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Department of Resources
Energy and Tourism

Energy Innovation Fund

Australian Solar Institute

Scoping Paper

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1 Introduction

It is widely recognised that global warming presents a serious threat and Australia must make a strong contribution to addressing this issue. In response to this threat, the Australian Government has committed to a range of measures to address climate change, which include the establishment of the Carbon Pollution Reduction Scheme by 2010 and the introduction of an increased renewable energy target of 20 percent of Australia's electricity supply by 2020.

The Government will also provide $150 million over four years for an Energy Innovation Fund (EIF) to support innovative renewable and clean energy technologies. The EIF will provide:

- $100 million for research into solar thermal and solar photovoltaic (PV) technologies, delivered through an Australian Solar Institute (ASI); and
- $50 million for a Clean Energy Program, which will provide grants for research into clean energy technologies in areas such as low-emission electricity generation, energy efficiency, energy storage and hydrogen transport fuels.

The objectives of the EIF are:

- to develop and advance Australia’s research and development capabilities and intellectual property in clean energy technologies;
- to assist in achieving Australia's 20 percent renewable energy target by 2020, by accelerating developments that will reduce greenhouse gas emissions and assist in mitigating global climate change; and
- to assist in developing Australia's clean energy industry and export opportunities.

1.1 The Australian Solar Institute

The establishment of the $100 million ASI will see a significant expansion of solar thermal and PV research capacity, which will help restore Australia's position at the forefront of solar energy development and research. The high level objectives for the ASI include:

- the advancement and acceleration of innovative solar thermal and solar PV technologies in Australia;
- to drive research that will have a major impact on the efficiency and cost effectiveness of solar technologies;
- to increase the competitiveness of solar technologies with other stationary energy generation;
- to retain local, and attract international expertise in solar energy research to Australia; and
- to make Australia a key player in development of solar energy technologies in the Asia-Pacific region.

This scoping paper provides guidance for Australia’s research and development community on the design and implementation of the ASI, to ensure the maximum dividend is achieved from this significant allocation of Government funding. It is essential that progress in meeting the objectives for the ASI is measurable through the development of key performance indicators to aid in regular reporting to Government.

It draws on an initial consultation on the solar thermal and solar PV component of the EIF that the Department of Resources, Energy and Tourism held on 25 March 2008 with researchers and executives from the CSIRO, the Australian National University (ANU) and the University of New South Wales (UNSW).

CSIRO, ANU and UNSW are now invited to produce a joint proposal on behalf of the Australian solar research community for the implementation of the ASI, based on this scoping paper, by mid-October 2008.

1.2 Background

Australia has been a leader in the development and use of renewable energy, particularly solar technologies, and consequently has had a strong uptake in remote area power systems and solar water heating.

Over the last decade, funding for renewable and clean energy research and development from Commonwealth and State governments has seen only a very modest increase. Researchers report that there has been a loss of Australian expertise in solar energy research, as research institutions have had to reduce staffing levels to cater for smaller budgets, and because researchers have been attracted to well funded overseas organisations such as those in Germany or the United States.

The ASI will provide an opportunity for Australian solar energy research and development organisations to build on existing capabilities and to re-establish a leadership position, particularly in solar thermal and solar PV technologies.

1.3 Challenges and opportunities

A significant challenge in building an Australian research and development capability in clean energy technology is to ensure that skilled researchers are not lost to overseas organisations. Funding for the ASI will increase domestic research capacity and assist in attracting international expertise. To capitalise on the new funding, CSIRO and existing centres of research at universities will need to recruit and train new staff quickly. There is a significant lead-time in academic and on-the-job training before centres will be able to accelerate research activity.

Critical to the success of the ASI will be the development of strong linking partnerships between a range of academic institutions and industry. The Australian Government is aware that CSIRO, ANU and UNSW are established participants in the field, but recognises there are other research groups and academic institutions carrying out significant solar energy research that could be incorporated into the ASI activities. The ASI's interaction with industry, university, and government partners will be a key to moving solar energy technologies into the marketplace.

