



Dr Matthew Hole,
Chair, Australian ITER Forum,
Research School of Physical Sciences and Engineering ,
Australian National University.
Ph : +61 2 6125 7606 Fax : +61 2 6125 4676

Dr John Soderbaum
Chair of Technology Gaps Working Group, COAG Climate Change Group.
Science and Technology Adviser, Energy and Environment Division,
Department of Industry Tourism and Resources.

Date : 03/05/2006

RE: Submission to Technology Gaps Study

Dear Dr. Soderbaum,

Thank you for bringing to our attention the Technology Gap study that is presently being conducted by the Department of IT&R, for submission to COAG. This submission is in response to your request for comment on particular questions. In composing these responses, we have also referred to the attached Outline of Technology Gaps Study. This response is composed by the Steering Committee of the Australian ITER Forum, and is lodged on behalf of the Australian ITER Forum.

Yours Sincerely,

Dr Matthew Hole

Professor D.J. O'Connor , Head, School of Mathematical & Physical Sciences , University of Newcastle
Dr Boyd Blackwell, Director H-1 National Plasma Fusion Research Facility, Australian National University
Dr John Howard, Senior Fellow Honours year coordinator, Plasma Research Laboratory, Australian National University.
Prof. Andrew Cheetham, Pro VC (Research), University of Canberra.
Prof. Brian James , Head of School of Physics, University of Sydney



1. What are (the views of the Australian ITER Forum) regarding prioritisation of energy technology RD&D? What (if any) are the implications for the level and nature of support across technologies and across the innovation chain?

Energy is the commodity vital to the existence of the developed world. There is a well documented, direct correlation between increase in energy usage per capita and the standard of living in Australia over the past century. In an age of dwindling fossil-fuel reserves, future access to a secure and abundant energy supply has been the principal economic driver of energy technology RD&D. Balancing these economic drivers is the scientific reality of climate change, caused by man-made CO₂ emissions, and geo-political instability, caused by the concentration of fossil fuel reserves.

Any prioritisation of energy technology RD&D must embrace both economic drivers and environmental and social constraints of research. Prioritisation of Australia's energy technology RD&D and should also recognize Australia's natural wealth, the global nature of energy RD&D, spin-off technology, and the importance of diversity in the technology mix.

A formal prioritisation of particular energy technologies is beyond the scope of this response. Instead, our response addresses clusters of energy technologies, characterized by three different timescales. Table 1 classifies different energy technology time-scales into three categories, and provides candidate technology examples.

Table 1: Energy technology commercialization horizon, and illustrative examples.

Commercialization horizon	Example energy technology RD&D sector
Short (< 5 yrs)	Energy efficiency Cleaner coal Hot rocks
Medium (5-20 yrs)	Energy Storage (e.g. fuel cells) Advanced photovoltaics Conventional fission reactors
Long-term strategic (>20 yrs)	Advanced fission cycles (e.g. Generation IV) Fusion energy

The implications for the level and nature of support:

- (1) Australia needs diversity in its energy research RD&D mix, spanning both the energy technology sectors, and all commercialization horizons. Our future energy supply will almost certainly be drawn from a combination of energy technologies. While there will be a plethora of potential sources of energy in the future, it is imperative that we have access to a reliable base load capacity with minimal greenhouse gas impact
- (2) Most industrial sector supported research has a commercialization horizon of less than 10 years. Broadly, industry support increases with a decreasing commercialization horizon. Governments should principally seek to accelerate industrial participation by either tax concession, or legislating compulsory energy targets.
- (3) Government has a duty to support longer-term strategic research, which promises significant benefit to society. Of those shown in the long term cluster in Table 1, it is important to note that Australia does not have a strategic funding program for fusion energy (ANSTO supports research into the uranium fuel cycle). We highlight this inconsistency as a technology gap that requires priority attention.

- (4) Advances in large scale energy technology RD&D are often driven by strategic international research programs (e.g. nuclear fission through the Generation IV program, fusion energy through the ITER project). Government can maximize global leverage by supporting Australian research programs which are fully immersed in international programs. Strategic engagement also enables Australia to participate in international policy dialog through membership of agencies such as the IAEA. It should be noted Australia's position on the Board of Governors of the IAEA is enabled by its technical capability in nuclear energy research for peaceful purposes.

2. What examples of Australian or international best practice support measures would you like to suggest?

We have argued that research into fusion energy should be publicly funded, both because of its long time development scale, and its immense significance in many spheres – climate change and environment, industrial growth, improvement in standard of living, and global political stability.

We therefore consider here only international best practice in support measures of this nature – publicly funded, long-term research and development. This is particularly relevant to the Technology Gaps Working Group of the COAG Climate Change Group, as we consider that there is a significant “gap” in both the research effort (in plasma fusion science), and more generally in the mechanisms which fund such research.

