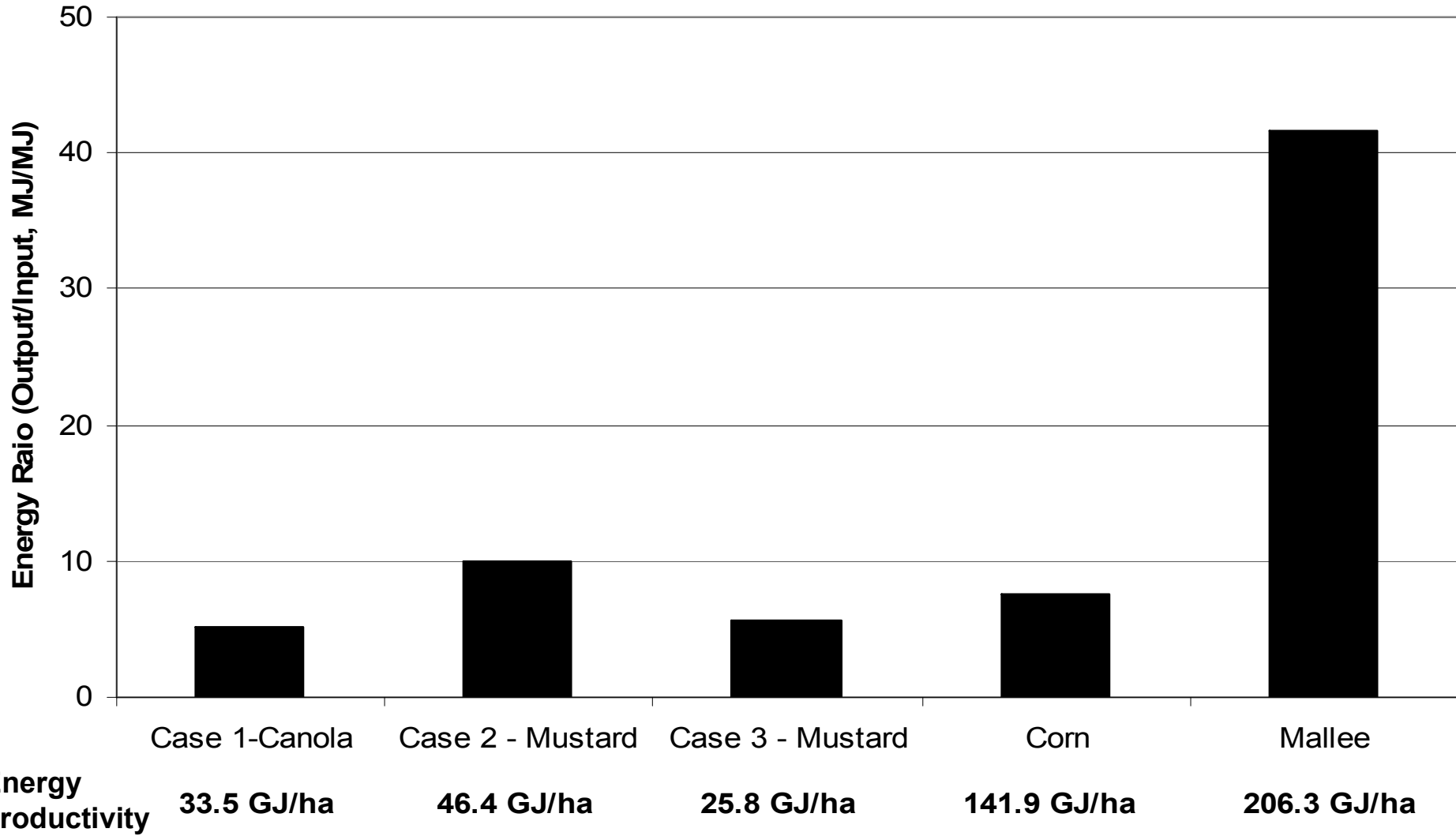
Mallee – a Good Option in WA



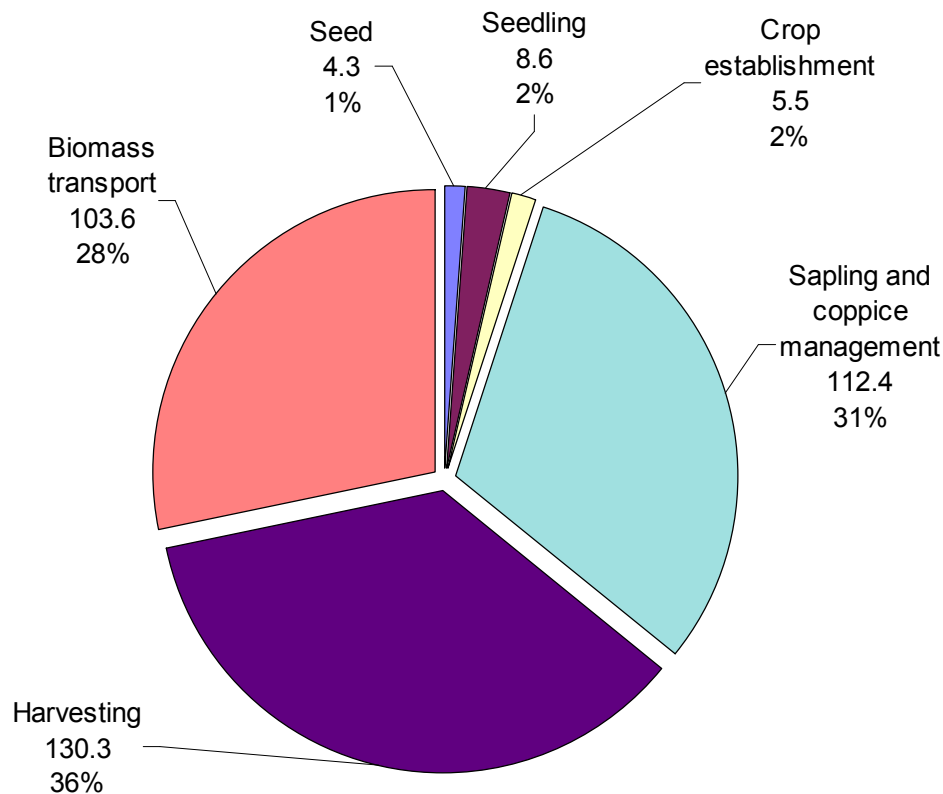
- Dryland salinity is a serious environmental, economic and social problem and leads to **hundreds millions of dollars productivity loss** in Australia
- Perennial plants are key components in a suite of strategies for combating dryland salinity and oil mallee stands out as one of the best perennial choices for that purpose.
- Therefore, biomass is a by-product and the potential mallee biomass supply is **~10 million dry tonne per annum in WA**. Therefore, **mallee is the only renewable which can make a realistic contribution to WA's future energy mix**.
- Mallee is planted in the land through “alley farming”, occupying typically <10% of the land, contributing significantly to biodiversity conservation and a more sustainable agriculture.



Energy Balance of Biomass Feedstock



GHG Emissions of Mallee Production



Unit: kg CO₂-e/ha/year

Total GHG emission: 364.7 kg CO₂-e/ha/year, ie 19.0 kg CO₂-e/gt

Total above-ground GHGs sequestered: 19,394.4 kg CO₂-e/ha/year, ie 1,010.1 kg CO₂-e/gt

Net GHGs sequestered: 19,029.7 kg CO₂-e/ha/year, or 991.1 kg CO₂-e/gt

All direct/indirect GHGs accounted.

Harvest cycle:

