Renewable Energy and Clean Technology
Global

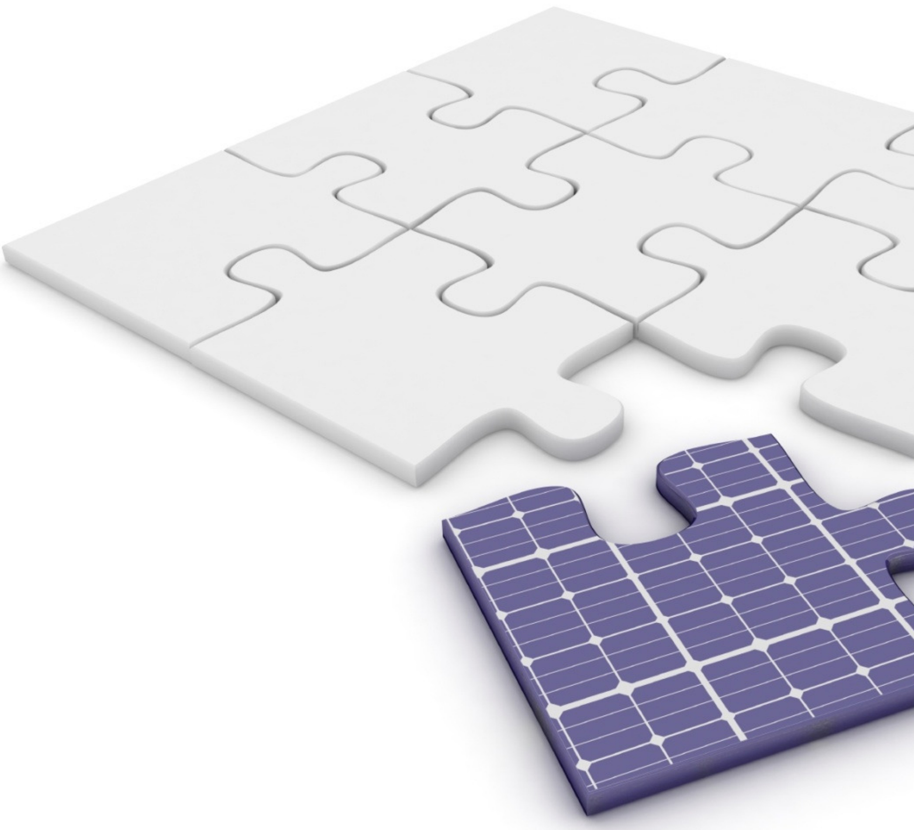
BAKER & MCKENZIE

Global Benchmarking Report

Solar RD&D Funding Sources and Models

Report for the Australian Solar Institute

November 2010



ASI
AUSTRALIAN SOLAR INSTITUTE

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1. Executive Summary

1.1 Background

The Australian Solar Institute (ASI) was established as part of the Australian Government's Clean Energy Initiative (CEI) to support the Australian solar industry in developing cost-effective solar technologies as means of generating electricity while addressing the need to reduce national greenhouse gas emissions. The ASI is supported by an A$100 million funding commitment from 2009 to 2012, which the ASI will invest to accelerate innovation in solar photovoltaic and thermal technologies in order to reduce the levelised cost of solar energy in Australia.

The ASI's mandate extends to cover skills development, knowledge building, strengthening international collaboration (including through dissemination of the outcomes of the Australian Government's Solar Flagships program) and, most relevantly for the purposes of this report, attracting private investment and collaboration in order to ensure sustained support for innovation in Australia's solar sector.

This report is the product of detailed desktop research into the solar and other renewable energy RD&D models currently in use globally, and as such is intended as a research document through which to propose ideas and elucidate relevant issues when considering different options for supporting solar RD&D in Australia. The report does not seek to assess, comment on, or influence current or future government policy or programs in this area, at a national or state level.

Rather, the report seeks to assist the ASI in leveraging private finance for the research and development (R&D) and demonstration (together with R&D, RD&D) of solar energy technologies in Australia, by:

– identifying and analysing, using qualitative assessment criteria, various funding models used in Australia and internationally to finance both solar-specific and broader renewable energy RD&D activities;

– assessing the advantages and disadvantages of different funding models; and

– making high-level recommendations as to which models offer the greatest potential to leverage private investment into solar RD&D in Australia.

Significantly, the R&D and demonstration components of solar RD&D differ in important ways. Solar technologies at the R&D stage in the innovation cycle face relatively long timeframes for market readiness, while technologies at the demonstration stage have a comparatively short commercialisation horizon but require greater funding in order to finance capital-intensive demonstration facilities. Consequently, each will be better suited to different forms of financing and attract different types of investors, and may equally require different public funding and incentive structures in order to attract increased private investment.

As a result, early stage solar R&D activities are leveraged in large part (if not entirely) by government grants, while businesses undertaking demonstration activities may draw funding from a wider range of sources, including equity investments from early seed investors, venture capitalists and private equity, debt finance (often a combination of concessional government loans and commercial private debt) and, in some cases, later-stage grant programs.

The ASI has successfully demonstrated that significant public and private investment for solar R&D can be leveraged through the proactive award and management of grants. The ASI's experience to date has also highlighted the challenge of attracting the ongoing private sector investment required to take successful solar R&D through the demonstration phase of the innovation cycle.

1.2 Funding models and assessment criteria

Funding models that incorporate a public funding component have proven effective in leveraging significant additional private investment in R&D in innovation industries like solar energy, with public financing mechanisms in the climate change mitigation sector able to increase private financing in the sector by factors of between three and fifteen.[1] In the solar and broader renewable energy sectors, the following models have been used to deploy public finance as a means of attracting increased private finance for RD&D:

Grants: public grant funding programs, which are the major source of finance for solar R&D activities globally, can drive private investment in solar RD&D both by providing capital for RD&D activities, and creating an incentive that can be made subject to particular private investment requirements (such as matched funding requirements).

Funds: fund structures, although demonstrating significant variation, can attract increased private finance for activities targeted for investment, by mitigating investment risks and allowing exposure to a wider range of investment opportunities.

Loans: loans for solar and other RD&D activities may also take a wide range of forms, all of which may be adapted to help attract increased private finance for RD&D, for example through application of concessional terms or provision of commercial finance to high risk enterprises which would not otherwise be able to secure funding.

Guarantees: a range of guarantee structures have been used to encourage private financing of solar and other renewable energy RD&D activities – with research indicating that the following may be the most commonly and effectively used.

Loan guarantees: where a public guarantor guarantees (part of) the debt finance provided by a private lender to a solar RD&D borrower.

Equity guarantees: where a public guarantor guarantees (part of) the equity finance provided by an equity investor in a solar RD&D business.

Performance guarantees: where a public guarantor provides a guarantee that may be called upon if a technology fails to perform as expected.

The above funding models were subject to qualitative analysis to evaluate their respective advantages and disadvantages across the following areas:

- the effectiveness of the model in leveraging private finance for solar RD&D in Australia;
- the suitability of the model for funding solar RD&D activities;
- the compatibility of the model with other relevant policies and measures;
- the adaptability of the model to accommodate material changes in circumstances; and
- the model's complexity of use, both for the ASI and private sector applicants.

This analysis was undertaken using "test models" structured to reflect the ASI's objectives, the Australian solar RD&D context for investments and global best practice.

[1] UNEP Sustainable Energy Finance Initiative, Public Finance Mechanisms to Mobilise Investment in Climate Change Mitigation, SEFI 2008.

1.3 Conclusions

The results of our assessment, as further detailed in this report, suggest that there may be no single funding model capable of effectively leveraging private finance for the full spectrum of solar RD&D activities, while also enabling the ASI to become financially self-sustaining and exert control over key RD&D activities and outputs, such as the management of intellectual property.

Different stages in the solar innovation cycle exhibit different parameters. For example, early stage solar technology R&D opportunities may have relatively low capital intensity profiles (as they generally do not entail significant upfront expenditure on costly plant and equipment) but be relatively numerous (at this early stage marginal technologies have not yet been tested and dismissed). By contrast, by the demonstration stage, opportunities may be relatively few with lower technology risks (as weaker technologies have fallen way), but be comparatively capital intensive (as demonstration may entail the construction of full-scale plant utilising the relevant technology).

The different funding risks and requirements arising from these different parameters may mean that a particular funding model may be relatively well-suited to a particular stage in the innovation cycle (such as a grants for early stage R&D when capital requirements are relatively low), but not so suitable for other stages.

One way to simply consider the different financing and investment approaches to solar RD&D activities is to divide them into:

– technology funding: funding (for the most part government grants) provided relatively early in the innovation cycle, to finance the initial development of a technology; and

– corporate financing: investments (often venture capital and angel equity investments) in companies that have traversed the early stage development of a technology and now require further financing to refine and prove the technology, in preparation for demonstration.

Financiers assessing investment opportunities may therefore evaluate earlier stage propositions by reference to the strength of the technology involved, while later stage investments will be determined based on evaluation of the company working to develop, demonstrate and deploy the technology, as much as the technology itself.

Once a technology has been successfully demonstrated and achieved viable economics and technology risks, projects utilising the technology may be able to be financed using more conventional project finance structures, including through debt from commercial financiers. This latter stage, i.e. the bankability of projects using new technologies, is the ultimate objective of solar and other technology developers seeking to navigate the innovation cycle.

The funding models assessed in this report should, at least at a basic level, be able to address the risks and objectives attached to one or more of these approaches, in order to have practical application in helping to drive solar technology innovation in Australia.

Notwithstanding the above complexities, based on the assessment criteria applied and the ASI's broader objectives, the following three models in our view may have particular potential to enable the ASI to leverage private investment into solar RD&D activities in Australia, as a result of their ability to create a sustained private investment incentive, mitigate risks, generate revenues and manage intellectual property:

Fund model

A fund model, under which the ASI would establish a public/private fund mandated to invest in dedicated Australian solar RD&D companies pursuing commercial objectives, would afford a range of opportunities through which to directly incentivise and leverage private investment. These include offering favourable investment terms and conditions (for example through payment of enhanced dividends to private investors), imposition of minimum private investment requirements (or conversely maximum public funding limits), and matched independent funding requirements for candidate investee companies in which the fund invests.

The private investment incentives established under a fund model would continue to exist for as long as the fund continued to operate, rather than being dependent on short term capital injection opportunities such as under a grant or loan-based model. A fund structured to make equity investments in investee companies would also give the ASI greater scope to control the management of intellectual property rights arising from the activities of investee companies, and greater access to company information for the purposes of monitoring investment performance.

Equity guarantee model

Under an equity guarantee model, the ASI would provide a partial equity guarantee in respect of private equity investments in Australian solar RD&D companies, subject to a matched investment requirement and fees commensurate with the ASI's risk exposure and administrative responsibilities.

Such a model would offer an ongoing private funding incentive in the same way as a fund, but without requiring the significant initial capital outlay that a fund model (or grant or loan model) would. The ability to incorporate a matched investment requirement into an equity guarantee model may also enable it to leverage greater private finance than a loan guarantee model (discussed below).

The financing incentive created by an equity guarantee model would endure for as long as the ASI were willing to offer equity guarantees, creating the potential to generate a sustained flow of private investment into Australian solar RD&D in the longer term. The ability to charge fees for provision of guarantees would also generate a steady revenue stream with which to finance the ASI's ongoing operations.

Loan guarantee model

Like the equity guarantee model, a loan guarantee model, under which the ASI would provide a partial guarantee in respect of private loans to Australian solar RD&D companies and again subject to fees commensurate with the ASI's risk exposure and administrative responsibilities, would establish an ongoing private funding incentive that would endure for as long as the ASI were willing to offer loan guarantees. A loan guarantee would also avoid the requirement entailed by grant, loan and fund models for significant initial capital outlay, while generating a steady revenue stream from guarantee fees which could be used to finance the ASI's ongoing operations.

It may, however, be more difficult under a loan guarantee model to incorporate a matched financing requirement equivalent to the matched investment requirement that can be established comparatively easily in an equity guarantee model (though such a requirement may be implicit through maximum gearing ratios imposed by lenders). As a result, a loan guarantee model may be less effective in leveraging private finance than an equity guarantee model.

Risks and challenges

Despite their various advantages, none of the above models represent a perfect financing solution for the ASI. A fund structured to make equity investments in Australian solar RD&D companies may be limited in its ability to invest in earlier-stage solar R&D activities, and will entail significant administrative complexity for the ASI in managing the fund. An equity or loan guarantee model would require the ASI to assume a degree of risk (whether credit, technology or other risk) without providing means through which to control the risk. As guarantor, it is unlikely the ASI would be able to exert significant control over management of intellectual property rights, and the administrative complexity of a guarantee model is likely to be relatively high compared to simpler direct funding models, such as grants and loans.

Likewise, while each of the other models considered (grants, loans and performance guarantees) demonstrates some potential to help leverage private finance in accordance with the ASI's objectives, each also faces risks and challenges which undermine its utility:

– while grant models demonstrate a range of important advantages (including powerful leverage of co-investment, reduction of investment risks and administrative simplicity – all of which have been borne out by the ASI's experience to date in providing solar RD&D grants), a grant-based program would create a greater risk of the ASI substantially depleting or even exhausting its funding resources, if no additional funding commitments were made to finance its continued operation (which funding commitments would likely need to come from governments, given the non-commercial nature of a grant program);

– although loan-based models have the potential to leverage short term private finance linked to loan award rounds, they are unlikely to create a long-term incentive that can drive sustained private investment in solar RD&D, and may only be economically feasible for solar RD&D companies approaching – and, in many cases, beyond – the demonstration stage in the innovation cycle, who are able to meet loan servicing requirements; and

– performance guarantees, although exhibiting the broader advantages of guarantee structures described above, would entail significantly greater administrative complexity, as a result of the need to determine appropriate performance indicators to trigger the guarantee, and appropriate payment amounts to be made should a guarantee be validly enforced.

