

Review of the National Innovation System: Australian ITER Forum submission

The Australian ITER Forum spans over 130 Australian scientists and engineers drawn from universities, Government research laboratories and industry, who support an Australian involvement in the international development of fusion energy via ITER project participation. The H-1 National Plasma Fusion Research Facility is Australia's only toroidal magnetic confinement fusion experiment.

Both the Australian ITER Forum and H-1 Board welcome the National Innovation System Review launched by the Rudd government. We believe government policy can effectively foster innovation through the support of strategically oriented research, and in doing so can channel the creativity into areas of the highest national benefit. For example, the recent international investment in fusion research has spawned a multi-billion dollar business in fusion technology development in many developed and developing countries. In addition to bringing the dream of fusion power to the demonstration stage, this will also undoubtedly advance those technologies and industries and spawn "spin-off" innovations. Although it has the credentials, Australia cannot take part in this without substantial commitment from the Government.

This submission identifies gaps and weaknesses in relation to strategic research and associated technology development in general, with particular reference to development of what is arguably the ultimate sustainable energy innovation, fusion power. We suggest solutions that build on themes from the Australian ITER Forum's strategic plan. "A strategy for Australian fusion science and engineering: Through ITER and into the future", available from the Australian ITER Forum website www.ainse.edu.au/fusion.html.

The strategic plan was developed over a 12 month period, drawing input from the international and domestic research community, as well as government departments and industry. The plan articulates the opportunities and benefits presented to Australia by joining other nations in the development of fusion power and proposes a new, multi-faceted Australian Fusion Initiative ("the Initiative") that spans the innovation system as it pertains to strategic research, innovation and industry involvement. This Initiative, if supported, secures Australian scientific expertise with a targeted fellowships scheme, provides appropriate support for Australian fusion science infrastructure, and advances Australian industry capabilities through a formal engagement with, and a contribution to, ITER. To date, public letters of support for the strategic plan and Initiative have been received from the ITER organization, the Australian Nuclear Science and Technology Organisation, the H-1 Board, seven Australian Universities, and five Australian learned societies and Academies.

In this submission we build on our previous policy submissions, and offer five specific ideas to address some of the systemic impediments to large-scale, long-term strategic research. In summary, they are:

- An evaluation body is needed to assess, determine and endorse the nation's strategic research directions.
- A research funding program spanning the University sector is needed to support strategic research in endorsed fields for which the Nation has no other research capability or activity.
- The global benefit of research needs to be better recognized when setting the national R&D priorities and in the assessment of competitive grants.
- Improved recognition of strategic research planning is warranted across both the innovation system and government.
- There is a need for more early to mid-career scientist career pathways, to avoid an exodus of domestic talent, and to build for our future.

In the remainder of this submission, we detail the reasoning behind each of these 5 ideas.

EVALUATION

Little assessment is conducted on the missed opportunity cost of failing to participate in emerging international science and technology programs. This is particularly acute when assessment involves the participation of multiple Federal government portfolios.¹ Evaluation of properly prepared proposals would be best conducted by a new whole-of-government body. We believe it is vital to provide an evaluation mechanism to weigh the modest opportunity costs for involvement in high risk and difficult research programs such as ITER against the potentially enormous dividends that such programs may deliver. In addition to assessing the science merit and social benefit of engagement, any such evaluation procedure must also:

- include the economic benefits derived from spin-off technologies (i.e. those that are incidental to the program),
- assess the missed-opportunity cost to the innovation system and Australia’s future economy (e.g. lost global market share in new technologies) by failing to respond.

STRATEGIC RESEARCH

Nearly all strategic research programs in Australia are undertaken by government research organizations, with comparatively few mission-oriented research funding programs in the University sector. In contrast with most other nations, Australian fusion science capability resides almost entirely in the University sector, and there is currently no government research organisation charged with advancing fusion research. A cohesive funded program is hence needed to bridge this gap.

For fusion science and technology, we have proposed the Australian Fusion Initiative, which would span Universities, government research organisations and industry, and have the responsibility for coordinating the Nation’s strategic development of fusion power. The Initiative would be endowed with funding flexibility and span to undertake strategic research, and fund human capacity development, enabling infrastructure, international engagement, and industry growth. In recent years, Australia has supported these components by independent funding programs and the diminishing University block grants. Such a distributed approach does not provide the coherence necessary to undertake strategic research, and so the Initiative would depend on new funding being established. The Initiative would also need to be sustainable over time, to give certainty and continuity to Australia’s international engagement in this area. We suggest a possible funding source is some form of carbon emission tax, channeling revenue back into research and development of low emissions energy technology.

GLOBAL BENEFIT

Our present innovation system is largely driven by the “national benefit” R&D priorities. In light of the increasing internationalisation of research, driven largely to meet global challenges, greater weight needs to be allocated to global benefit when compiling the “national benefit” R&D priorities. Australia would further benefit from greater international input in setting national R&D priority areas. The priorities should also be regularly reviewed in light of international developments.