It is important that funding is used to build on existing internationally recognised achievements by Australian researchers, drive fresh approaches and initiate innovative research, rather than simply providing for continuation of current research activities. The ASI may distribute funding through both targeted programs and through more generic competitive project rounds. This will generate positive outcomes for Australia’s solar energy research community in universities, the public research sector and industry.

There will be developmental and efficiency benefits from the integration of PV and solar thermal research in one institute, as there are many synergies between the two technologies. Many international institutes combine activities on these two streams. For

example, the National Renewable Energy Laboratory in the United States has a Solar Energy Technologies Program that supports research and development in both solar PV and solar thermal energy technologies. Each research area is enhanced by crosscutting functions, including industry partnerships and technology transfer, analysis, and program integration.

It will be important for the ASI to develop a business model that leads towards a self-sustaining operation when Australian Government funding ceases in June 2012. It is also expected that by 2012, the impact of the introduction of the Carbon Pollution Reduction Scheme and the increased renewable energy target will have changed the investment landscape. These developments will help attract private sector investment to maintain the operations of the ASI.

1.4 Leverage Benefits

Expected benefits to the Australian solar research community from the establishment of the ASI include the ability for participants to forge new or stronger links with peak overseas research organisations, thus fostering collaboration and making Australia a more attractive environment for researchers. These key overseas bodies include the Fraunhofer Institute for Solar Energy in Germany, the National Renewable Energy Laboratory in the US, the International Energy Agency and the recently established Solar Energy Research Institute of Singapore. This will assist in building the research capacity of Australian organisations. The very significant level of funding being provided through the ASI will also allow leveraging of additional funding from industry, State and Territory governments and the finance sector, driving a higher level outcome rather than merely incrementally increasing existing Australian research activities.

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2 Technologies supported under the ASI

2.1 Solar thermal technologies

The term 'solar thermal' has a very broad meaning and can refer to solar water heating systems[1] through to large scale concentrating solar power stations in the multi-megawatt scale.

Solar thermal electricity has been successfully demonstrated on a large scale in California over the last 20 years, but activities in Australia have mainly been at pilot stage. Large scale solar thermal technology is currently cheaper to construct than PV cells, although it has not yet benefited from similar levels of investment. Future cost reductions can be expected through emerging economies of scale, and through research and development on energy storage and heat transfer efficiency.

Australian researchers are at the forefront of the research and development of new approaches for concentrating solar thermal applications. This work includes investigations into lower cost manufacturing and the use of concentrating solar thermal systems for desalination and hydrogen production. New approaches to energy storage are also being investigated to allow concentrating solar power stations to provide continuous power.

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[1] Research into new technologies for solar water heaters will not be part of the ASI but may be eligible for funding support under the Clean Energy Program component of the EIF or the Climate Ready Program under Clean Business Australia.

Integration of concentrating solar thermal systems into hot fractured rock geothermal power systems is also being considered as a means of improving efficiency.

Collaboration with industry to further the research and development of solar thermal systems will position this technology for near and long term commercial markets in Australia and overseas, and will stimulate the domestic manufacturing industry, energy utilities, researchers and engineering services companies.

2.2 Solar photovoltaic development

Solar PV cells have been used since the middle of the 20th century, when space applications led to rapid development of the technology. A further boost to development resulted from the oil crisis of the 1970s. Since then, there has been considerable research aimed at improving conversion efficiency and reducing costs. However, in the Australian context of low electricity prices from coal fired generation, the cost of solar power generation has remained prohibitive without some form of subsidy. The exception is remote power applications, where the high cost of generation from diesel power systems can make solar power competitive.

Solar PV systems in the domestic sector have seen significant growth in the last ten years, driven by the Mandatory Renewable Energy Target and rebates to purchasers from the Commonwealth and State governments. The Australian Government's Carbon Pollution Reduction Scheme and the increase of the Renewable Energy Target to 20 percent are expected to further boost uptake.

The key to solar PV systems becoming mainstream electricity generators is a significant reduction in cost. Costs can be expected to continue to come down as the size of the market increases, but new technology development remains the most likely way of achieving significant cost reductions.

