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The Secretary
Senate Rural and Regional Affairs and Transport
Parliament House
Canberra ACT 2600

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Inquiry into Australia's future oil supply and alternative transport fuels

We make this submission as representatives of the Australian ITER Forum, a group of Australian scientists and engineers from six Universities, the Australian Nuclear Science and Technology Organisation (ANSTO), and the Australian Institute of Nuclear Science and Engineering (AINSE). The ITER Forum is dedicated to advocating an Australian role in the International Thermonuclear Experimental Reactor (ITER) - the next step on the journey to a magnetic confinement fusion power plant.

Whilst we recognise that the major focus of the inquiry is on the Australia's future oil supply and alternative transport fuels, we believe that the Senate Committee should be informed about the current status and long-term prospects of thermonuclear fusion as an energy source. In particular, if combined with hydrogen as an energy carrier, fusion energy offers a long-term replacement to oil. We note that fusion, and ITER, were jointly raised in a Public Hearing of this Committee on May 12.

Fusion energy, which has attracted little media attention, is released when lower atomic weight elements join to form a new heavier element, in a reaction first discovered by the Australian Sir Mark Oliphant in 1934. It is the fundamental process that powers the Sun. Successfully harnessing nuclear fusion promises **millions of years of clean, base-load power generation, with virtually no greenhouse emissions.**

In the Sun, fusion is enabled by gravity, which is sufficiently strong to overcome the repulsive force between similarly charged ions. On Earth, gravity is too weak, so instead the fuel ions have to be heated to immense temperatures : 100 Million ^{o}C. To constrain the material at such high temperatures we use strong magnetic fields. The most advanced magnetic confinement geometry is the tokamak, a donut-shaped vessel in which the plasma resides. The plasma is kept confined along lines of magnetic force. In essence, these act as a thermoflask, keeping the plasma hot.

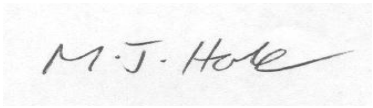
Fusion is also environmentally and politically friendly. The fusion process itself generates zero greenhouse gas emissions: emissions are totally derived from the construction and processing of materials and fuel used in the reactor. Unlike fission, the direct products of fusion are not radioactive. Rather, radioactivity is generated indirectly, by neutron activation of the first wall and vessel structure. Employing present-day technology, the entire fusion power plant could be completely recycled within 100 years of shutdown. Fusion is also intrinsically safe. There can be no chain reaction, explosions or

melt-down. At worst, a loss of magnetic confinement will damage the first wall of the system. Magnetic confinement fusion cannot be used as a weapon, or in weapons development.

The next step in fusion development is the ITER project, a US$10bn international project in energy supply research and development, and supported by seven countries and groupings, the US, Russia, China, Japan, Korea, India and the EU. Australia is, at this stage, not part of this partnership. In addition to the scientific and technology benefits, the industrial spin-offs of ITER for the ITER partners will be immense. Most of the costs of the ITER experiment are in industrial contracts to provide the machine components and structures. There are some obvious short and long term benefits for Australian engineering and component manufacturing industries in this project. Involvement by Australia would also increase our standing in international science and engineering and give us access to a large range of technologies.

ITER, which is a precursor to a demonstration power plant, will determine the viability of fusion power. For the first time ever, ITER will explore a continuous operation fusion regime, in which the heat of the confined products of reaction is comparable to the external heating. In continuous operation, ITER will yield 5 times more power than is required to sustain the reaction, while in pulsed mode, the power gain could be as high as 30. Australia is presently seeking to be involved in the ITER project, through a federally funded workshop to be held in October.

In closing, we also note that ITER is the world's largest science project. Given the international importance of this project and its potential implications for energy generation and transport, we believe it is in the interests of the Australian public that these developments be discussed at the highest levels of government. On Dec. 8, 2005, representatives from the ITER Forum submitted evidence to a House of Representatives Inquiry on developing Australia's non-fossil fuel energy industry. If requested, we would be willing to speak to the present Inquiry.



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