¹ Fusion is an example of a science and technology field with multiple portfolio interests. The successful realisation of fusion power is of great importance to Resources and Energy, and Climate Change with regard to clean base-load power generation. The products of the innovation system: discovery, international engagement and leverage, and industry spill-overs are of direct relevance to Innovation, Industry, Science and Research. Fusion science has great leverage potential to attract students to science and engineering, with payoffs to Education and Training. Finally, engagement in international mega-science projects advances Australia’s international relations, with carriage by Foreign Affairs and Trade.

Australia would also benefit from greater international input into assessment of competitive grants. Because of Australia's relatively small community and the domestic assessor weight in the peer review process, there is a tendency for reviewers to encourage projects in research fields already well established, at the expense of missing new international opportunities.

STRATEGIC PLANNING

Under the leadership of an institutionally representative Steering Committee, the Australian ITER Forum has led initiatives to inform the general public and media, briefed government departments, parliamentarians and Ministers, provided public policy submissions, testified before Parliament, and conducted a successful workshop on identifying possibilities for Australian involvement in ITER. Most recently, we have undertaken a 12 month strategic planning process drawing on the Australian and international innovation community, as well as government departments, in outlining a pathway forward for the nation to develop fusion science capability leading to ITER engagement. The recommended funded structure, the Australian Fusion Initiative, would reward the nation with highly-leveraged access to a multi-billion dollar research facility. It would help advance Australian industry capabilities through technology transfer and by opening business opportunities with the ITER community. Perhaps most importantly, it would ensure the retention and development of skills, and prepare the nation with the expertise to evaluate and/or deploy fusion power in the longer term.

We believe that in every other field of science and technology, the relevant innovation community (including that of publicly funded research) also has a responsibility and formative role in advising government of the context and impact of research developments, and identifying opportunities available and strategic needs. Such planning integrates views across the community, brings coherent policy advice to decision makers, and by offering carefully planned, appropriate-scale, high-value proposals, minimises missed-opportunities. Based on our experience we suggest that there are some cost-neutral ways that strategic planning might be further encouraged. These include:

- Greater peer recognition of the value of strategic planning, through quantified measures of research leadership in assessment schemes such as competitive grants, and/or establishment of strategic planning awards,
- Better promotion of existing schemes that support strategic planning (e.g. International Science Linkages conference funding, ARC Linkage Learned Academies Special Projects).

EARLY AND MID-CAREER OPPORTUNITIES

We welcome the new mid-career Future Fellowships scheme which is designed to provide research opportunities for early and mid-career scientists. Such schemes could help also meet the challenges of participation in large scale international research by allowing some of the fellowships to be allocated or targeted to strategically-orientated international research programs. Recognising that talent is diversely distributed across the nation, any such targeting should not be institution specific.

In closing, our fusion science and engineering strategic plan recommends formation of the Australian Fusion Initiative, \$63 million ten year funding program that would deliver a long term, internationally integrated capability for Australia in fusion science. Either funding the Initiative, or enabling other mechanisms to deliver the same components with coordinated oversight, is now critical if the nation is to have any future capability in fusion energy. Addressing the five issues raised above would also yield systemic improvements in the national innovation system.

Yours Sincerely,



Dr Matthew Hole,
Chair, Australian ITER Forum, and
H-1 National Plasma Fusion Research Facility Board Member,
Research School of Physical Sciences and Engineering,
Australian National University.

Co-signatories: § Australian ITER Forum Steering Committee, ¶ H-1 Board members

¶ Professor D.J. O'Connor, Chair of the H-1 National Plasma Fusion Research Facility Board, FAIP, FInstP, CPhys, University of Newcastle

¶ Assoc. Prof. Boyd Blackwell, Director H-1 National Plasma Fusion Research Facility, Australian National University.

¶ Dr George Collins, Chief of Research, Australian Nuclear Science and Technology Organisation.

¶ Professor John Howard, Senior Fellow, Plasma Research Laboratory, Res. School of Physical Sciences and Engineering, Australian National University.

¶ Professor Andrew Cheetham, Pro Vice Chancellor (Research), University of Western Sydney.

¶ Professor Brian James, Vice President, Australian Institute of Physics, Honorary Associate Professor, School of Physics, University of Sydney

¶ Professor Joe Baker AO, OBE, FTSE

¶ Professor Marcela Bilek, Federation Fellow, School of Physics, University of Sydney.

¶ Professor R. L. Dewar, Dep. of Theoretical Physics, Res. School of Physical Sciences and Engineering, Australian National University.

¶ Dr Dennis Mather, Executive Secretary, Australian Institute of Nuclear Science and Engineering.

¶ Prof. Halina Rubinsztein-Dunlop, Centre for Biophotonics and Laser Science, School of Physical Sciences, University of Queensland

¶ Professor Julio Soria, Personal Chair in Mechanical Engineering, Aerodynamics and Fluid Mechanics Director of the Laboratory for Turbulence Research in Aerospace & Combustion, Department of Mechanical and Aerospace Engineering, Monash University.

¶ Dr Horst Punzmann, Research Engineer and Facilities Manager, Plasma Research Laboratory, Res. School of Physical Sciences and Engineering, Australian National University

§ Professor Igor Bray, Curtin University of Western Australia.

§ Dr Robert Carman, VC Innovation Fellow, Dep. of Physics, Macquarie University