In this context, whilst funds, equity guarantees and loan guarantees have been identified as part of this review as having strong potential, they should be considered as options within a broader spectrum of alternatives identified in this report, with each alternative exhibiting certain advantages and disadvantages when compared to other potential approaches.

A portfolio of models?

Realising the advantages and disadvantages of the various funding models reviewed (as discussed in more detail in the body of the report), if the ASI is to promote private financing for all stages of the solar RD&D cycle, it may be necessary to offer a portfolio of financing instruments targeting different RD&D stages.

For example, grant programs have proven their effectiveness in channelling public and private funding to early stage solar R&D activities (as evidenced by the ASI's own experience, and that of many other similar bodies around the world, in providing solar RD&D grant funding). Indeed, a grant program may be the only funding model practically capable of attracting private finance for these key stages in the innovation cycle (given that such activities are generally undertaken on a non-commercial basis by university bodies and other research institutions likely to have difficulty in either servicing a loan or returning a dividend to equity investors). The ASI may therefore need to distribute part of its funding resources as grants to these institutions, in order to help leverage private finance for this initial step in the RD&D cycle.

However, as solar RD&D businesses approaching demonstration and commercialisation may be capable of repaying a loan (possibly on the condition that it is provided on concessional terms) or returning a dividend once their technologies have been commercially deployed, the ASI may wish to consider also using part of its funding resources to establish an ASI Solar RD&D Fund, offer loans to later stage solar RD&D businesses, and/or provide guarantees to private financiers (whether equity or debt) of such businesses. These models have the potential to create a private financing incentive through the latter stages of the solar RD&D cycle, and also generate revenues with which to finance the ASI's continued operation.

The applicability of the various funding models assessed across the solar innovation cycle, as suggested by the results of research and analysis underpinning the report, is set out diagrammatically in Figure 1.

It should be noted, however, that Figure 1 represents only a summary of the most efficient funding model options and applications as suggested by research findings, and should not be interpreted as discounting or ruling out the potential utility of any particular funding model for any particular application. It also reflects certain generic assumptions as to changes in the technology risk posed by a new solar technology and the capital intensity of its development, as well as the number of investment opportunities that may exist at different points in the solar innovation cycle.

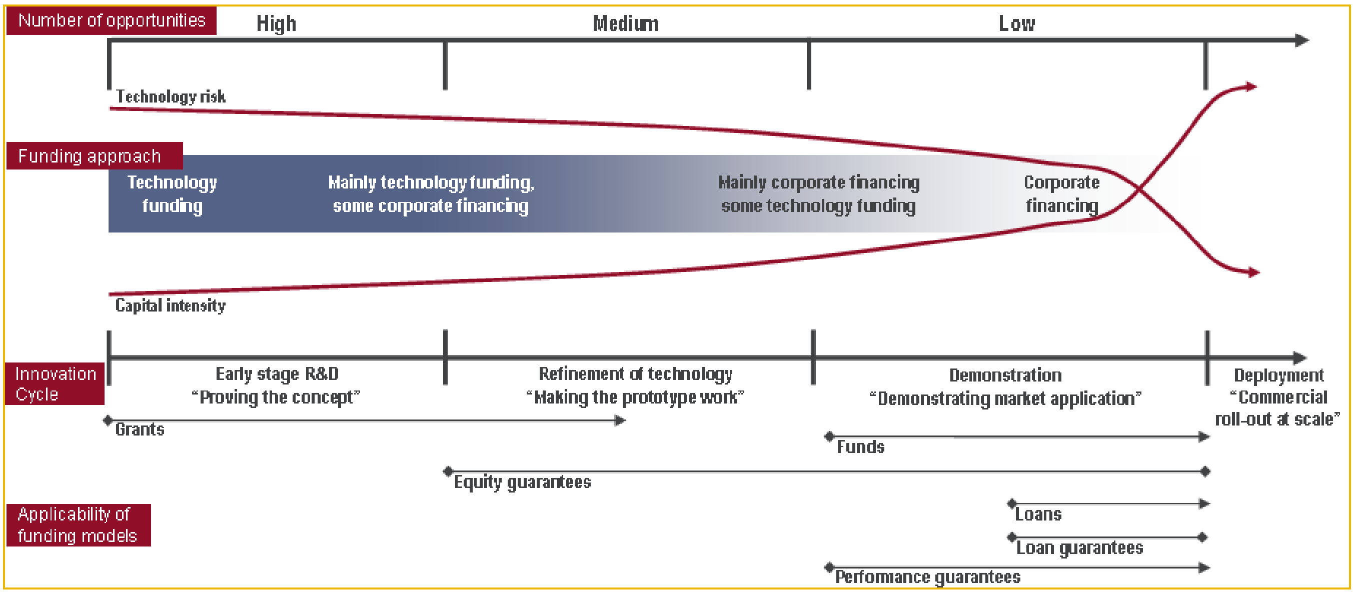

Figure 1 - Applicability of RD&D funding models to stages in the solar innovation cycle

Finally, each of the funding models examined in this report is likely to require some level of ongoing Australian Government funding or other involvement. If, for example, a grant model is adopted to finance early stage solar R&D, this may necessitate periodic top-up funding to replenish funds distributed to successful grant applicants. The capital outlays required under fund and loan models (whether for seed investment or provision of debt finance) will also require the ASI to have access to public funding sources adequate to meet these capital requirements, while any guarantee-based model may require the Australian Government to provide a back-to-back guarantee to the ASI, in order to ensure the ASI is able to meet its payment obligations as guarantor and maximise the credit rating of guarantees.

Detailed research and analysis underpinning the above conclusions is set out in **Section 4**.

2. Introduction

2.1 Report objectives

This report has been prepared by Baker & McKenzie to assist the Australian Solar Institute (ASI) in identifying and harnessing private funding sources through which to finance the research and development (R&D) and demonstration (together with R&D, RD&D) of solar energy technologies in Australia.

To this end, the report seeks to:

- identify and analyse a range of models and structures employed in Australia and internationally to finance both solar-specific RD&D activities and RD&D in the renewable energy sector more broadly;
- assess the advantages and disadvantages of different solar RD&D funding approaches; and
- make high-level recommendations as to which funding models offer the greatest potential to enable the ASI to leverage private investment into solar RD&D in Australia through deployment of its public funding resources.

The analysis and recommendations set out in the report are based on detailed desktop research into the solar and other renewable energy RD&D models currently in use globally, as well as largely qualitative assessment of the key funding models identified.

2.2 Report scope

This report covers a number of key funding models used to finance solar RD&D activities in Australia and internationally, as identified in our desktop research. The most widely-used renewable energy RD&D funding models are:

- grants;
- concessional loans;
- funds; and
- guarantees, including:
  - loan guarantees;
  - equity guarantees; and
  - performance guarantees.

The report outlines the typical features of, and common variations in, each of the above models (as used to finance solar and broader renewable energy technology RD&D activities), and illustrates these with case studies drawn from our research.

Each of the above models has been subject to qualitative assessment using criteria designed to test each model's:

- effectiveness in achieving the ASI's objectives;
- suitability for solar RD&D;
- adaptability, should prevailing circumstances change either at a sectoral or project/business level; and
- complexity, for both the ASI and potential private sector applicants under each model.

The details of these assessment criteria, as well as the rationale behind each, are set out in **Annexure 1**. The results of these assessments form the basis for the conclusions set out in **Section 1.3**.

The report also includes brief discussion of indirect funding models (such as incentives to promote commercial solar technology deployment, which may in turn drive earlier stage solar RD&D) as well as corporate and philanthropic financing provided independently of direct public RD&D support.

2.3 About the ASI

Introduction

The ASI is a company limited by guarantee subject to the *Commonwealth Authorities and Companies Act 1997* (Cth). The ASI was established as part of the Australian Government's Clean Energy Initiative (CEI), within its Resources, Energy and Tourism portfolio. The CEI includes a commitment to develop a suite of cost-effective low emission energy technologies.

The ASI is supported by a funding commitment from 2009 to 2012 of A$100 million. The Commonwealth is currently the ASI's sole member, but it is intended that the ASI will attract new partners and investors over time such that it will be sustained by private investment beyond its initial four year term.

Australian solar research institutions have held world leading positions in solar innovation for some time. However, strong competition for that position has emerged and support is required if Australia is to retain its leadership position. The ASI has been established to provide much needed support to the Australian solar R&D community.

Role

Globally, deployment of solar energy is growing rapidly. In 2008, US$36 billion was invested in solar photovoltaics (PV) and US$5 billion in concentrating solar thermal (CST). By 2020, between 200 and 400GW of solar (thermal and PV) capacity is expected to be deployed worldwide. While Australia has vast solar energy resources, solar energy currently remains a minor contributor to energy supply. 100MW of PV capacity has been deployed in Australia primarily through residential programs, while CST remains at the demonstration stage.

The ASI invests in R&D to accelerate innovation in PV and CST technologies that have the potential to significantly reduce the levelised cost of solar energy compared to existing sources of stationary electricity generation.

Other aims of the ASI include skills development, knowledge building, and strengthening collaboration between Australian and international solar research and industrial experts. This includes dissemination of the knowledge and insights gained from the Australian Government's A$1.5 billion Solar Flagships program.

The ASI has been established with a long-term agenda. Attracting further investment and collaboration are key roles of the ASI, in order to ensure sustained support for innovation in solar energy in Australia. Lasting success in these areas can only come through a sustainable solar industry that invests in Australia with an ongoing commitment to R&D.

Stakeholders

The ASI's primary stakeholders are governments, universities and research institutions in Australia, as well as the global solar industry. The ASI encourages collaboration between stakeholders who demonstrate commitment and capability to invest in Australian solar energy innovation.

2.4 R&D and demonstration: specific risks and requirements

Whilst this report addresses the funding requirements of solar technology RD&D, it is important to recognise that RD&D is comprised of two distinct project cycle phases – R&D and demonstration. The needs of both phases vary significantly and, as a corollary, will require different forms of financing, attract different types of investors and may necessitate different public sector funding and incentive structures.

For example, solar technology R&D requires substantial upfront capital financing, coupled with a relatively long technology time to market and therefore poses a high investment risk profile. As a result, R&D projects commonly receive significant (if not all) funding from government. This may take the form of research and/or development grants. Later in the R&D stage, when a technology has somewhat matured, angel investors may also make investments.

Solar technology projects at the demonstration stage have a comparatively shorter technology time to market. Nonetheless, projects at this stage commonly face difficulties in attracting sufficient funding for the development of capital-intensive demonstration facilities. Even where initial funding is secured, sustained capital injections are required to carry a project through the "cashflow valley of death" (see Figure 2, p 14). Generally, public sector funding will still account for a substantial proportion of project costs, though it may impose higher matched private funding requirements and may be given in a form other than a grant (e.g. debt financing). At this stage, early seed investors, venture capitalists and private equity funds may also offer financing, though usually in conjunction with public financing mechanisms and almost always as a consortium with other private investors.

2.5 Solar RD&D: who's doing what in Australia?

A number of Australian solar industry stakeholders are actively undertaking solar technology RD&D activities, including government bodies, scientific research institutions, industry associations and private sector entities. We have included brief descriptions of the key Australian solar public sector RD&D participants below.

Commonwealth Scientific and Industrial Research Organisation (CSIRO)

CSIRO is Australia's national science agency and one of the largest research agencies in the world. In 2003, it launched the National Research Flagships Program, through which total funding of close to A$1.5 billion is expected to be deployed by 2011.[2] This program focuses on a defined set of key industries (including electricity generation) and uses public private partnerships (PPPs) through which to target clearly defined goals. In the solar energy context, CSIRO's Energy Transformed Flagship aims to:

– improve the affordability, reliability and grid integration of renewable energy technologies including solar; and

– provide government and industry with tools, data and modelling that can inform policy assessment and investment decision-making.[3]

Australian Bureau of Agricultural and Resource Economics (ABARE)

ABARE is an Australian Government body that undertakes economic research and modelling in order to, *inter alia*, promote the competitiveness of Australia's energy sector and the quality of the Australian environment.

Australian Research Council Photovoltaics Centre of Excellence (ARC PCE)

The ARC PCE seeks to advance research in the field of silicon PV solar energy technology, and to apply this knowledge to silicon PV projects. Based at the University of New South Wales, the ARC PCE is at the forefront of solar PV research. In 2009, the Centre designed a "first generation" solar cell which achieved a new world record for conversion of 43% of sunlight into electricity. The ARC PCE is made up of five research teams that focus on improving the efficiency and cost of silicon-based PV and photonic devices.[4] The ARC PCE enjoys close ties with the private sector, including with Suntech Power, China Sunergy Co Ltd, BT Imaging and various PV manufacturers located in Australia, the US, the UK, Germany, Spain, Italy, South Korea and China.

The ARC Centre of Excellence for Solar Energy Systems (ARC CESES)

The ARC CESES is located at the Australian National University (ANU) and aims to develop improved silicon concentrator solar cells for 10 to 50 sun linear concentrators. The ARC CESES enjoys a track record of collaboration with government, industry and other research institutions and has received funding from the Asia Pacific Partnership on Clean Development and Climate (via the International Science Linkages program) and the Department of Defence's Capability and Technology Demonstrator program.

[2] http://www.csiro.au/org/AboutNationalResearchFlagships.html

3 http://www.csiro.au/org/Energy-Transformed-Flagship-Overview.html

4 http://www.pv.unsw.edu.au/Research/advancedsilicon.asp

Centre for Sustainable Energy Systems (CSES)

The CSES is located at ANU and currently comprises 50 researchers. Whilst the CSES is not strictly limited to solar technology, the centre has nonetheless invested substantial resources in the development of solar technology, including in nanophotonics, sliver solar cells, semiconductors and solar cells, hybrid PV and solar concentrators. The CSES has recently implemented an ASI-funded A$5 million project to establish solar laboratories and research equipment.