The ASI will accelerate this development process through a large injection of funding to support Australia's research and development activities. Results from research and development will provide a strong incentive for the private sector to co-invest and secure rights to develop and commercialise technologies coming from these processes. State governments are also expected to provide co-funding to support research at the ASI, which will leverage the economic benefits both in the short and medium term.

Organic PV is an emerging sector within the solar PV industry with potential to significantly reduce the real cost of solar power and it is expected this technology will be included in the ASI portfolio of research. There already is significant activity in this field in Australia, through the Victorian Organic Solar Cell Consortium, which includes more than 70 researchers collaborating on this technology at research centres around the country.

In the more established solar technologies there are areas of significant overlap between concentrating solar thermal and solar PV system development. An example is concentrating solar PV technology, which uses high efficiency multijunction PV cells and has potential to produce hydrogen in addition to electricity.

3 Proposed mechanism to establish the Australian Solar Institute

3.1 Concept

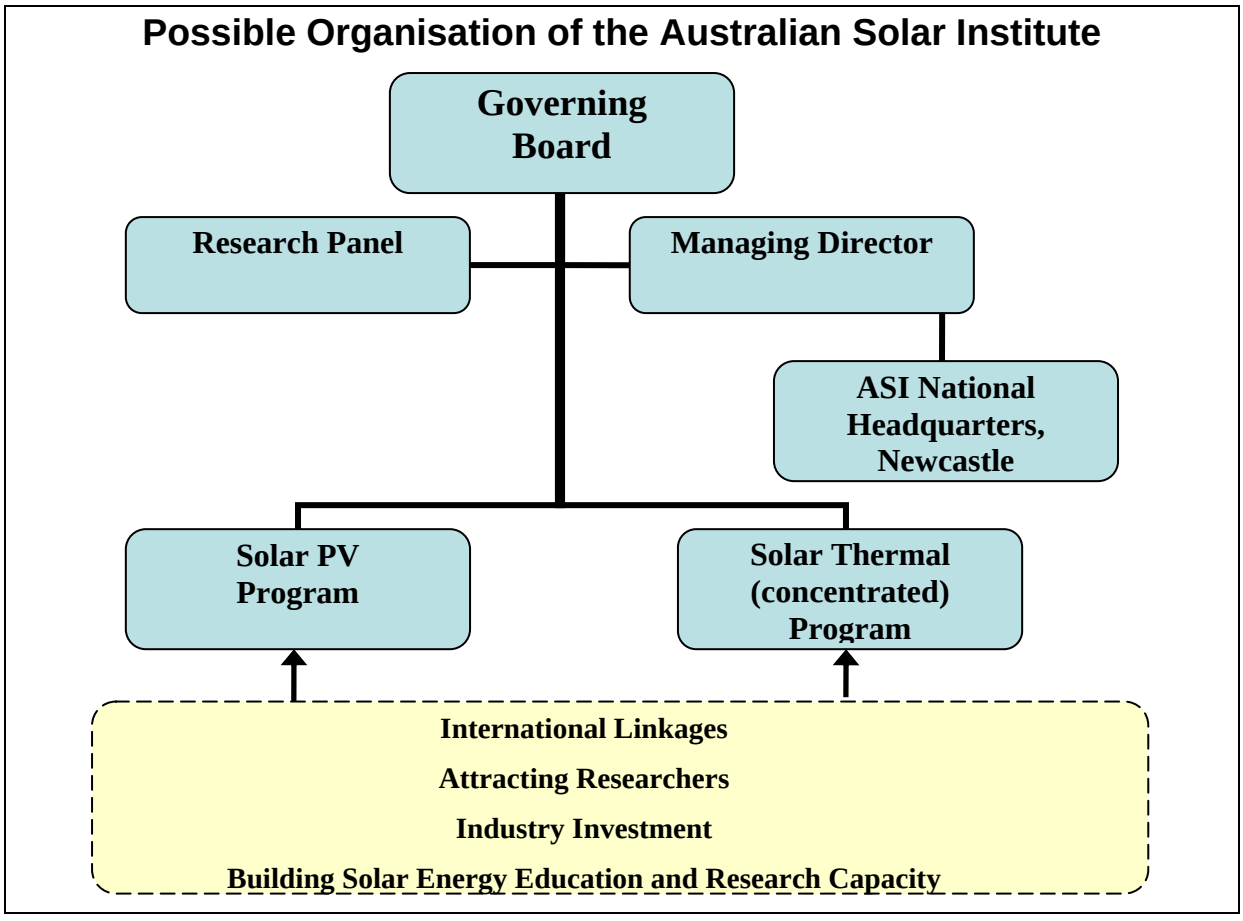
The ASI will maximise research opportunities and promote close relationships between the different fields of research by providing a critical mass of researchers and funding and by reducing research costs through the use of shared resources. The ASI will be a virtual institute that brings together the best researchers in Australia and which can attract international expertise. The ASI will also facilitate training and education of the next generation of Australian solar energy researchers and assist in developing international linkages.

