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2011 Roadmap
Research Infrastructure Branch
Department of Innovation, Industry, Science and Research
GPO Box 9839
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Re: Exposure draft of the 2011 Strategic Roadmap for Australian Research Infrastructure

Dear Roadmap Team**,**

The Australian ITER Forum spans over 150 Australian scientists, engineers, and research managers drawn from universities, Government research laboratories and industry, who support development of fusion energy by increased international engagement leading to ITER project participation. Fusion, a reaction first discovered by the Australian Sir Mark Oliphant in 1934, is the fundamental process that powers the Sun and the stars. Successfully taming nuclear fusion offers clean, base-load sustainable power generation, virtually free of greenhouse emissions. ITER, one of the worlds' largest scientific projects, is the next step fusion energy experiment designed to demonstrate the viability of fusion power.

We thank the Dep. of Innovation, Industry, Science and Resources for this opportunity to comment on the "2011 Strategic roadmap for Australian Research Infrastructure". The document articulates the need for investment in research infrastructure, and identifies capabilities areas at a high level.

We would like to suggest the following to strengthen the case for funding, and improve the evaluation process.

1. International context.

Greater importance should be placed on the international context of research infrastructure. Fundamental advances in many fields require multinational facilities beyond the scope or remit of nations.

A good example is the ITER project, which is supported by seven parties include two developing countries, the People's Republic of China and India, as well as the EU, Japan, the Republic of Korea, the Russian Federation and the USA. The research, engineering and operational experience outcomes of ITER will guide design of prototype power plant(s), and the fusion engineering community envisages that fusion will become a commercial technology in the second half of this century.

Although ITER is recognised under the "Sustainable Energy" section (pg 57), and the multinational dimension is mentioned under "A National Approach", we suggest the international dimension be

identified in the summary paragraph of "Research Infrastructure" (pg 7). Our suggested insertion is in italics:

"Australian researchers need to have access to leading-edge infrastructure, *whether located in Australia or internationally,* in order for their research outputs to be internationally competitive. This will additionally attract international researchers to Australia to undertake their work, *or collaborate with Australian scientists."*

We note that access to major international research facilities is crucial in many fields of science. The former International Science Linkages scheme supported competitive grant projects with major international facilities, and Australian scientist participation in major research facilities through the "Access to Major Research Facilities Program" managed by ANSTO. The latter program supported Australian scientist engagement with 24 facilities in astronomy, 12 facilities in neutron scattering, and 22 facilities in physics. The absence of both programs poses a risk to the ability of Australians to engage in global leading-edge infrastructure.

2. Sustainable Energy Capabilities

The aim of ITER is to demonstrate feasibility of fusion energy for peaceful purposes. The project has both physics and technology objectives:

- Physics: the generation, diagnosis and study of plasmas dominated by alpha particle (self) heating. To produce power, fusion power plants need to access this burning plasma regime. The physics goals encompass multiple "Grand Challenges", including plasma self-organization, measurement and diagnosis, non-Maxwellian and nonlinear physics, confinement transitions, exhaust and fuelling control, high "bootstrap" (self-current driven) regimes, energetic particle modes, and plasma stability.
- Technology: demonstration of integrated operation en-route to a power plant, and address of the crucial materials issue. Fusion power plants will be subjected to up to $2MW/m^2$ of 14MeV neutron flux loading, and up to $20MWm^2$ on the plasma 'divertor'. ITER will access fusion regimes producing up to $0.5\ MW/m^2$ of fusion neutrons, and develop a tritium test breeding blanket to transmutate lithium. Under the ITER Broader Approach, a parallel accelerator based test facility, the International Fusion Materials Irradiation Facility will be constructed, to reproduce fusion power plant reactor conditions, accelerate materials development and qualify materials for a prototype commercial reactor.

In addition to ITER are activities that seek to develop improved confinement configurations more appropriate for a commercial power plant (e.g. a stellarator: the class of experiments to which the Australian H1 Plasma Fusion research experiment belongs), and materials synthesis and characterisation for high thermal and neutron flux environments. In light of the breadth of this research, which spans energy transformation, confinement, and materials, we suggest the following modification to the text on page 55.

"Advances in energy systems engineering fundamentally rely on the discovery *of improved processes for energy transformation and confinement*, and the discovery of advanced materials, their fabrication into components and deployment in engineered systems. *Both are particularly true for high density baseload power systems such as fission and fusion."*

We also suggest that under Challenges and Assumptions (pg 55), the Australian Plasma Fusion Research Facility be identified as a funded initiative that has begun to address energy and emission issues relevant to a sustainable energy landscape.

3. Evaluation Mechanism.

A limitation of the document is the omission of a formal mechanism by which infrastructure proposals would be evaluated and assessed. The document refers only to a facilitation process similar to NCRIS capabilities that would define the next level. We propose that a more formal mechanism and a call for proposals be established to make the facilitation process system more transparent and open. We also recommend that the distinction of landmark infrastructure be eliminated, and such proposals included within the NRIC process. NRIC could assess such proposals, but refer the funding decision to Cabinet if deemed out of budget scope.

Yours Sincerely.

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