Energy Research Centre (ERC)

The ERC is located at the University of Melbourne and conducts research into, *inter alia*, the development of technology which enables the cost-effective generation of energy from renewable resources such as geothermal, biofuels and solar.

Victorian Organic Solar Cell Consortium

The Victorian Organic Solar Cell Consortium is an unincorporated research consortium focused on the development of affordable, flexible, large-area plastic solar cells. Its membership currently includes Melbourne University, Monash University and the CSIRO Future Manufacturing Flagship as research providers, Securency International, Innovia Films and Bluescope Steel as industrial partners, and Bosch SEA as a consulting member.

Victoria-Suntech Advanced Solar Facility (VSASF)

The VSASF is a newly formed facility located at the Swinburne University of Technology (SUT). The VSASF is a collaborative R&D facility between the SUT's Centre for Micro-Photonics, which recently received a A$3 million grant under the Victoria Science Agenda Investment Fund, and Suntech Power Holdings Co. Ltd, the world's largest manufacturer of solar PV modules. The VSASF aims to develop next generation solar technology based on nanoplasmonic solar cells, with the aim of increasing PV cell efficiency.

Enterprise Connect Clean Energy Innovation Centre (CEIC)

With funding of A$20 million over four years, the CEIC helps to develop the performance of Australia's small and medium sized clean energy companies. By providing professional business advisory and development services, the CEIC hopes to improve the productivity and competitiveness of these companies, while also helping to build collaboration between researchers and businesses and assisting businesses in accessing the latest technologies and data.

The Australian Government

At the federal level, the Department of Climate Change and Energy Efficiency (DCCEE) is responsible for developing renewable energy and energy efficiency policies, whilst the Department of Resources, Energy and Tourism (DRET) is responsible for developing and administering programs related to Australia's resources and energy sectors. The various programs and initiatives that DCEE and DRET collectively deliver represent a key component of the Australian Government's national energy strategy.

Australian State Governments have also implemented various programmes aimed at promoting solar RD&D and commercialisation, many in partnership with the private sector.

A list of Federal and State solar RD&D programmes and initiatives can be found at **Annexure 2**.

2.6 Barriers to Australian solar RD&D

Solar RD&D activities in Australia face a number of barriers in securing financing, both for R&D (which may face particularly long commercialisation timeframes) and demonstration (at which point technologies and businesses must bridge the "valley of death" that precedes commercialisation – see Figure 2 below).

Barriers to financing for solar technology RD&D, both in Australia and more generally, include:

- lack of critical mass and pipeline of similar solar RD&D projects;
- lack of cost-competitiveness of solar energy technologies relative to conventional energy technologies and other more market-ready renewable energy technologies;
- relatively high performance and technology risks, particularly for more innovative/less proven solar technologies;
- the limited market for solar energy projects, in a broader electricity market in which satisfactory power purchase arrangements may be difficult to secure given the domination of a small number of vertically-integrated wholesale electricity purchasers, leading in turn to a correspondingly limited availability of finance;
- long project development and repayment timeframes coupled with high initial capital costs;
- risks and costs associated with grid connection;
- risks associated with regulatory uncertainty (as a result of the current dependence of most solar technologies on regulatory support measures in order to be viable);
- lack of long-term market data to be used as a basis for risk determination, including in relation to sophisticated, reliable solar resource generation forecasting methodologies;
- more attractive investment opportunities offshore due to larger market capacities and a greater availability of public and private capital (e.g. China and the United States); and
- reduced risk appetite, coupled with heightened insolvency risk and an increase in the cost of capital, due to the global financial crisis.

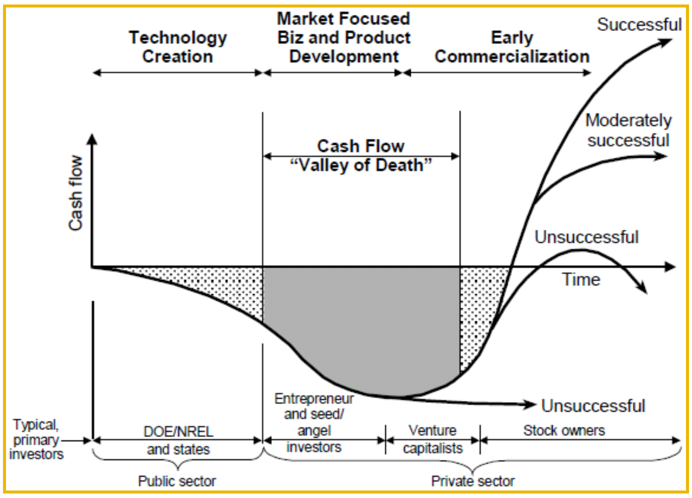

Figure 2 – Cash Flow "Valley of Death"

Source: Murphy, L and Edwards, P, *Bridging the Valley of Death: Transitioning from Public to Private Sector Financing*, National Renewable Energy Laboratory, 2003.

Clearly, solar RD&D activities, as well the commercialisation of demonstrated technologies, face a range of significant barriers, including a lack of public and private financing. Although public spending in the renewable and clean energy sectors has generally been increasing, greater funding from both public and private sources is required to help novel solar energy technologies navigate the RD&D cycle and proceed to commercialisation and deployment.

3. Potential funding models

3.1 Introduction to funding models

The funding required to finance the global transition from fossil fuel-fired power to renewable energy generation "vastly exceeds the capability of the public sector".[5] Although public funding resources form an important component of renewable energy financing, the value of public funds can be enhanced by maximising their leverage of finance from the private market.

In addition, industry investment in renewable energy RD&D is relatively low compared to RD&D expenditure in other industries: in the USA, 20% of revenues in the pharmaceutical sector, 15% of revenues in the information technology sector and 16% of revenues in the semiconductor sector are spent on RD&D, compared to 0.23% of revenues in the renewable energy sector.[6]

This reflects the relative infancy of renewable energy industries and markets, including solar. Of the R&D investment made by Australian businesses, more than 90% is made within the investing business's own industry sector.[7] For example, the large majority (if not all) of the R&D investment made by a pharmaceutical business is likely to flow to pharmaceuticals R&D. Although this may be a logical outcome, relatively novel industries, such as solar and other renewable energies, are unlikely to have reached a level of commercial and capital development at which significant funding is available to be committed to R&D. Relatively immature industries are more likely to devote funding to business consolidation and expansion, rather than R&D. The R&D funding figures quoted above for different industries support this conclusion.

Funding models that can use public funding to attract private finance for solar RD&D will help address this imbalance, mitigating solar RD&D investment risks and maximising the effectiveness of public expenditure. The effectiveness of such models in new and innovative sectors is proven, with public financing mechanisms in the climate change mitigation sector able to increase private financing in the sector by factors of between three and 15.[8]

This section sets out basic descriptions of each of the funding models subsequently identified in this **Section 3**, together with a range of case studies illustrating their application in practice. It should be noted, however, that although each model is presented in isolation for the purposes of identifying its advantages and disadvantages, in many cases different funding models are combined with one another (whether formally or informally), or applied with particular variations or additions. A public funding grant, for example, may be conditional upon the grantee securing a matched private equity investment, which private investment may then be protected by a publicly-backed equity guarantee.

The funding models discussed below should also be viewed in light of broader indirect funding policies and incentives that influence solar RD&D financing decisions. Current indirect measures and incentives relevant to solar RD&D in Australia are summarised in **Section 3.9**.

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[5] Green Investment Bank Commission, *Unlocking investment to deliver Britain's low carbon future*, GIB Commission 2010, at p.9.

[6] International Energy Agency, *Global Gaps in Clean Energy RD&D – Update and Recommendations for International Collaboration*, IEA 2010 at p.9.

[7] Science and Innovation Mapping Taskforce, Mapping Australian Science and Innovation: R&D Funding and Expenditure: Background Paper, Department of Education, Science and Training 2003, p 17.

[8] UNEP Sustainable Energy Finance Initiative, Public Finance Mechanisms to Mobilise Investment in Climate Change Mitigation, SEFI 2008.

Finally, we note that public funding initiatives often involve cooperation between government and private sector participants. These cooperative initiatives generally operate as PPPs, combining public resources and political support with private sector resources, knowledge and business practices. Without this combination of resources and know-how, private investment in higher risk activities such as technology RD&D could be perceived as too risky for commercial private investment, reducing the availability of private financing and significantly mitigating the effectiveness of public funding measures. Each of the funding models discussed below represents some form of PPP, whether formal or informal, designed to harness the benefits the public and private sectors each offer.

Purely public partnerships, in which a number of government donors, bodies and/or development institutions collaborate to provide funding for development programs, are not assessed in detail this report. It should be noted, however, that a large proportion of the R&D funding provided to Australian universities comes from purely public sources, without significant private sector contributions or involvement.

3.2 Grants

Grants have traditionally been the mainstay of public financing for solar and broader renewable energy RD&D (particularly early stage R&D where funding for initial technology development is required – see discussion in Section 1.3), and have proven ability to leverage private investment, whether in the form of private equity or debt investments.

The means through which grants can promote private financing, as well as other key features of grant structures used to support solar and other renewable energy RD&D activities, are summarised below. Importantly, these features can contribute significantly to the mitigation of the risks inherent in financing RD&D for emerging technologies.

The features common to most grants include:

– preconditions to funding;
– cost-sharing, in-kind contributions and matched funding requirements;
– rights to intellectual property;
– reporting requirements; and
– key milestones and a funding timetable.

Each of these features is discussed in turn below.

In most cases, grants are subject to a number of pre-conditions. Examples of common pre-conditions include:

– satisfactory financial, legal and technical due diligence;
– procurement of a parent guarantee; and
– having secured parallel grants, public funding under any other relevant public initiatives or private funding (whether on a matched funding basis or otherwise).

For example, in providing a grant for solar RD&D funding, the Victorian Government imposed pre-conditions requiring the grantee to demonstrate that it had secured:

- the balance of funding (aside from Federal and State Government funding) required for the completion of the RD&D project; and
- a grant of equivalent value from the Australian Government.

Grants are generally given on a partial basis (i.e. only part of the funding required for the supported project or business will be provided), and grantees are often required (sometimes as a contractual obligation or as a condition precedent to the grant) to source complementary public or private sector finance to provide the remainder of the funds required. This may involve:

- securing public funding from other initiatives (e.g. other grants) on terms satisfactory to the grantor;[9] and/or
- requiring the grantee to secure an equal (i.e. 1:1) or greater (e.g. 2:1) amount of private funding (e.g. venture capital or private equity funds, or financial contributions from industry) on terms satisfactory to the grantor.

Typically, costs in relation to administration, licensing, permits and authorisations and utility arrangements are shared between the grantor and the grantee, in agreed shares or on otherwise agreed terms.

The terms of the grant may specify that the various intellectual property rights that arise in the course of RD&D vest in the grantee or grantor. For example, a grant may provide that:

- intellectual property rights in the technology developed vest in the grantee; and
- the grantor will have a permanent, irrevocable, royalty-free license to use reports, plans, documents or data developed during the project.

Grants may also provide that, where the grantee fails to reach certain milestones set out in the grant agreement, whether or not due to the grantee's fault, the grantor is entitled to use all intellectual property arising from the project.

Grant structures generally incorporate stringent reporting requirements, for the purpose of enabling the grantor to monitor the progress of the project. These may include:

- project designs, plans and timelines;
- accounts and accounting reports (often required to be audited);
- reports in relation to project milestones and other project development updates;
- post-grant reports; and
- notification of disputes with financiers or other material adverse events.

[9] Both the Victorian State Government and the Australian Government have previously conditioned their solar RD&D grants upon the securing of complementary grants under other initiatives.

Grants may also give the grantor rights to inspect and review a grantee's financial records for the purpose of substantiating expenditures related to the grant – for example, this is commonly found within grants awarded under the California Solar Institute Research, Development, Demonstration and Deployment Program (CSI RDDD program).

Grant funding will generally be provided in phases, based on completion of key milestones and in accordance with a project/funding timetable. This helps to provide more sustained support for a business or project seeking to develop or demonstrate a particular technology, while creating an incentive to ensure that funded activities achieve the relevant milestones and progress to completion. The milestones set out in the grant agreement often represent an itemised budget and give an indication of where and how the entirety of the grant is to be utilised.

For example, in the context of a solar demonstration project, a grant may be staged so that payments to the grantee are made upon completion of the following steps:

- the securing of development approval;
- acquisition of title to the land for the project (lease or freehold);
- the commissioning of the demonstration plant;
- satisfactory performance testing and evaluation; and
- provision of a final report on the project.

Significantly, the ASI already has experience in providing grants for solar RD&D, which experience has confirmed the advantages of grant programs described above. Specifically, the ASI's grant activities to date have:

- achieved an average $2:1 funding leverage ratio ($3-5:1 in some cases) in ASI-funded solar R&D projects, with investment from the ASI complemented by industry and State Government funding contributions to increase support for Australian solar researchers and provide commercial paths to market for their technologies;
- enabled co-investors to benefit from the ASI’s technical support for solar R&D projects, the resulting reduced risk profile of the projects supported, intellectual property arrangements under which the ASI has not taken ownership of intellectual property rights in technology arising from projects, and the relatively simple administrative arrangements permitted by a grant program; and
- created a portfolio of solar R&D that will, if successful, deliver commercial, technical and environmental benefits across a diverse range of energy markets.

Additional case studies of grant-based programs implemented in Australia and internationally are set out below.

Case study 1: US Department of Energy Solar Energy Technologies Program (SETP)

The US Department of Energy (DOE) currently implements the Solar Energy Technologies Program (SETP), a funding program under which projects compete for grant funding. Grants are provided to successful applications in accordance with milestones specified in a grant agreement. Grant funding under the SETP is structured to be delivered in the following quasi-rounds:

- University Photovoltaic Product and Process Development (2008).
- Concentrating Solar Power Component Feasibility Studies (2010);
- Concentrating Solar Power Systems Studies (2010);
- the High Impact Supply Chain R&D for PV Technologies (2010);
- the Photovoltaic Manufacturing Initiative (2010); and
- the Photovoltaic Technology Incubator (2010).

