Appendix Three

CSIRO response to question on notice on 12 May 2006

CSIRO Government Relations
CSIRO Corporate Centre
PO Box 225, Dickson ACT 2602
Telephone: (02) 6276 6368 Facsimile: (02) 6276 6304
www.csiro.au
ABN 41 687 119 230

Our Ref: 06-239 future oil supply

Ms Roxane Le Guen
Committee Secretary
Senate Rural and Regional Affairs and Transport Committee
Department of the Senate
PO Box 6100
Parliament House
Canberra ACT 2600

Tuesday, 27 June 2006

Dear Ms Le Guen,

During the hearing on 12 May as part of the inquiry into Australia's future oil supplies and alternative transport fuels, the following question was asked of CSIRO, which was taken on notice at the time:

> **CHAIR**-I asked a question of ABARE before and I think someone said to try asking CSIRO. ABARE was saying it was $40 a tonne for CO_2. Do you know how much that converts to per barrel?

We have consulted with a number of our experts on this issue and CSIRO provides the following answer to the Committee:

It should be noted first of all that the question is not straightforward and that the calculation depends on the type of fuel generating the CO_2 and through what production process.

The following table shows the barrel of oil equivalents (BOE) of a tonne of different fuels:

tonne of	**Equals BOE**
Liquefied Natural Gas (LNG)	8.7
Liquefied Petroleum Gas (LPG)	8.458
oil	7.9
condensate	9.04
coal	~3 to 5

This allows us to assume an average of 8 barrels (bbl) per tonne of liquids. Looking then at the different types of liquids production the following numbers result:

Tonne CO_2 / Tonne HC from TIGAS / coal	**Tonne CO_2 / Tonne HC from TIGAS / natural gas**	**Tonne CO_2 / Tonne HC from Fischer Tropsch**
3.9	0.67	1.2

(Note: HC means hydrocarbons. TIGAS is one of the more efficient ways of making synthesis gas, which is then recombined to make synthetic fuel. Fischer Tropsch is the conventional means of recombining the synthesis gas to make mainly diesel)
Based on an average of 8 bbl/Tonne of liquids, we arrive at the following amounts of CO_2 per barrel of HC:

Tonne CO_2 / bbl HC	0.48	0.08	0.15

Working on the assumption of a carbon tax of AUD40 per tonne CO_2, this equates to:

AUD equivalent / bbl HC	AUD19.30	AUD3.20	AUD6.00

To really understand the costs per barrel, it is necessary to put taxation costs in context. We have summarised the costs of the different CO_2 options per barrel of HC from different sources (figures taken from the Stanford University economics of CO_2 sequestration):

	AUD – from TIGAS/coal	**AUD from TIGAS/ natural gas**	**AUD Fischer Tropsch from natural gas**
Cost per bbl HC in AUD of capturing CO_2	33	7	14
Plus one of:			
Cost per bbl HC in AUD of underground sequestration of CO_2	46	9	18
Cost per bbl HC in AUD of using CO_2 for Enhanced oil recovery	7	1.5	3
Cost per bbl HC in AUD of using CO_2 for enhanced coal-bed-methane production	23	4	8

A recent paper by Allinson *et al* (2003) estimated the cost of capture and storage of CO_2 in Australia to be USD 13-45 per tonne (AUD 17-60) (Allinson, W.G., Nguyen, D.N. and Bradshaw, J. 2003. The economics of geological storage of CO_2 in Australia. *APPEA Journal* **43** (1), pp623-636.)

We trust that the above provides sufficient information in response to the question. Should the Committee have any further questions regarding the information provided in this letter, please do not hesitate to contact me.

Yours sincerely

Sheila Lunter
Senior Adviser Government Relations