3.2 Management structure

A national headquarters for the ASI will be established at the CSIRO Energy Centre in Newcastle. A suggested management model for the ASI is the establishment of a Governing Board of Directors supported by a Research Panel and a Managing Director. The Board could include representatives from:

- CSIRO, ANU and UNSW and other members of the solar energy research sector;
- industry; and
- the finance sector.

The following diagram shows the elements that could be included in the ASI.



The Governing Board should provide guidance and oversight of the research activities of ASI members. The Chair of the Governing Board should be a prominent and respected member of the solar research community to ensure the ASI is recognised internationally.

The Governing Board should set up a management and governance structure to run the ASI. The national headquarters, to be located at the CSIRO Energy Centre in Newcastle, would be responsible, through the Managing Director, for:

- administering ASI funding;
- overseeing ASI programs, projects and other activities; and
- providing support for the ASI Board and Research Panel.

The Research Panel should comprise individuals from CSIRO, ANU, UNSW and other institutions in the solar research sector. The Research Panel would provide expertise for the evaluation of projects and programs and make recommendations to the Governing Board on activities to be supported under the ASI.

The two main program arms of the ASI could be:

- a Solar PV Program that would provide support for research into technology enhancements and new materials which are aimed at improving efficiency and reducing costs; and
- a Solar Thermal Program that would focus on significant expansion of solar thermal research capacity in Australia.

There will be other activities that apply to the complete spectrum of ASI activities that may warrant establishment of separate program streams, such as international networking, industry investment and education.

3.3 Funding

The EIF provides $100 million in funding to ASI over the four-year period from 2008-2009 to 2011-2012. The funding should be used to support specific research programs and projects, but a proportion of the funding should be allocated to core ASI activities, including administration and training, capacity building and international collaboration. However, administrative costs need to be minimised to ensure the majority of available funding is focused on supporting research activities. The Governing Board will need to develop funding sources for continuation of the ASI beyond 2012.

3.4 Eligible research programs and projects

Technologies that could be supported under ASI programs include solar thermal concentrators, solar PV, and overlapping technologies. Technologies which are not covered include those relating to domestic hot water generation, solar heating and cooling, for which other Government programs provide possible funding support.

Eligible programs and projects could include:

- Low-cost 1st generation PV technologies that use Australia's abundant resource of high-purity quartz to produce low-cost solar-grade silicon and high efficiency solar cells;
- 3rd generation advanced PV technologies that deliver high efficiency and low cost manufacturing routes and photonics;
- Thin film technologies;
- Compound semiconductor multi-junction technologies;
- Organic PV technologies;

- Solar-enhancement of fossil and biomass fuels for electricity and transport fuels;
- High temperature steam generation for hybrid fossil and stand-alone power;
- Large scale energy storage suitable for variable renewable generation;
- Concentrator optical optimisation and cost reduction;
- Solar furnace for very high temperature processes and materials;
- Distributed polygeneration (Brayton cycles; small low temperature troughs for heating, cooling);
- Low temperature water purification such as desalination and detoxification, but excluding presently commercial solar water-heating; and
- Hybrid technologies that use spectrum splitting to produce both electricity and hydrogen for solar energy storage.