As at the date of this report, grants totalling in excess of US$90 million have been awarded under the first three grant rounds. Some grantees are expected to receive in excess of USD$10 million during the life of their grant agreements. Grants under the latter three grant rounds are expected to total US$166-176 million.

DOE grants under the SETP have employed a number of the typical grant provisions discussed above, including:

- requiring the grantee to secure in-kind financial contributions from non-government sources; and
- intellectual property rights in respect of technology developed through funded activities (as opposed to research data and other related information) vest in the grantee.

Case study 2: Commonwealth of Australia s Law Emissions Technology Demonstration Fund (LETDF)

The Australian Government's LETDF provided grant funding to Australian renewable and clean energy demonstration projects. In the solar context, A$75 million was specifically set aside under the LETDF to help fund the development, demonstration, and commercialisation of concentrating solar PV technology. Of this solar-specific grant, A$4.5 million was allocated to the RD&D of the recipient technology, and the program also included the construction of a 2MW demonstration project.

The LETDF grant was awarded on conditions typical for grant fund models (as outlined above), including:

- that at least A$4.5 million of funding was to be sourced from the Victorian State Government;
- detailed reporting requirements, including submission of a detailed annual project plan and updates on progress towards project milestones;
- intellectual property was to vest in the grant recipient, subject to the Australian Government being granted a "permanent, irrevocable, royalty-free, world-wide, non-exclusive licence (including the right to sub-license) to use and otherwise do any acts in relation to any reports, plans, documents or data"; and
- an assurance that the balance of funding required (in addition to Federal and State Government funding) would be secured from other sources.

The total amount of funding pledged by both Federal and State Governments to the entirety of the project (i.e. for both RD&D and commercialisation) totalled A$125 million. TRUenergy, a foreign-owned Victorian power company, also invested around A$53 million.

Case study 3: Carbon Trust UK

The Carbon Trust UK is a not-for-profit organisation primarily funded by the UK's Department of Climate Change and the Devolved Administrations. In addition to R&D grants and technical support, Carbon Trust UK also provides seed investment capital for the financing of early-stage clean energy technology opportunities. Carbon Trust UK provides seed capital upon a number of conditions, including:

– funding is generally limited to amounts of up to £500,000 (and in any case, only up to 50% of the project cost);

– total investment (project) size is to be between £500,000 and £1,500,000;

– funding is provided on the condition that commercial investors contribute an equivalent amount; and

– due diligence is to be conducted upon the recipient of funding.[10]

Grant-based funding models may vary significantly in how these basic structural features are applied. For example, the US Advanced Research Projects Agency – Energy (ARPA-E) within the US DOE provides grant funding exclusively for renewable and clean energy technologies that are inherently unsuitable for private investment, such as technologies that have repeatedly failed to perform. As a result, grant funding from ARPA-E is conditional upon proof that that a project will not be able secure parallel private funding, rather than a more conventional matched funding requirement.

Grants may also be offered on the basis that ownership in certain assets arising from the solar RD&D project vest in entities other than the grantee. For example, under the CSI RDDD program, the California Public Utilities Commission (which administers the program) retains legal title to all non-expendable equipment purchased by the grantee with grant funding. Other grant funding agreements may also provide for vesting of ownership of capital assets – such as solar demonstration plant assets – in a private sector investor. This may provide a substantial incentive for private sector involvement.

Eligibility criteria may also vary from programme to programme. Most grants, such as those under the DOE's SETP and the CSI RDDD, place a heavy emphasis on the ability of projects to reach commercialisation by a specified future date. Other grants have different eligibility criteria. For example, grants under the ARPA-E are only awarded where the recipient project is unsuitable for private investment. On the other hand, grants offered by Japan's New Energy and Industrial Technology Development Organisation (NEDO) under its Grant for Technological Development by R&D Venture Businesses program required that a grant applicant be a corporate spin-off, so that whilst it is an independent corporation, it nonetheless receives support and backing from a parent company.

Finally, the effectiveness of grants to support activities within a targeted sector, and leverage private sector funding on the basis of that support, can be enhanced and prolonged into the medium term by allocating funding to recipients in multiple rounds, as opposed to a single funding round that may create initial momentum within a sector without driving the longer-term investment required to take a technology through the RD&D process and bring it to market.

[10] http://www.carbontrust.co.uk/emerging-technologies/fast-track/investment/pages/funds.aspx

3.3 Funds

Typical structure

A fund is, at the most basic level, a special purpose vehicle into which multiple investors (including other funds) can pool their capital, for the purposes of investing this in a wider range of investments than would be feasible for any one investor acting individually, and sharing the costs and benefits of this diversified investment amongst participating parties.

Investments are generally made over a certain term, after which the fund will exit or liquidate its investments and, assuming the investments made by the fund have appreciated in value, return to investors their respective principals plus a dividend. A fund may receive investments from governments and other public bodies, while also attracting corporate and philanthropic investments, investments from high net worth individuals, and investments from other funds (in which case the recipient fund would act as a "fund of funds"). As a corporate vehicle, a fund will have a board and also a manager, responsible for identifying investment opportunities and taking investment decisions.

Funds are a commonly-used funding model for investment in higher risk sectors, given their inherent risk mitigation characteristics:

– by drawing investments from multiple parties or sources, funds inherently distribute the risk attached to an investment amongst several investors (who may otherwise be reluctant to make any investment in the relevant target or targets); and

– by pooling the funds made available for investment, funds are able to:

  - as mentioned above, distribute these pooled funds across a broader range of investments, enabling participants to gain exposure to a more diverse portfolio of investments, while similarly diversifying their risk exposure; and
  - channel a greater total investment to a target business or project than might otherwise occur, increasing the capital with which the target can finance its activities in order to realise its business objectives.

This risk profile is suited to corporate financing (i.e. equity investment) targeting companies that have taken a technology through the early stages of innovation and development and must now refine the technology in order to reduce its performance risks prior to its demonstration.

The ASI could establish a fund to invest in Australian solar RD&D companies, in order to provide corporate finance for Australian solar RD&D activities. Such a fund could then employ the following features to enhance private sector investment beyond an the ASI initial seed capital investment:

– "Evergreening" or automatic reinvestment into the fund of fund dividends, in order to maximise the capital invested by fund participants during the fund term, with a view to in turn maximising the divided realised at the term's expiry. For example, the California Clean Energy Fund (CalCEF) reinvests a large proportion of the profits generated from its various investment activities, in order to maximise its contribution to clean technology development.

– Where a fund receives both public and private investments, the fund may be structured to pay a preferential dividend to private investors, with the ASI (as the core public investor) participating on a non-profit basis, whereby it received returns adequate to cover its operating costs but did not take a commercial dividend. The dividend distribution structure of the CVC Renewable Energy Equity Fund (CVC REEF), discussed below, provides an example of such an approach.

– Funds receiving public and private investments may also include quantitative funding commitments or constraints designed to further leverage private investment:
  - a fund structure may include a requirement that no more than a certain percentage of its capital (e.g. 50%) is drawn from public sources, in order to quantify and indicate to the market the level of private sector funding which is sought; or
  - a fund incorporating public and private funding may include a government commitment to match private sector investments, for example on a 1:1 or 2:1 basis up to a specified upper limit (the CVC REEF case study below also provides and example of this).

Under a corporate finance fund structure, intellectual property rights arising from RD&D activities would remain with the investee company. Equity investors in the company, including the ASI and private investors, would be entitled to a share proportionate to their respective equity stakes of the proceeds flowing from those rights. Although intellectual property rights would be controlled by the investee company, to the extent an investor was able to control the company (i.e. by taking a majority interest in it), the investor would be able to exert control over dealings with the intellectual property. This model therefore does not present particular intellectual property risks for the ASI but, except to the extent that the ASI may be able to control an investee company as a majority shareholder, likewise does not provide any particular intellectual property advantages.

Case study 4: CVC Renewable Energy Equity Fund (CVC REEF)

CVC REEF is an example of how government funding can be mobilised through a venture capital fund mechanism, to leverage private sector investment in renewable energy technology RD&D.

CVC REEF was established by the Australian Government for the specific purpose of investing in Australian businesses involved in renewable energy technology RD&D and/or in the process of commercialising such renewable energy technologies. Fund management is outsourced to an external manager (CVC REEF Investment Managers Limited), and the structure of the fund was designed to stimulate private venture capital investment via government-sponsored equity finance.

In accordance with the REEF program guidelines,[11] government assistance was provided to CVC REEF on a 2:1 matched funding basis. Ultimately, CVC REEF was able to raise approximately A$26.5 million worth of funding. Private sector sources accounted for around A$8.8 million, whilst the remaining A$17.7 million was provided by the Australian Government as part of its match funding commitment.

In return for providing each investee company financial capital, managerial expertise and an enhanced business reputation, CVC REEF acquires part-ownership of each investee and often a seat on the company board.

In accordance with CVC REEF's funding arrangements, all proceeds from each investment is distributed to the Australian Government, private sector investors and the fund's manager. In respect of the first tranche of capital (equal to the initial funding committed by CVC REEF to a given investment), distribution of proceeds is on a pro rata basis (i.e. the Government is entitled to a 2/3 proportion, whilst the private sector investors are entitled to 1/3). Both the Government and private investors also receive an interest component. For all investment proceeds in excess of this first tranche:

– the Government receives 10%; and

– the private sector investors and the fund manager collectively receive 90%.

[11] Available at http://www.ausindustry.gov.au/VentureCapital/RenewableEnergyEquityFundREEF/Documents/doc50602020011219120324.pdf

CVC REEF has been successful in leveraging private sector investment because:

- it has provided a strong incentive through the Government's initial 2:1 match funding commitment; and
- has created a further investment incentive through the potential to receiving profits disproportionate to investors' initial investments.

A further example of a fund seeded by both public and private investors is provided by Cleantech Ventures' "Cleantech Australia Fund", a $50 million venture capital fund which had its first close in September 2007.[12] The current fund is made up of $20 million provided through the Australian Government's Innovation Investment Fund (IIF) program and $30 million from VicSuper, a superannuation fund committed to sustainability. The Cleantech Australia Fund focuses on investments in eligible companies that are commercialising clean technologies; those which generate superior commercial benefits to customers whilst simultaneously addressing significant environmental concerns such as climate change, water scarcity, water quality and resource constraints.

Not only can funds attract investments from a variety of sources, they can also be combined with other funding models in order to deploy fund capital in a variety of ways. Although funds are commonly mandated to make equity investments in companies active in a particular sector, they may also be structured to offer loans and other financial instruments (in which case the fund's mandate will need to reflect this).

Revolving loan funds (see discussion in **Section 3.4**) are an example of funds that provide loans rather than make equity investments. As discussed in **Section 3.4**, Pennsylvania's Green Energy Revolving Loan Fund draws on both public funding (provided from the US economic stimulus package) and private investment (leveraged through a matched investment requirement) to offer loans for energy efficiency and renewable energy projects in existing, commercial buildings in Pennsylvania.

In this regard, the International Energy Agency has reported that many existing funds are not set up to channel investment to the debt and equity instruments most commonly used to finance solar and renewable energy RD&D, limiting the ability of these funds to contribute to these activities and realise a share of the benefits they generate.[13] Realising this, it will be important for any fund established to invest in solar RD&D to have the legal capacity and mandate to invest in or finance a variety of debt and equity instruments.

Although it may also be possible to establish a fund to invest in solar RD&D projects (rather than companies), such a model is likely to be difficult to implement as it would essentially require the fund to project finance solar RD&D activities. Given the difficulty in making RD&D activities bankable as well as the limited lifetime of fund-based investments, this would likely be problematic.

A fund-based model designed to provide financing specifically for early stage R&D represents a further variation on the fund approach. However, the commercial uncertainty of early R&D activities would expose any investment in such a fund to relatively high risks (particularly technology risks), and although this would also create opportunities for large economic returns (particularly if the fund invested in leading breakthrough solar technologies), the risk profile could potentially deter all but the most aggressive venture capital investors.

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[12] For more information, see http://www.cleantechventures.com.au/funds-under-management/cleantech-australia-fund/.

[13] International Energy Agency, *Global Gaps in Clean Energy RD&D – Update and Recommendations for International Collaboration*, IEA 2010 at p.12.

3.4 Loans

Loans are a versatile funding model and, whilst they have a long history of use in financial markets, continue to be adapted for new and specific financing applications.

Loans provided by public bodies to solar RD&D companies may generally be structured in one of three ways:

Loans on commercial terms: in some circumstances, a solar RD&D company may be able to service a commercial loan, but may be perceived to present too high a risk for private commercial lenders (for example due to perceived performance risks associated with innovative solar technologies), such that the borrower is simply unable to secure private debt finance. In these contexts, a public body like the ASI may step in to fill the gap left by private lenders, by accepting the borrower's credit risk (and technical risk to the extent this impacts a borrower's solvency) and providing a loan on commercial terms (i.e. at interest rates reflecting the borrower's high risk profile).

Although this approach may represent the preferential loan model for the ASI, as it represents an essentially commercial structure without any particular adaption to leverage private investment, and may not be broadly applicable to Australian solar RD&D businesses, we have not addressed this loan structure in detail.

Concessional or "soft" loans: concessional loans are characterised by terms relatively favourable to the borrower, most frequently low or zero interest rates (reducing the cost of capital) and longer tenors (reducing the level of ongoing repayments), that are designed to make debt finance more available and affordable for:

– pre-commercial companies (such as solar RD&D businesses yet to commercialise their technologies) that lack the cash flow required to service a commercial loan, provided at commercial interest rates; and

– companies (such as solar and other renewable and advanced clean technology businesses) engaged in activities entailing, or perceived to entail, particularly high or novel risks, that face particularly high interest rates given the risks they are perceived to present.