Some global examples of best practice support measures include:

European Framework Programmes, and the Research Directorate “J” – Energy.

The European Framework Programmes provide a mechanism for strategic planning of research, technology and demonstration and for coordination of efforts within the European States. This measure supports the development of many future energy sources, including advanced fission cycles and plasma fusion energy. Although it only accounts for about 5% of the European RD&D budget, it nevertheless enables very large scale research.

The United States Department of Energy

This directs and administers strategic, goal oriented research, development and demonstration of energy sources and their technology, across both national laboratory and university environments. More fundamental or smaller scale projects are funded by a separate Science body (the National Science Foundation).

Genome sequencing project

This is one of the biggest international biology programs which commenced with primarily government funding more than 20 years ahead of the completion of the program. Since the successful sequencing of the human genome there has been growing industry investment in this area. This underlines the trail-blazing, long term nature that best suits government supported research.

Snowy Mountains Scheme

The Snowy Mountains Scheme is one of the great Australian technological achievements, providing vital infrastructure in both energy and water resource management. Unfortunately, the difficulties in establishing this scheme arose largely from the absence of any Federal body with strategic planning responsibility for energy and environment. Rather, the Snowy Mountains Scheme was enacted under defence powers of the Commonwealth.

Australian Implications

Ideally, given the importance of global warming and climate change, and the ramifications on the economy, all publicly funded energy research should be administered under the auspices of a focused government department: an Australian Department of Energy. Presently, energy research spans: the Department of Education, Science and Training; the Dept. of Industry, Tourism and Resources; and

the Dept. of Environment and Heritage. Central coordination of energy policy would highlight the importance of energy research, eliminate confusion between government departments on the responsibility for energy research, minimize administrative overhead, and minimize overlap of different energy funding programs.

Regarding fusion energy research in Australia, any funding model should recognise that research capability is located mostly in University environments. The only existing publicly funded structure that supports strategic collaborative University research is a Centre of Excellence. We note that the time scales of fusion energy research and a Centre of Excellence are not commensurate. An alternative funding arrangement, that may provide longer time scale strategic research is an Office of Fusion Science in or across DEST/DITR/DEH/ANSTO.

3. What are your views on the importance of support measures for the different stages of the innovation chain?

Table 2 outlines suggested support measures for the various stages of the innovation chain, characterised by the three different time-scale horizons.

Table 2: Support measures for different stages of innovation chain

Commercialization time-scale	Support Measure
Short (< 5 yrs)	Industry RD&D
Medium (5-15 yrs)	CRC
Long-term strategic (>15 yrs)	Government research organizations, Government administered strategic research programs Centres of Excellence, which are reviewed every five years.

4. What are your views on existing levels of coordination between jurisdictions and between jurisdictions and the private sector?

Recent problems in relation to the siting of the synchrotron and low level nuclear waste dumps as well as the ever present competition for Centres of Excellence and CRC's based in different states reveal that the process is competitive rather than cooperative. We need to ensure that there is better coordination between federal and state to ensure that we maximise the outcomes from research taking advantage of all available expertise, not just that which is best located in one region.

5. What are your views on the possible role of centres of excellence for particular technologies?

In today's global environment, energy technology programs with long-lead times (ie. > 15 yrs) tend to be supported by international consortia. Effective participation in international research programs requires funding commensurate with the time scales of the research program. Australia's principal source of strategic funding is the ARC Discovery Program, which statistically favours 3 year programs, with maximum funding duration of 5 years. This duration is too short to provide strategic funding in most energy technology sectors. Centres of Excellence, which normally have longer funding time-frames provide greater strategic support to enable Australia to participate in energy research.

There are several energy technologies whose research capability has already been significantly enhanced by Centre of Excellence formulation. These include photovoltaics, through the ARC Centre of Excellence for Advanced Silicon Photovoltaics and Photonics, and solar energy, through the ARC Centre for National Centre for Solar Energy Systems. Other energy technologies are already well supported by a range of CRC and government research centres. These include :

CRC for Clean Power from Lignite
CRC for Coal in Sustainable Development
CRC for Greenhouse Gas Technologies
CSIRO Energy Transformed Flagship
ANSTO,

Of all of these energy technologies spanned by these organizations, there is however only **one** that is not presently supported by Australia with any strategic research funding component at all. The missing technology is nuclear fusion. Whilst the Commonwealth does provide infrastructure support for the Major National Research Facility, located at the ANU, there is no actual research funding support.

Although the time scales of fusion energy research are greater than those of a Centre of Excellence, we submit formulation of a Centre of Excellence in fusion energy would fill this missing technology gap, especially if provision were provided for renewal at 5 year intervals subject to reassessment. We also note that com