3.5 Eligible applicants

It will be important to ensure that programs and projects funded through the ASI provide an opportunity for all significant academic institutions and promising Australian researchers in the fields of solar PV and solar thermal to seek funding. Projects should be undertaken in Australia, to ensure that the benefits of the Government's investment are captured in Australia.

In general, funding from the ASI under the Solar PV Program and the Solar Thermal Program should be available to research centres at universities, public sector research organisations such as CSIRO and the private sector. The funding is intended to support research that shows strong potential for commercial uptake and is expected to include small-scale proof-of-concept projects.

In selecting programs and projects for award of funding, the ASI should take into account:

- the merit of the proposed project;
- funds leveraged from industry, State and Territory governments, financial institutions and other sources;
- the degree of excellence of the project team in solar research and development as measured by publications, patents and commercialisation of research; and
- referee reports from international experts.

3.6 Eligible expenditure

Generally, expenditure under the following headings could be eligible if it is directly related to approved projects:

- salaries;
- contractors employed to support research activities;
- materials and consumables used to carry out research activities; and
- upgrading and re-equipping of laboratories with new instrumentation and fabrication equipment.

Other miscellaneous expenditure, directly related to eligible project activities, may also be eligible.

Guidelines will need to be developed as part of the governance process for the ASI, for agreement by the Commonwealth, containing full details on eligible expenditure including expenditure limits.

3.7 Assessment process

A competitive process will be required for selecting research programs and projects and allocating the research funding, to ensure that worthwhile and innovative research is funded. The Governing Board will need to establish a Research Panel, to evaluate proposals and make recommendations on programs and projects to be awarded research funding.

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4 Intellectual property

The Australian Government does not expect to have any ownership of intellectual property (IP) developed through ASI funded programs, but it is essential that any IP developed is properly managed and protected.

The ASI will need to develop an IP management plan, to be agreed with the Commonwealth, to ensure that the rights and obligations of participants in ASI funded programs and projects are clearly understood and to ensure that IP developed through Australian Government funding supports the national interest.

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5 Interaction with other programs

There will be synergies between the ASI and the Clean Energy Program components of the EIF, and with other Australian Government programs such as those under the Renewable Energy Fund, the Climate Ready component of Clean Business Australia and the Clean Energy Enterprise Connect Centre. Guidelines and eligibility criteria for these programs are being developed to ensure that the programs are complementary and cover a broad spectrum of the innovation continuum.

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6 Next steps

The three peak institutions involved in solar research are requested to collaborate to produce a joint proposal by mid-October 2008 for the implementation of the ASI on behalf of the Australian solar research community. CSIRO, ANU and UNSW should take into account the points made in this scoping paper, and their response document should include details of:

- the proposed organisational and administrative structure;
- governance arrangements, including proposed composition of the Governing Board and Research Panel;
- how other academic institutions and prospective solar research groups will be incorporated into the organisation and activities of the ASI;
- the proposed approach to project and program identification and selection and the administration of grants;
- proposed ASI objectives and performance indicators;

- the annual budget, including proposed funding allocation for the main streams of research, administration, cross-cutting activities such as training and capacity building, and international outreach and collaboration;
- the proposed timeframe for the establishment and commencement of operations of the ASI; and
- the development of a plan to ensure the ongoing operations of the ASI when Australian Government funding ceases in June 2012.

Following consideration of this response and approval from the Minister for Resources and Energy, the Department of Resources, Energy and Tourism will negotiate a contract with the relevant parties to establish and operate the ASI. This contract will provide details of arrangements for the payment of funding, subject to achievement of contract milestones.

For guidance, the expected timetable is:

- scoping paper provided to CSIRO, ANU and UNSW early September 2008;
- joint proposal provided to the Department by mid-October 2008;
- proposal agreed and approved by the Minister for Resources and Energy by mid-November 2008;
- draft contract forwarded by the Department in late-November 2008;
- contract signed and initial payment to allow commencement of ASI operations by mid-December 2008;
- establishment of the ASI, including the engagement of a Governing Board and appointment of administrative staff in early 2009; and
- official launch of the ASI in mid 2009.

The response document should be forwarded to:

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