Subordinated debt: a public body that provides a loan to a private borrower may accept a lower priority ranking than private lenders in the event of a default. In this case, private lenders, who will be repaid before the subordinated public lender, are more likely to recover a greater proportion of their respective loans. This improves the borrower's credit rating in respect of this prioritised private debt, thereby reducing the interest on the debt and associated cost of capital. As a result, private debt finance becomes more affordable for a borrower who may not have been able to service the debt were it provided on commercial terms. It may potentially also make commercial debt finance easier to obtain (in that lenders may be more willing to grant the loan), although this will depend on whether private lenders can become comfortable lending as a result of a subordinated debt structure, or whether they would continue to consider the risks too great.

Loans may not, however, represent an appropriate funding structure for the full spectrum of solar RD&D activities. Solar companies still in the R&D stages of technology development may be less capable of servicing a loan (even a concessional loan) than a company at the demonstration stage, for whom the prospect of commercialisation is much more immediate. The risk of repayment default (and consequent loan acceleration and potential insolvency) is likely to be significantly greater for early stage R&D companies than for companies at or approaching demonstration, rendering loans less feasible both for borrowers wishing to avoid over-gearing, and lenders unwilling to accept these risk levels. The applicability of loans may therefore be limited to the later stages of the innovation cycle, potentially reducing their overall value for the ASI in seeking broadly to fund solar RD&D activities. This issue is discussed further in **Sections 4.5** and **4.6**.

A variety of loan structures have been used for the purpose of financing RD&D in solar technology. The majority of loans do exhibit some common basic features, and these are outlined below. For the purpose of capturing and comparing a broad spectrum of loan agreements, a range of loan agreements relating to renewable energy projects at various stages of development (including deployment and commercialisation) were examined.

Like grants, loans are often subject to several pre-conditions, including:

– satisfactory financial, legal and technical due diligence;

– procurement of a parent guarantee; and

– procurement of matched private debt or equity finance.

The due diligence pre-condition is imposed so that the prospective lender may be fully informed and aware of the financial and operational integrity of the borrower, thereby filtering out borrowers and projects which present undue risk. The latter two conditions may sometimes be utilised to i) reduce the lender's risk exposure; and, ii) leverage private sector investment.

In addition, loans for higher risk activities like solar RD&D are often made conditional. In many such loans, conditions will exist that specify the provision of the loan is conditional upon:

– the loan being syndicated as part of a larger debt finance arrangement; and/or

– the loan being limited to a specified proportion of the anticipated project costs, such that a proportion of private or other independent financing must also be secured (for example, a loan under the European Investment Bank Risk Sharing Finance Facility generally provides that it must not constitute more than 50% of total project cost – see below for more details).

The type and level of returns payable on solar RD&D loans are also designed to address the respective risks borne by the lender and borrower, in addition to the loan's ability to leverage private sector funds. Repayments are structured to include a return for the lender, either in the form of interest charged at a fixed rate or some alternative form of return (such as a variable rate of return, options or performance-based bonuses). In the case of fixed interest rates, loan agreements may provide for:

– commercial interest rates;

– "soft loan" (i.e. concessional or lower than commercial) interest rates; or

– zero percent interest rates (where the lender receives a return in a form other than interest repayments).

Examples of the latter include:

- Commercialisation Australia's Early Stage Commercialisation repayable grants programme, which provides repayable grants of amounts from A$250,000 to A$2 million, and requires the grants to be paid at zero interest (i.e. the maximum amount to be repaid is capped at the initial value of the grant) once a the recipient business achieves certain commercialisation milestones (e.g. particular sales values);[14] and
- the UK Carbon Trust Interest Free Loans programme, which currently offers zero-interest loans to be used for the purpose of financing and investing in "energy-saving projects".[15]

In the case of loans subject to variable interest rates (and other variable rates of return), repayment clauses may provide for:

- bonus interest fixed or tied to performance and/or the value of the borrower's business;
- royalty on sales, profits or EBITDA; or
- options to purchase an ownership position in the business.

Loan agreements may utilise a combination of both fixed and variable rate interest, and related variable return provisions.

Other considerations which may be made by a lender include:

- the seniority of the debt being offered by the lender in light of other debt provided to the project; and
- the manner in which loan repayments are structured.

Seniority of debt should be considered as it may affect the credit risk borne by a lender. Public lenders providing debt finance in pursuit of a public interest often provide subordinated loans, giving seniority to private lenders who then enjoy reduced credit risk exposure and may then be more willing to provide private debt finance, potentially on more favourable terms (e.g. at reduced rates of interest) (see Case Study 6).

Loan repayment structures should also be considered as they dictate the manner in which the lender recoups its finances. Loan repayment structures may demonstrate significant diversity and variables include:

- whether amortisation of the loan principal occurs during the loan life or at maturity; or
- whether repayments are made as constant annuities or as project-specific and tailored instalments.

For example, loans offered by the Business Development Bank of Canada (BDC) are sometimes structured as "balloon loans", where a loan is not amortised fully during its term. Borrowers generally enjoy lower, interest-only repayments, with the principal of the loan (or a large proportion of it) payable at maturity.

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[14] Commercialisation Australia *Customer Information Guide*, Commercialisation Australia 2010, p 15.

[15] http://www.carbontrust.co.uk/cut-carbon-reduce-costs/products-services/business-loans/pages/loans.aspx

Case study 5: Risk Sharing finance Facility (RSFF)[16]

The RSFF is a joint initiative of the European Investment Bank (EIB) and the European Community (EC). The RSFF was specifically established to improve access to debt financing for private companies or public institutions promoting research, development and innovation. Credit risk is shared between the EIB and the EC (and also other partner banks). Whilst not specifically geared towards funding renewable technologies, there have nevertheless been a number of substantial loans approved for solar R&D/RD&D projects. These include (with loan amounts in parentheses):

- Abengoa RDI project (€49 million direct risk RSFF loan; €60 million loan guaranteed by banks);
- ANDALSOL 1 & 2 (€120 million direct risk RSFF loan; €109.2 million intermediated);
- Abengoa RDI financing for Solucar – Central Solar Receiver (€50 million direct risk RSFF loan; €78 million intermediated);
- Abengoa RDI financing for Solnova 1 & 3 (€110 million direct risk RSFF loan); and
- Sener/Abu Dhabi's Gemasolar (€80 million direct risk RSFF loan).

RSFF loans are market-rated, non-subsidized loans with interest rates that reflect a project-specific risk margin. As such, these loans are not designed to be cheaper or provided on a low-interest basis, but nonetheless provide a source of loan financing to higher-risk projects which would not be provided otherwise by private, commercial banks.

In addition, RSFF loans:

- are structured as medium- to long-term loans (helping to reduce periodic repayment amounts);
- are subordinated loans, in order to incentivise private investor lending (which would generally have seniority);
- have a minimum size of €7.5 million;
- are approved following a project assessment which considers:
  - the eligibility and techno-economic and financial viability of the project; and
  - the risk profile of the borrower; and
- impose an in-kind contribution or matching requirement to ensure that the share of EIB/EC financing is limited to 50% of the total amount of eligible project cost.

Case study 6: Subordinated Debt Loans issued by the Business Development Bank of Canada

The Business Development Bank of Canada (BDC) is a financial institution owned and guaranteed by the Canadian Government that provides financing and consulting services to a range of Canadian small businesses for a range of purposes including, *inter alia*, technology development.

The BDC uses a range of RD&D financing models, including venture capital seed financing and subordinated debt. BDC subordinate loans generally have four to seven year terms, and repayment provisions may:

- be structured as balloon payments (which involves periodic interest repayments, with the principal repayable upon maturity); or
- be structured as regular monthly payments tailored to the client's needs.

BDC loan provisions may also:

- require cash flow sweeps (which stipulate that any excess cash flow in the business must be used to service the loan);
- provide for variable returns on the lender's loan, in addition to the fixed interest payments; and

[16] http://www.eib.org/products/loans/special/rsff/index.htm
http://www.estelasolar.eu/fileadmin/ESTELAdocs/documents/STEI_Forum/Presentations/Session_2.2.B_-_Joaquin_Cervino_Zubillaga_-_EIB_Support_Mechanisms_for_Solar_Energy_in_Euro-Med_Region.pdf

– require syndication of loan facilities with other lenders.

Rather than offering stand-alone loans, some public bodies have instead chosen to employ a revolving loan fund structure. These structures may be established with an initial capital injection by government and are set up with the intention of utilising loan repayments from existing borrowers to create additional loans.

Effective revolving loan funds can become a source of sustained debt financing. Interest and other fees paid by borrowers may be used to cover the cost of administration and operations so that the fund may also have the ability to preserve its original capital base.

Some examples of revolving loan funds include:

– the proposed Investments for Manufacturing Progress and Clean Technology Act of 2009 (US) (IMPACT), which would establish a $30 billion revolving loan fund designed to allow businesses to "retool for renewable energy project lines"; and
– Pennsylvania's US$48 million Green Energy Revolving Loan Fund (GERLF), US$12 million of which has been received by the State of Pennsylvania as a Federal grant. The GERLF also provides a good example of a loan facility which contains a matched funding requirement. The manager of the fund, The Reinvestment Fund (TRF), was required to provide a minimum match of US$18 million in private funding. TRF ultimately provided USD$36 million, bringing the pool of the entire GERLF to US$48 million.

Whilst both of these examples do not relate specifically to RD&D, it should be possible to adapt the revolving loan fund structure to solar technology RD&D without undue difficulty.

Detailed analysis of two variant loan structures, concessional loans and subordinated loans, can be found in **Sections 4.5** and **4.6**.

3.5 Loan guarantees

Loan guarantees play an important role in channelling investment into solar RD&D. They play a particularly significant role in leveraging private debt finance, by reducing the credit risk exposure of private lenders.

Although loan guarantees vary depending on the loans to which they relate, they nonetheless exhibit certain common key features, including:

– conditions and pre-conditions to the guarantee;
– the loan value to be covered;
– loan components to be covered;
– the term of the loan guarantee;
– the type of loan guarantee offered; and
– the crediting rating of the guarantor.

In order to adequately mitigate the guarantor's risks, conditions or pre-conditions are commonly found in loan guarantee agreements. The availability of a loan guarantee may be conditional upon:

– the structure of the underlying loan to be guaranteed; and

– the structure of project financing for the underlying project, of which the underlying loan forms one funding component.

For example, under the US DOE Loan Guarantee Program, the face value of the loan guaranteed must not exceed 80% of the total project cost, such that at least 20% of the total project cost must be funded by an alternative source of capital.

This relates to the issue of “moral hazard” associated with any form of guarantee that arises from re-allocating a particular risk to the guarantor. If a guarantor were to agree to take on 100% of a party's exposure to a particular risk, this could lead the party to take on an unduly high risk that normally would be unacceptable, on the basis that 100% of this risk can then be passed through to the guarantor. For example, if a guarantor were willing to offer a 100% loan guarantee (i.e. covering the full value of the loan), this could potentially lead the lender to give loans to un-creditworthy or otherwise high-risk borrowers to whom it would not normally lend, on the basis that this risk would ultimately be borne entirely by the guarantor.

In order to avert any "moral hazard", loan guarantees will typically cover an agreed percentage of the subject loan, rather than its full value. The percentage guaranteed will in turn depend on the terms of the loan, the risk profile of the borrower and the risk appetite of the lender. Typically, this percentage will not exceed 80% of the loan amount, and many guarantors will only guarantee up to 50% of a given loan amount (although see discussion below of 100% loan guarantees offered by the US DOE, which also requires the borrower to have contributed a "significant equity investment" in the project).

For example, Austria Wirtschaftsservice GmbH's (AWS) "Double Equity Guarantee" program incorporates a loan guarantee component, which guarantees may cover up to a maximum of 80% of the underlying loan and may be conditional upon procurement of an equivalent equity investment by a business angel or venture capital investor.

This concept of risk-sharing between the public body and private sector applicants (in this case the guarantor and a lender) not only reflects the "moral hazard" created by guarantee structures, but is often a key point of distinction between all types of all quasi-commercial facilities and, for example, grants.

Loan guarantees also contain specific triggers, which set out in detail the circumstances in which a guarantee may be called upon by the beneficiary. Loan guarantees may be divided into two main types, by reference to their triggers:

– guarantees of payment, which require a guarantor to pay the lender upon a borrower defaulting on a loan repayment; and

– guarantees of collection, where the lender must first seek to collect payment from the borrower following default and, in the event that this fails, may then require the guarantor to pay on the loan guarantee.

The term of a loan guarantee will vary, generally corresponding to the term of the underlying loan. Loan guarantees may also include mechanisms for extension, subject to certain terms and conditions.

The creditworthiness of a guarantor may substantially enhance the value of the guarantee given. Public guarantors may be able to provide an instrument with a relatively high credit rating where they can assume an underlying government credit rating (typically AAA).[17] Loan guarantees enjoying such credit ratings generally provide better lender protection than the collateral available from most private entities, making them potentially very effective in enabling lenders to provide debt finance at affordable rates of interest.

Like loans, loan guarantees may not be suited to funding the earlier R&D stages of technology development, as technology developers may be less able to service a loan than companies whose technology is approaching demonstration, and for whom commercialisation is much closer. Loan guarantees may therefore be likewise limited to the later stages of the solar innovation cycle.

