AUSTRALIAN LIQUID BIOFUELS
NATIONAL PRODUCTION BOUNDARIES

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This paper compares the energy content of ethanol derived from Australia's annual production of sugar and wheat with the energy content of annual consumption of auto gasoline, auto diesel and primary oil. It demonstrates the energy content of anhydrous ethanol from sugar and wheat would be a small fraction of the energy content of annual consumption of petroleum-based fuels. While anhydrous ethanol from biomass is technically viable as a transport fuel it cannot be produced on a scale that replaces current petroleum products. It is not remotely possible to divert much of these agricultural products to fuel production at the expense of food supply.

SUGAR

Annual production of sweeteners (sugar and honey) is notionally 5 million tonnes with variations according to seasons and markets. Honey is a negligible component (ABARE 2005). One tonne of sugar yields 0.385 tonnes of anhydrous ethanol that has a high heating value (HHV) of 29.65 GJ/tonne (Patzek & Pimentel 2005). Thus potential annual anhydrous ethanol production from sugar is 1.925 million tonnes with an HHV of $57x10^6$ GJ.

WHEAT

From 1991/92 to 200/05 average annual wheat production was 17.2 million tonnes with a range from 8.97 million tonnes (1994/95) to 26.13 million tonnes (2003/04). Average production from 1999/01 to 2004/05 was 21.3 million tonnes (ABARE 2005). We will use a figure of 22 million tonnes. Proposals for production of anhydrous ethanol from wheat quote a yield of 0.4 litres per kilogram of wheat (Grant et al. 2005). Ethanol has a density of 0.787 kg/litre that translates this yield to 0.315kg ethanol/kg of wheat. This figure is consistent with the ethanol yield from corn in the US (Patzek 2005). Thus potential annual ethanol production from wheat is 7 million tonnes. At an HHV of 29.65 GJ/tonne this is 207 million GJ per year (Patzek 2005).

PETROLEUM FUELS

The HHV of gasoline is 46.7 GJ/tonne and its density ranges from 720 to 800 tonne/klitre – we will use a figure of 740 kg/klitre. The HHV therefore is 34.6 GJ/klitre (Patzek 2005). Annual consumption is 19,876 ML or 14,708,600 tonnes equivalent to 687 million GJ (ABARE 2005).

The HHV of diesel is 45.9 GJ/tonne and its density is 0.84 kg/litre. The HHV therefore is 38.6 GJ/litre (Patzek 2005). Annual consumption is 15,185 ML or 12,755,000 tonnes equal to 585 million GJ (ABARE 2005).

The HHV of crude oil is 42 GJ/tonne and its annual consumption is 38.8 million tonnes, or equivalent to 1,630 million GJ (BP 2005).

Potential Annual Ethanol Energy Output
Compared to Annual Petroleum Products

Annual Petroleum Products GJ $x10^{6/}$/yr		Wheat $207x10^6$GJ/yr	Sugar $57x10^6$ GJ/yr
		Per cent petroleum product	Per cent petroleum product
Gasoline	687	30%	8%
Diesel	585	35%	10%
Gasoline + diesel	1,272	16%	4.5%
Crude oil	1,630	12.5%	3.5%

UNITED STATES FOSSIL FUELS AND BIOMASS ENERGY

The annual fossil fuel consumption in the United States of America, if all burnt, would yield $20x10^{15}$ kcalories of energy. The energy content of the annual net addition to all biomass from photosynthesis is $13.5x10^{15}$ kcals (Pimentel & Pimentel 1996). The fossil energy potential is 40 per cent greater than that for all biomass. About 70 per cent of biomass energy is fixed on agricultural land. Oil comprises 40 per cent of US fossil fuel consumption, most of it as transport fuels.

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