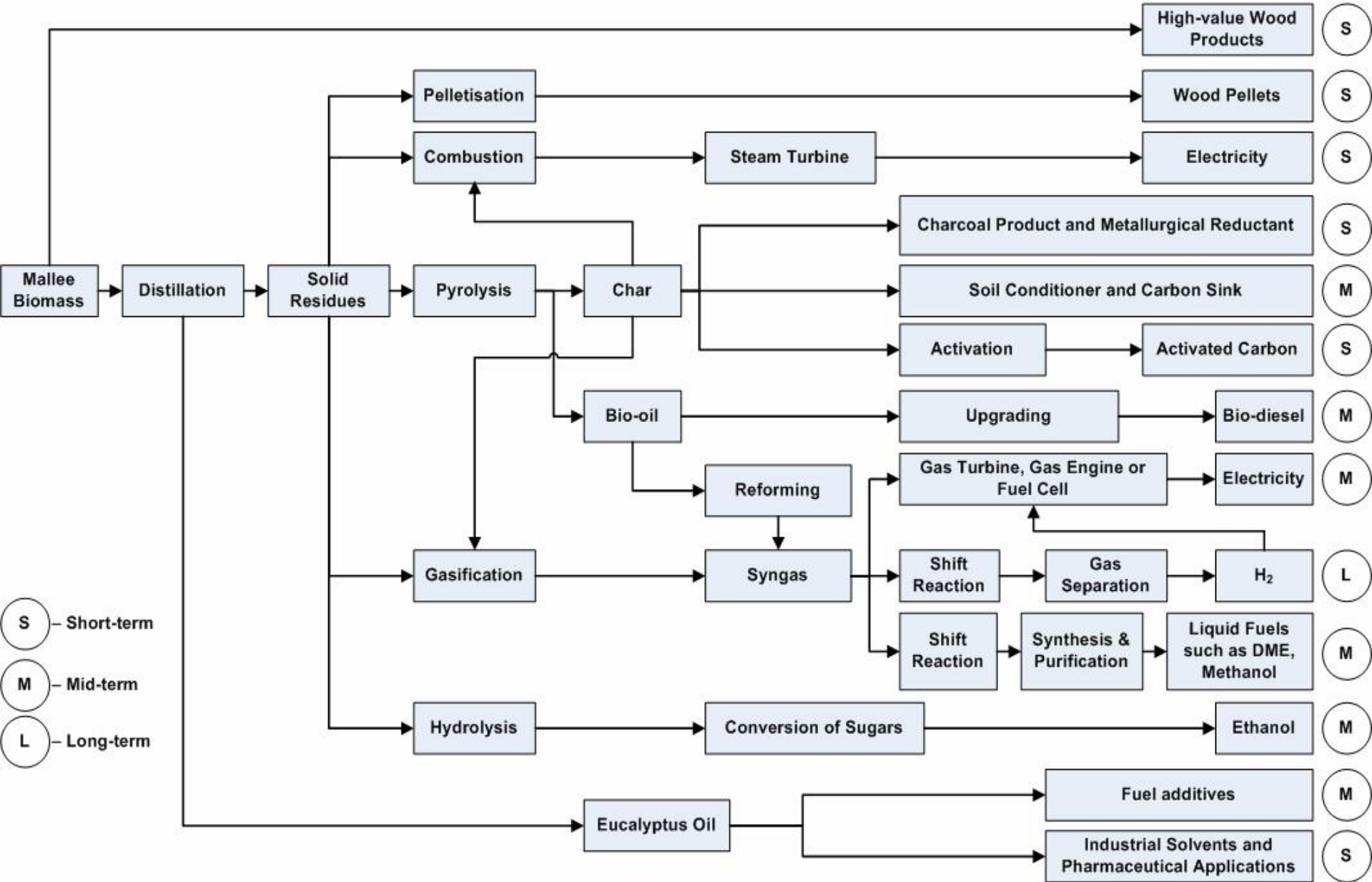
5 years for the 1st cycle

3 years for the subsequent cycles

Biomass yield: 60 gt/ha/harvest cycle

Key conclusions:

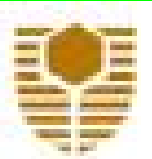
1. If mallee biomass is used for bioenergy generation, <2% of GHG emission is non-renewable.
2. GHG emission from soil due to fertiliser applications contributes to ~20% of the total non-renewable GHG emission.
3. If used to substitute fossil fuels, the biomass produced per hectare per year leads to ~19 tonnes CO₂-e avoided.



As Much As We Don't Like...



- **Given our current energy-use patterns, biomass and renewable can only provide a partial solution (up to 30% energy supply) to the scale of energy problems we are facing.**
- **Considerable R&D is in great need to develop advanced efficient energy production/utilisation technologies and/or discover new energy sources.**
- **In the foreseeable future, maintain our living standards will continue to rely on fossil fuels, which is unfortunately not sustainable.**
- **We will have to change our live styles and adopt tough energy conservation measures, for the sake of our future generations.**



The Way Ahead...

Ethanol from cereals, biodiesel from canola, transport fuels produced from fossil fuels etc. can play roles in

- (1) introducing new transport fuels in the market place;
- (2) developing familiarity among the consumers
- (3) establishing required infrastructure



Transition

Transition



Present non-sustainable system based on fossil fuels

A more sustainable system in which mallee plays important roles

A future sustainable system

Acknowledgement

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