Case study 7: US DOE Loan Guarantee Programme

Under the US DOE Loan Guarantee Programme, the DOE may provide 100% loan guarantees for loans relating not only to renewable energy RD&D, but also deployment and commercialisation. However, these 100% loan guarantees may only be provided where the lender is the US Treasury's Federal Financing Bank (FFB).[18] Generally, 100% loan guarantees are avoided by guarantors, in order to share the risk entailed by the loan between guarantor and lender and deter a lender from agreeing, on the basis that it is fully protected by the guarantee, to provide a loan to a high risk borrower to whom it would not otherwise lend. As mentioned above, this sharing of risk is common to all quasi-commercial funding models in which repayment or some other return is sought, and the risk of that return being lost sought to be mitigated.

Where the lender is not the FFB, the DOE still surpasses most other loan guarantors in terms of the extent of coverage, offering loan guarantees of up to 80% of the loan value. Other guarantors, such as the EIF, may only offer loan guarantees of up to 50% of a lender's investment.

Other features unique to the DOE Loan Guarantee Programme are listed below:

- It is a condition of a DOE loan guarantee that repayment of the guaranteed loan by the borrower is not subordinated to other financing obligations of the borrower and enjoys a "first lien"[19] position on all assets of the project.
- DOE loan guarantee agreements provide that, in the case of a business default or project failure, the DOE has the discretion to "[ensure] availability" of rights to intellectual property, technical data and physical assets to anyone, including itself, so that the project may be completed, operated or disposed of. This discretion, effectively a "step-in" right, may be contrasted to most other guarantees, where the guarantor will generally have limited rights to intellectual property arising from or subsisting in a project.
- DOE loan guarantees may have tenors of up to 30 years, which far exceed the tenors able to be offered commercially by private financiers (the only other types of entities generally able to provide guarantees or loans with this type of tenor are multilateral development banks and export credit agencies). By contrast, AWS's "Double Equity Guarantees" may extend to a maximum of 10 years. In the context of a solar technology (or other renewables) RD&D project, a DOE loan guarantee may therefore have a unique ability to protect, and leverage, sustained private sector investment into the long-term. This is not usually possible under certain other funding models such as grant and loan programs (which are usually most effective at leveraging private investment in the short-medium term).

During FY09, some of the largest solar-related loan guarantees were given by the DOE, including:

- US$1.45 billion loan guarantee in favour of lenders to Abengoa Solar (July 2010);
- US$0.4 billion loan guarantee in favour of lenders to Abound Solar (July 2010);
- US$1.37 billion loan guarantee in favour of lenders to BrightSource Energy (February 2010); and
- US$0.535 billion loan guarantee in favour of lenders to Solyndra Inc (March 2009).

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[17] For example, under the DOE Loan Guarantee Program, the DOE is entitled to the full faith and credit of the US, pursuant to s1702(j) of Title XVII of the Energy Policy Act of 2005.

[18] The Federal Financing Bank is an agency of the US Treasury, created by the US Congress with the aim of centralising borrowing and financing activities of federal agencies

[19] A creditor with a "first lien" position means that that creditor's debt has highest priority in the case of a solar RD&D business default.

Besides the DOE Loan Guarantee Programme, other notable loan guarantee programmes include:

- the European Investment Fund's (EIF) "EU Guarantees" provided under its Competitive and Innovation Framework Programme Small and Medium Enterprises Guarantee Facility (CIP SME Guarantee Facility);
- guarantees under the EIB RSFF (see discussion in **Section 3.4**, above); and
- AWS's "Double Equity Guarantee" for uncollateralised subordinate loans to start up companies (see above). Despite being named an equity guarantee, the structure of this option essentially consists of a partial guarantee for up to 80% of loan volume, generally capped at a maximum of €2.5 million.

From the discussion above, it is apparent that a number of innovative loan guarantee facilities have been developed which, whilst incorporating many of the listed typical features, have also included non-generic terms in the hope of greater leverage of private investment. The DOE Loan Guarantee Programme, for example, is an innovative model introduced and governed by statute and currently implemented in the US (see Case Study 7).

Other loan guarantee structures may make use of a counter guarantee, which involves a second guarantor giving a guarantee (the counter guarantee) in respect of a primary loan guarantee. For example, the ASI may act either as the primary loan guarantor (in which case it will need to finance the procurement of a counter guarantee) or as the counter guarantor, in which case it may provide private loan guarantors with a publicly-backed counter guarantee, in return for a fee for assuming part of the loan guarantor’s risk.

Similar to the loan guarantee given by the primary loan guarantor, the counter guarantor will generally give a guarantee in respect of only a percentage of the total value of the primary loan guarantee. These types of guarantees are not uncommon – for example, EIF also offers EU Guarantees in the form of counter guarantees. Through their use, the aggregate risk associated with the RD&D activities of a borrower may be further spread across a larger number of stakeholders.

Another interesting guarantee variation is found within EIF's CIP SME Guarantee Facility, which in certain circumstances, may provide free-of-charge capped guarantees in exchange for the additional assumption of risk by financial intermediaries.[20] Eligible intermediaries include banks and other guarantee schemes and guarantees may be in the form of loan, equity or counter-guarantees.

3.6 Equity guarantees

Publicly-backed equity guarantees may be provided by government bodies to venture capitalists, angel investors and other equity investors making seed/early investments in solar RD&D companies, to mitigate the risk that the equity investment (or, more commonly, a part thereof) will be lost should the investee company fail. In this context, equity guarantees may be best used to promote equity investments in solar technology companies following completion of earlier stage technology development, at the point when venture capitalists and angel investors move to invest equity with which the company can proceed to the next stages of technology development, prior to demonstration.

[20] http://www.eif.org/what_we_do/guarantees/cip_portfolio_guarantees/index.htm

An equity guarantee is typically structured as a partial guarantee (e.g. 50%-70%) covering part of a party's equity investment in an early-stage venture. The extent of coverage given by a guarantee will depend, *inter alia*, on the nature of the investee company and the risk profile of its operations. For example, the Sofaris Biotechnology Fund (SBF) generally offers partial equity guarantees of up to 50% of the value of a party's equity investment, which may be extended up to 70% in certain circumstances (see below).

If the company fails, the investor can enforce the guarantee to recover an appropriate part of the covered equity investment. Triggers for enforcement generally include insolvency of the investee company, or its loss of a pre-determined equity percentage.

Equity guarantees frequently impose matched funding requirements, whereby the guarantee will be conditional on the beneficiary of the guarantee also making a non-guaranteed equity investment. Again, this ensures that the equity guarantee will only cover a part of the investor's total equity investment, helping to reduce moral hazard (the risk that an investor will make an unduly risky equity investment on the basis that the investment is fully protected by an equity guarantee).

As for loan and other guarantees, guarantors providing equity guarantees will charge a fee, often calculated as a percentage of the guaranteed funds. These fees would be used to help cover the ASI's ongoing operational costs, or to finance further solar RD&D measures and initiatives. The fee should be high enough to justify the ASI's assumption of risk as guarantor, without becoming prohibitive for prospective investors.

Case study 8: Sofaris Biotechnology Fund (SBF) Development Technologique pour les FCP/FCPR

SBF provides portfolio equity guarantees to venture capital investors (a portfolio guarantee applies to multiple equity investments made by the beneficiary of the guarantee in a defined class of investee companies).

Generally, SBF guarantees:

- are partial and cover up to 50% of the value of the investment (with the exception that coverage may be raised to 70% for investments in companies under 3 years old);
- have a tenor of around 10 years; and
- are triggered upon the insolvency of the investee company or where the investor divests its equity stake at less than half the value of its original investment.

Case study 9: Austria Wirtschaftsservice GmbH (AWS)

AWS is Austria's national promotional bank, the institution by which the Austrian Government implements its economic policies. Essentially, AWS aggregates the experience of four prior existing organisations – the BŰRGES promotional bank for small and medium enterprises (SMEs), the Finance Guarantee Company, the Innovation Agency and the European Recovery Programme (ERP) Fund. AWS provides a range of investment promotion programmes and services for pre-seed and seed financing, including equity guarantees.

AWS provides up to 100% equity guarantees to business angels for cash investments of up to €20,000 and up to 50% guarantees for investments of up to €1 million. These guarantees are available only to holders of minority shareholdings in the company. The start-up entrepreneur (and his or her family members) are expressly ineligible. Fees generally amount to around 0.5% p.a. of the

Case study 9: Austria Wirtschaftsservice GmbH (AWS)

guaranteed amount.

AWS also operates a Technology Financing Program, under which AWS may provide partial equity guarantees of up to 50% in respect of venture capital equity investments of between €200,000 and €1.8 million. These may be structured alongside a 100% guarantee for a parallel subordinated bank loan. Restrictions may apply to guarantees under this program. For example, business angel investors are only eligible for these equity guarantees where such investors represent a minority syndication partner in the venture capital company. Fees generally amount to around 1.0% p.a. of the investment amount.

Equity guarantees (and other guarantees) are less frequently utilised compared with funding models such as grants, loans and funds. As such, most equity guarantees generally incorporate the typical provisions discussed above, with any variations focused around the specific settings for each of these provisions (for example the percentage coverage of a partial guarantee, the guarantee fee structure and the enforcement triggers).

A detailed assessment of a model equity guarantee is set out in **Section 4.8**.

3.7 Performance guarantees/efficacy insurance

Performance guarantees and efficacy insurance have not been used extensively in relation to solar or renewable energy technology RD&D. Most instances where performance guarantees have been applied to the solar industry relate to deployment of solar technology as opposed to earlier-stage RD&D (see case studies below). However, performance guarantees may have the potential to act as an effective public funding model, capable of leveraging significant private investment, in the demonstration context. Performance guarantees have therefore been assessed on this basis, by reference to broader renewable energy demonstration and commercialisation experience.

A performance guarantee operates in much the same way as a loan guarantee, except that where the latter provides a guarantee for a borrower's repayment of a loan, the former provides an investor with a guarantee for the performance of the technology (e.g. workability of solar technology), by reference to specific performance indicators. "Efficacy insurance" functions in a similar way, usually in a situation where a technology owner/user takes out an insurance policy in respect of the good performance of the technology, with a payment claimable from the insurer in the event that the technology does not perform as expected.

Given the need for specific expertise in the evaluation of a technology's expected performance, independent engineering firms will likely need to be consulted before a guarantor is in a suitable position to decide whether to grant a performance guarantee.

Where performance falls below certain prescribed thresholds and performance indicators, the guarantor would make payments according to a pre-agreed schedule and up to a capped amount. Generally, the technology supplier/developer would be liable for a first tranche of loss before the guarantor becomes liable.

A guarantee of this kind may mitigate the risk of non-performing technology (and other associated risks) faced by private investors. The benefits of using performance guarantees include that:

– investors may focus on financial and other project risks in which they have relatively strong expertise; and

– the level of risk assumed by each financing entity is lowered, which may in turn encourage greater private financing.

Conversely, a number of barriers hamper the adoption of performance guarantees and efficacy insurance as viable funding models, including:

– the lack of actuarial data for insurers to predict the probability of loss, especially at the early stages of a project; and

– high underwriting costs (especially due to insurers having to develop product-specific policies for each technology) coupled with high risk of technology failure.

As mentioned above, performance guarantees are more commonly used later in the project cycle, most particularly at the deployment and commercialisation stages. Nonetheless, there is potential for performance guarantees to be suitably adapted to the earlier stages of a solar project cycle. This is especially the case at the demonstration stage, during which solar technology performance becomes more readily measurable and the lack of performance data is less pronounced. The demonstration stage is also commonly associated with an intensification of capital needs (and hence risks). Performance guarantees and efficacy insurance may be able to provide the incentives required to sustain private sector investment after initial funding and into the longer-term. Examples of solar technology-related performance guarantees are set out below.

Case study 10: Solar Insure s Solar Performance Guarantee Insurance (as part of its Energy Products Performance Guarantee Program)[21]

Solar Insure is an international commercial insurance brokerage firm with a specific focus on renewable energy (particularly wind and solar energies). Customers range from large solar manufacturers/suppliers to smaller solar and wind contractors.

Solar Insure's program provides insurance coverage to both project owners and lenders. Performance guarantees under this program are designed to protect these parties where predicted power generation of solar equipment and any relevant revenue thresholds are not met.

SunRun Money-Back Performance Guarantee[22] and Solon's Performance Guarantees[23] offer performance guarantees in a similar manner to Solar Insure.

Case study 11: Self Energy UK s Energy Performance Guarantee[24]

Whilst not specifically applicable to solar technology, the Energy Performance Guarantee is a good example (in the building energy efficiency sector) of how an energy performance guarantee may be provided. In this case, the primary performance indicator is reductions in energy consumption and carbon emissions. Self Energy provides funding for the set up of energy-saving equipment

[21] http://www.solarinsure.com/

[22] http://www.sunrunhome.com/why-sunrun/leading-home-solar-company/solar-performance-guarantee

[23] http://www.renewable-energy-sources.com/2010/03/05/solon-extends-the-performance-guarantee-for-all-solar-modules/

[24] http://www.selfenergy.co.uk/energy-performance-guarantee/

Case study 11: Self Energy UK s Energy Performance Guarantee[24]

and provides a guarantee in relation to the energy savings to be achieved. Arrangements are made for the sharing of benefits and energy savings, in addition to Self Energy's recoupment of investments and transfer of ownership of equipment from Self Energy to the recipient of the guarantee.

Denmark's Export Kredit Fonden (national export credit agency) provides a range of public guarantees for technologies and projects designed to help reduce greenhouse gas emissions and mitigate climate change, which may include solar and other renewable energy projects.[25] In the context of performance guarantees, these include:

– a guarantee provided in respect of advance payments for carbon credits issued under the Kyoto Protocol's Clean Development Mechanism (CDM), which may be called upon to reimburse the advance payment should the project fail to generate the agreed or expected volume of credits, for example due to technology failure or underperformance; and

– a payment guarantee for exports of new and commercially untested climate change mitigation technologies.

An assessment of a performance guarantee test model based on a review of available materials is set out in **Section 4.9**.

3.8 Corporate and philanthropic investment

Corporate (venture capital, private equity and strategic corporate finance and acquisitions) and philanthropic (wealthy individual/foundation) investment in the solar RD&D sector is typically structured as an equity investment, with the financier:

– acquiring shares in a company developing or demonstrating a particular solar technology as a basis for realising a return on its equity investment; and

– having ongoing involvement in, and control over, the investee business commensurate with the level of its investment.

Both corporate and philanthropic sources of capital are integral to the funding of solar and renewable energy RD&D, due to their relative willingness to take on the associated risks and often strong commitment to achieving the environmental, social and other non-financial benefits that may arise from such investments.

Corporate investments are generally made on the basis that high initial risks will potentially be offset by high financial returns in the future, whether through high dividend payments, or sale of the successful technology or business.

In this regard, some venture capital firms have expressed concern of late that investments in solar companies may not match the typical venture capital business model. Venture capital investors generally seek to address the key risks presented by an investment opportunity within a short timeframe using a relatively small level of

[25] See http://www.ekf.dk/weoffer/ekf_climate,

investment. However, as discussed in **Section 2.6**, solar technologies present a range of risks, which are often more difficult and costly to address than are permitted under the usual venture capital model and not all of which will arise from investments in other sectors. In particular, the following three heads of risk have been identified as potentially incompatible with venture capital business models.[26]

Technology risk: the risk that the technology being developed by an investee company will fail to perform as expected (whether at the demonstration stage or subsequent commercial deployment).

Market risk: the risk that even where a technology performs as intended, it will not have a competitive advantage with which to capture a market share and achieve commercial success.

Regulatory risk: the risk that the regulatory frameworks and settings on which solar technologies currently depend for competitiveness will be terminated or modified, such that solar technologies can no longer compete successfully with other energy options.

Nonetheless, venture capital financing for clean technologies in particular has experienced a resurgence during the first half of 2010 - up to US$2.02 billion was been invested into the clean technology industry in the second quarter of 2010 alone. This represents a 43% increase compared to the second quarter of 2009. Significantly, investment in solar technologies accounted for US$811 million, or around 40% of total investments,[27] despite recent hesitation amongst venture capital firms as to whether the solar industry fits their venture capital business models.[28]

Philanthropic investors targeting solar and other clean technology RD&D face the same investment risks as venture capitalists. Philanthropists are, however, often able to further justify this risk exposure through:

- an ethical commitment to contributing to renewable energy initiatives or common good/public interest sectors; and/or
- non-financial benefits that may flow from such investments, goodwill, reputational benefits and prestige.

Both corporate and philanthropic investors often mitigate their risk exposure through the following measures:

- partnering or effectively syndicating with other investors, bringing increased investment flows to the beneficiary, increasing available capital with which to realise RD&D objectives, as well as increased knowledge/expertise and "strategic advantages" (see discussion below of Google's consortium solar investments); and
- diversifying their investments across a range of beneficiaries (although this dilutes the impact of the capital invested).

Case study 12: Google.org philanthropic solar investments

During the course of 2008, Google's "philanthropic" arm invested in a number of renewable energy businesses, including companies seeking to develop and demonstrate innovative solar technologies.

[26] B. Romano, *Venture capitalists look to ditch "zombie solar"*, Recharge News, 23 July 2010 at p.2.

[27] B. Romano, *Record start for clean-tech, thanks to solar*, Recharge News, 16 July 2010 at p.18

[28] Insert reference from Paul's article, *Venture capitalists say they are looking to ditch 'zombie solar'*, Recharge News, 26 July 2010

Case study 12: Google.org philanthropic solar investments

Initially, Google made a US$10 million investment in eSolar as part of a funding consortium of US$130 million, which includes investors such as Oak Investment Partners.

Later in 2008, Google made another US$10 million investment, this time in BrightSource as part of a funding consortium which ultimately mobilised US$115 million in equity funding. Other investors in this funding round included BP Alternative Energy, Statoil Hydro Venture and a number of leading US venture capital firms.

These investments were made by Google following its announcement to commit more than US$25 million in new grants to philanthropy.

Corporate and philanthropic investment may also be channelled through a fund, rather than provided as direct equity investment. This approach, whereby multiple investors commit capital to a fund which may then invest in a range of selected companies, captures both the syndication and diversification risk mitigation benefits described above. Specific discussion and examples of funds are provided in **Section 3.3**.

3.9 Indirect policy measures

In Australia, a number of regulatory and policy frameworks have the potential to provide added incentive for public and private investment in solar technology RD&D. Relevant policy measures include the various renewable energy policies available at both the federal and State level, fiscal measures, planning and development concessions in relation to solar projects and tertiary education programs funded by the Government.

A number of these measures, such as renewable energy policies and planning and development concessions, are by their nature directed towards the latter stages of the solar project innovation and development cycle (i.e. once a solar technology is ready to be deployed for commercial application). For example, benefits derived from policies such as the National Renewable Energy Target and solar feed-in tariffs are captured once a technology has been deployed as a part of a project (whether small- or large-scale) to generate electricity for private consumption.[29] Similarly, planning and development concessions are designed to alleviate the potentially drawn-out and expensive development approval process associated with demonstration, deployment and commercialisation.

By contrast, tax concessions may be designed specifically to benefit eligible parties undertaking solar R&D, or demonstration. An overview of these measures is set out at **Annexure 3**.

[29] Though such indirect measures may provide a longer-term incentive for investment earlier in the project cycle, in view of the additional benefits that may be realised upon deployment.

4. Analysis of funding models

4.1 Introduction to assessment criteria

Each of the key funding models identified in **Section 3** has been subjected to qualitative analysis using criteria agreed with the ASI, in order to evaluate their respective advantages and disadvantages as a model for the ASI funding in driving private investment in solar RD&D in Australia. The criteria applied have been structured to analyse the following characteristics of potential funding models:

- the effectiveness of the model in leveraging private finance for solar RD&D in Australia;
- the suitability of the model for funding solar RD&D activities;
- the compatibility of the model with other relevant policies and measures;
- the adaptability of the model to accommodate material changes in circumstances; and
- the model's complexity of use, both for the ASI and private sector applicants.

Descriptions of the individual assessment criteria applied are set out at **Annexure 1**.

The performance of each funding model against the assessment criteria has been scored using the following 3-point scale:

2: clearly and unequivocally capable of satisfying the criterion.

1: moderately capable of satisfying the criterion, subject to conditions or limitations.

0: relatively incapable of satisfying the criterion.

In addition, a triple multiplier was applied to each of the following criteria, in order to increase their weighting to reflect their significance for the ASI and its objectives:

- investment leverage and effectiveness;
- the ASI's financial sustainability; and
- the ASI's risk exposure.

The outcomes of each assessment are tabulated by model.

4.2 Development of test models

Analysis of each funding model was undertaken using "test models" developed based on common or best practices identified in the course of research. Each test model has been structured to reflect the ASI's mission and objectives, as well as the Australian context for solar RD&D investments. In this way, each test model is designed to:

- be consistent with global best practice;
- be relatively balanced in terms of effectiveness, risk, return and cost; and

- allow the ASI, to the extent possible, to:
  - direct its investments and all complementary private finance exclusively to Australian solar RD&D businesses; and
  - retain within Australia all intellectual property rights arising from supported solar RD&D activities.

One test case has been generated for each funding model discussed in this report, with the exception of loans (where two variant test cases have been assessed).

The total score and ranking for each test model are specified as part of its assessment.

4.3 Grants

Description of test model

The test grant funding model incorporates the following key features:

- a 1:1 matched private funding requirement, such that in order to be eligible for a grant of a specified amount, applicants must have secured an equal amount of private investment (a matched grant funding requirement has been excluded);
- grant payments are staged in accordance with short- to medium-term solar RD&D milestones;
- transaction costs will be shared equally between the grantor and grantee;
- intellectual property rights arising from grant-funded activities will vest in the grantee, provided that the grantor is in turn granted an unconditional, irrevocable, worldwide, royalty free licence to use research data, reports and other findings; and
- grants will be awarded in multiple bi-annual "funding rounds".

Advantages and disadvantages

A leading advantage offered by a grant funding model is its potential to immediately leverage significant amounts of short-term private investment, particularly through application of a matched funding requirement. A grant program structured in this way may attract private funding for solar RD&D in Australia through:

- the incentive created by the grant itself, as an equity contribution that may be able to meet a significant proportion of the costs entailed by solar RD&D activities, thereby strengthening the prospects for successful development and deployment of the relevant solar technology and encouraging parallel private investment in the technology; and
- the quantitative requirement that such private investment be at least equal to the amount of the grant itself (a similar in-kind contribution requirement may also be applied).

These private funding incentives will renew at each funding round under the grant program.

Other important advantages of a grant funding model are:

- the scope it provides for control of intellectual property rights arising from funded activities (a grant agreement may specifically provide for intellectual property rights to vest in the grantee or other appropriate entity, and require that such entity retains such intellectual property rights, for example as a condition to ongoing grant payments to be paid in accordance with the staged grant funding schedule); and
- its administrative simplicity (for both the ASI as grantor and grant applications) and the scope to monitor grantee performance by reference to the schedule of milestones against which grant funding is to be provided.

The ASI's experience to date in providing grants for solar RD&D, as discussed in Section 3.2, confirm these various advantages.

Conversely, a key disadvantage of a grant funding model is its potential to leverage private investment only in the short-term, without generating a long-term investment incentive that draw a sustained flow of private finance into solar RD&D. Once each funding round has passed and grants have been awarded issued, the program is unlikely to provide a material incentive for private investment until the next funding round arrives.

Additionally, as grants are provided essentially as lump sum equity donations, the ASI will not be entitled to repayment of grant amounts. In this way, a grant funding model places a greater burden on the ASI's funding resources than loans (which are required to be repaid), funds (which are designed to generate dividends for investors) and guarantees (which, while appearing as contingent liabilities on government balance sheets, are only required to be paid upon the occurrence of a valid trigger event and generate revenue from guarantee fees). A grant program therefore creates a much greater risk of the ASI substantially depleting or even exhausting its funding resources, if no additional funding commitments are made to finance its continued operation. Given the uncommercial nature of a grant program, any such top-up funding would likely need to be drawn from government(s), as there would be little incentive for the private sector to contribute funding directly to the ASI (private sector finance would be more likely to flow to grant applicants, from whom a commercial return could be realised). As a result, a grant model is likely to require ongoing funding support from the Australian Government, to replenish funds distributed to successful grant applicants.

A further disadvantage of a grant program is its inability to adapt to changing circumstances: once a grant has been awarded, it may be difficult to recover or revoke. If the grant agreement were to allow the grantor to reduce, amend or withhold the grant if circumstances such as Government policy or solar technology costs change, this would create uncertainty as to the real value of the grant and undermine its effectiveness.

Table 1 – Assessment results for grant funding model

Effectiveness

Criterion	Score	Analysis
Investment leverage and effectiveness	1 (x3=3)	A grant program may leverage increased private funding through matched funding (as confirmed by the ASI's experience to date in using grant models to leverage complementary State Government and private funding). Leverage of private investment will follow grant funding rounds: this will help provide a sustained incentive for private sector investment into the medium, but is likely to result in an inconsistent flow of private finance, with peaks at the time of award of each funding round, followed by drops or lapses in investment. The ability of a grant program to attract sustained private funding in the long-term may be limited, unless the program itself is equally long term. Private sector finance is likely to flow only to grant applicants (rather than the ASI directly), and then only in accordance with grant funding rounds able to create leverage opportunities (such as matched funding requirements). These factors may in turn limit the quantum of private funding leveraged by the model over time. A grant program has moderate potential to reduce the costs and promote the deployment of solar technologies in Australia, as it may enable breakthroughs through provision of funding to early stage R&D institutions such as university research bodies (as is commonly the case), and/or help businesses at the demonstration stage bridge the valley of death. Its longer term effectiveness in this regard may, however, be limited by the lack under a grants program of a more sustained incentive for private investment in solar RD&D, as discussed above.
In-kind contributions	2	Grants may be made conditional on the securing of in-kind contributions, as an addition or alternative to a matched funding requirement (although replacement of a matched funding requirement with an in-kind contribution requirement would be likely to reduce the ability of the program to leverage direct private investment).
Risk mitigation	1	Although a grant reduces the private sector investment required for a project or business, thus reducing the magnitude of private risk exposure, the equity injection provided by a grant does not directly address the causes or sources of risks facing solar RD&D projects and businesses.
Performance measurability	2	Staging of grants in accordance with specific milestones allows: – periodic assessment of performance against those milestones; and – greater transparency of public and private funding requirements (as funding milestones should reflect funding needs), and how funding received is expected to be used.
ASI financial sustainability	0 (x3=0)	Provision of grants as lump sum donations will place a significant burden on the ASI's financial resources without generating any return revenue stream, creating a significant risk of the ASI substantially depleting or exhausting its funding resources. Private financiers would be unlikely to provide top-up funding as there would be no commercial incentive to directly fund the ASI, meaning ongoing finance would need to be provided by government(s).
ASI risk exposure	1 (x3=3)	In providing grants, the ASI faces the risk of losing funding provided to solar RD&D businesses or projects that fail (although is risk is mitigated to an extent by providing funding in stages rather than entirely upfront).
Total	**11/24**	

Suitability

Criterion	Score	Analysis
Technological applicability	2	A grant-based funding model can be applied to all forms of solar energy technologies.
RD&D applicability	2	Grant funding is often used to finance technology, including solar, RD&D. Grants are arguably the principal means of funding early stage R&D, but may equally be applied to demonstration activities (see, for example, the Australian Government's Low Emissions Technology Demonstration Fund, discussed in **Section 3.2**). By structuring grants in stages, funding may be linked to the completion of distinct RD&D milestones or stages.
Timeframe compatibility	1	At a project level, timelines for grant funding stages can be tailored to match expected RD&D timeframes. At a policy level, grant programs can complement short and medium term policy objectives by providing capital support for activities implemented pursuant to those objectives. It may, however, be difficult to link grant funding to longer-term policy objectives, unless a commensurate commitment to longer-term program funding is also made.
Policy complementarity	2	Grants may be linked to ancillary RD&D support measures such as tax concessions (e.g. accelerated depreciation for assets or materials purchased using grant funding) and planning concessions (e.g. simplified development approval requirements for demonstration projects). Generally, grants represent a highly flexible funding model and may be used in conjunction with other models, such as loans and guarantees, as well as ancillary support measures.
Intellectual property management	2	Grants may be provided subject to certain intellectual property rights being allocated to the grantor (e.g. licences to use reports, data and other research outcomes from supported activities). Grant programs generally do not provide for the grantor to take title to intellectual property rights in technologies developed, and it is unlikely that a prospective grantee would agree to accept a grant on such terms. Grants may be subject to a condition requiring that intellectual property in technologies developed using grant funding remains with the grantee (presumably an Australian entity), or shared on agreed terms between the grantee's project partners, whether they be local or international.
Total	**9/10**	

Adaptability

Criterion	Score	Analysis
Adaptability	0	A grant mechanism may be adapted through amendments to the quantum of the grant, in addition to its constituent stages and milestones. However, this may create uncertainty/risk as to the value of the grant, if key terms affecting the quantum or timing of grant funding are subject to change.
Resistance to failure	0	Where grant funding is provided to commercial businesses e.g. to finance demonstration activities, a staged grant may mitigate the risk of ASI funding being applied to a business or technology that ultimately fails, provided such failure occurs prior to the grant being fully paid out (in which case grant funding would cease). However, there is little protection to enable recovery of grant funding already provided to a solar RD&D business or project that subsequently fails.
Total	**0/4**	

Complexity

Criterion	Score	Analysis
Financial complexity	2	Grant mechanisms, as lump sum capital injections, are relatively simple. Private sector participants should be familiar with grant funding arrangements and, aside from application processes and requirements, should experience little difficulty in incorporating grant funding into business models and plans.
Administrative complexity	1	Grant mechanisms, as lump sum capital injections, are relatively simple. The ASI has experience in administering the provision of grant funding. Selection of grantees will entail a degree of complexity in processing applications based on appropriate criteria, and staged funding structures will necessitate monitoring against milestones and reporting requirements.
Total	**3/4**	

4.4 ASI Solar RD&D Fund

Description of test model

The test ASI Solar RD&D Fund funding model incorporates the following key features:

- the fund will be mandated to invest only in dedicated Australian solar RD&D companies (project-based investments or financing, as well as investments in R&D activities undertaken by entities other than private companies pursuing commercial objectives – such as university-based early-stage R&D activities – would not be permitted under the fund's mandate);
- the ASI will make an initial seed capital investment in the fund on a non-profit basis, such that:
  - the ASI's dividends from the fund are used first to cover its costs in administering the fund;
  - the remainder of the ASI's dividends will be reinvested in the fund during its term, to maximise the amount of funds available for investment (private investors could elect under such a model whether to reinvest their dividends); and
  - at the expiry of the fund term, the ASI will distribute the final dividend to which it is entitled, net of its operating costs (which dividend will have been maximised through earlier dividend reinvestment), as follows:
    - 50% of the dividend will be paid to the ASI to finance the ASI's future support of Australian solar RD&D activities; and
    - 50% pari passu among private investors participating in the fund, in proportion to their respective investments;
- the fund will accept investments from Australian and international investors;
- the fund will be managed by appropriately qualified staff drawn from within the ASI, in order to reduce costs and internalise payments to fund managers; and
- the fund’s board will comprise members drawn from the ASI as well as appropriately qualified external appointments.

Advantages and disadvantages

An ASI Solar RD&D Fund model designed to invest in private commercial solar RD&D businesses presents a number of important advantages, spanning leverage of private investment, risk mitigation and control of intellectual property and information.

An ASI Solar RD&D Fund will leverage private investment in a number of ways, as outlined in the table below. Significantly, the incentive for private investment in the fund will not depend on short term capital injection opportunities (such as under a grant or loan-based model). Rather, the incentive will continue to exist for as long as the fund continues to operate, particularly as a result of the final enhanced dividend payment to private investors as well as the fund's inherent risk mitigation benefits, which also make the model more resilient than certain others (grants and loans) to the failure of investee solar RD&D businesses.

The total amount invested in Australian solar RD&D businesses will be increased as a result of the ASI's reinvestment of the remainder of its dividends once its operating costs have been covered. This amount will be further increased if private investors elect to do the same.

As the fund will make equity investments in investee companies, this may give the ASI:

– greater scope to control the allocation and management of intellectual property rights arising from the activities of investee companies; and

– greater access to company information, such that investment performance can be monitored relatively closely.

A significant disadvantage of a fund model structured as set out above is the limitation on its ability to support earlier-stage solar R&D activities. By focusing investments on private companies undertaking solar RD&D activities in pursuit of commercial outcomes, the fund will not channel support to R&D activities undertaken by dedicated R&D entities such as university-based research institutions, who in fact account for the majority of early stage R&D within the Australian (and global) solar industry. As a result, the fund may potentially be limited to supporting private Australian businesses established to bring a particular solar technology through the final R&D stages to demonstration and, ultimately, commercialisation.

A fund may also require additional funding support from the Australian Government, to provide the capital to be deployed by the fund as seed investments in selected solar RD&D companies.

The administrative complexity faced by the ASI in managing the fund and its investments is a further disadvantage of an ASI Solar RD&D Fund funding model. The ASI will not only need to process the influx of investments but, more particularly, will need to make careful investment decisions in deploying funds received (as well as its own capital). This will necessitate careful screening of target companies, as well as rigorous transparency, accountability and governance procedures. Internalisation of these processes will, however, avoid the need to meet the cost of paying an external fund manager to perform them instead.

The ASI's position as an investor in the fund may also limit the scope to support the model using other indirect fiscal and other incentives, as this may give rise to a perceived conflict of interest given the potential benefit that the ASI, among other investors, would realise from such measures.

Table 2 – Assessment results for ASI Solar RD&D Fund funding model

Effectiveness

Criterion	Score	Analysis
Investment leverage and effectiveness	2 (x3=6)	An ASI Solar RD&D Fund may attract ongoing private funding (i.e. immediately as well as through the medium- and longer terms), through: – the ability of the fund to provide an opportunity to invest in solar RD&D activities while mitigating investment risk through the fund structure; – the increased fund liquidity and sustained investment that will result from the ASI's "evergreening" (automatically reinvesting) its net profits from the fund; – the enhanced divided payed to investors at the expiry of the fund term; – the expertise of the fund board and fund manager (potentially drawn from within the ASI) in making sound solar RD&D investments; and – the relatively favourable investment climate in Australia. Although a fund of this kind may not leverage the same level of initial private sector investment as may flow under a grant or loan model structured in rounds with a matched funding requirement, this factor can be offset to a degree by the seed funding provided by the ASI. The fund is also more likely than other models to generate a sustained flow of private finance into solar RD&D, due to its ability to incentivise and accommodate ongoing private investments, as well as the re-investment of the ASI net profits from the fund. In this way, an ASI Solar RD&D Fund may be able to make a significant contribution to reducing the cost and increasing the deployment of solar energy technologies in Australia. Investments by the fund in solar RD&D businesses could also be conditioned on the investee securing a certain level of matched funding. including through minimum direct private equity investments in the investee.
In-kind contributions	1	It is likely to be difficult to link investments in the fund to in-kind contributions. Investments by the fund in solar RD&D businesses could, however, be conditioned on the investee securing a certain level of in-kind contributions.
Risk mitigation	2	An ASI Solar RD&D Fund structure will mitigate the risk exposure of private investors contributing to the fund by: – diluting risk exposure across multiple investors, including the ASI; – enabling diversified investment across multiple businesses and technologies; – allowing access to the solar RD&D investment expertise within the fund's board and management team; – the ability of the fund, as an equity investor in investee businesses, to control business operations in order to preserve investee financial health; and – "evergreening" reinvestment of the ASI's net profits from the fund, to promote fund liquidity and ongoing investment.
Performance measurability	2	By facilitating equity investments in solar RD&D businesses, a fund structure will provide the ASI with access to information relating to investee companies and projects, providing a strong basis for assessment of their performance.

Criterion	Score	Analysis
ASI financial sustainability	1 (x3=3)	Although the ASI will be required to make an initial seed capital investment into the fund, the ASI may be able to meet its ongoing operational costs from fund dividends.
ASI risk exposure	2 (x3=6)	As an investor in the fund (providing seed capital as well as ongoing investment of its net profits) the ASI's risk exposure under the fund will be mitigated by: – the diluted risk exposure inherent in fund structures; – enabling diversified investment across multiple businesses and technologies; – allowing access to the solar RD&D investment expertise within the fund's board and management team; and – the ability of the fund, as an equity investor in investee businesses, to control business operations in order to preserve investee financial health.
Total	**20/24**	

Suitability

Criterion	Score	Analysis
Technological applicability	2	A fund-based funding model can be applied to all forms of solar energy technologies.
RD&D applicability	0	Investments made by the fund in solar RD&D businesses and projects, as single lump sum equity injections, are not easily amenable to application across RD&D phases. In particular, the fund will not channel support to R&D activities undertaken by dedicated R&D entities (e.g. university-based research institutions). The fund may, however, seek to invest in a range of companies at different stages of the RD&D cycle, in order to mitigate the above disadvantage and provide support to activities at each of the RD&D stages. Ongoing investments made by the fund (including of longer term contributions from the ASI's reinvestment of net profits) will also create opportunities for sustained equity support for business at different stages of the RD&D cycle.
Timeframe compatibility	1	The single lump sum equity injections made into solar RD&D businesses under a fund structure are not easily amenable to application across the full RD&D timeframe. Ongoing investments may, however, allow sustained equity support for particular businesses or projects across longer timeframes. It may also be possible to link ongoing investment decisions made by the fund may with short-, medium and long-term policy objectives and positions (for example medium- and long-term solar energy capacity and generation targets).
Policy complementarity	0	The institution of complementary Government measures to support companies in which the ASI has an equity investment may result in a perception of conflict of interest.
Intellectual property management	2	The fund, as an equity investor in investee businesses, will be able to exert a degree of control over the management of intellectual property rights that accrue to these businesses (proportionate to the level of the fund's investment).
Total	**5/10**	

Adaptability

Criterion	Score	Analysis
Adaptability	1	The fund, as an equity investor in investee businesses, will be able to exert a degree of control over the management of these businesses, in order to adapt to material changes in business operations or conditions. Depending on the ability of the fund to liquidate its equity stake in investee businesses, it may be difficult for the fund to exit financially distressed businesses.
Resistance to failure	1	As above, the fund, as an equity investor in investee businesses, will be able to exert a degree of control over the management of these businesses in order to preserve investee financial health. Depending on the ability of the fund to liquidate its equity stake in investee businesses, it may be difficult for the fund to exit financially distressed businesses, subjecting the fund to the risk of loss of its equity investment if one or more investee businesses fail.
Total	**2/4**	

Complexity

Criterion	Score	Analysis
Financial complexity	2	An ASI Solar RD&D Fund is relatively simple for investors to use: investors may simply elect whether to invest in the fund based on their particular investment objectives. Investors are also likely to be familiar with fund-based funding models.
Administrative complexity	0	Administration of the fund will entail significant administrative complexity for the ASI. In particular, screening and selection of companies in which to invest will necessitate detailed due diligence investigations, as well as transparent and accountable investment decisions. The administrative burden borne by the ASI in operating the fund could be reduced by outsourcing fund administration and management responsibilities to an external party, as is the case for CVC REEF, discussed in **Section 3.3**. Engagement of an external fund manager would, however, entail additional cost and reduce the level of return available for reinvestment or distribution among private investors.
Total	**2/4**	

4.5 Concessional loans

Description of test model

The test concessional loan funding model incorporates the following key features:

- a condition that the loan may not constitute more than sixty percent of the finance secured by the borrower for implementation of its solar RD&D programme;
- the loan will be provided on a "soft loan" basis, i.e. applying concessional interest rates set below commercial levels and a long-term repayment period, such that monthly instalments are reduced;
- the borrower will be required to pay back both the principal and interest in monthly instalments (as opposed to, for example, being required only to repay interest instalments during the term and the principal at maturity, as under a balloon loan structure); and
- the ASI's right to repayment will rank equally with creditors of the same class (rather than being subordinated).

Advantages and disadvantages

Like for a grant program, an important advantage offered by a concessional loan funding model is its potential to immediately leverage short-term private finance (whether debt or equity, or alternatively in the form of in-kind contributions), most notably through application of a condition that the loan may not constitute more than sixty percent of the finance raised by the borrower for solar RD&D activities.

Unlike under a grant program, however, the ASI should recover the funding it lends to successful applicants (although with only minimal interest return given the soft loan structure, and subject also to borrower repayment default). This represents a significant advantage when compared to a grant program, and should reduce the risk of the ASI depleting or exhausting its funding under the programme, and makes the programme significantly more sustainable in the longer term – particularly given that the loan is structured such that the borrower must repay both principal and interest during the loan term, rather than at maturity (albeit over a longer term). For this reason, the quantum of private sector finance required under the loan can be slightly reduced (in this example to forty percent, as the loan may provide up to sixty percent of the borrower's finance).

The equal ranking (rather than subordination) of the loan will also help to reduce the ASI's exposure to borrower credit risk, and increase the likelihood of the ASI recovering at least part of the loan in the event that the borrower becomes insolvent. Non-subordination of the loan does, however, exclude the private investment incentive that would otherwise result if the loan were subordinated.

Although a concessional loan funding model has the potential to leverage short term private finance linked to the awarding of the loan and its forty percent private finance condition, this model is unlikely to create a long-term incentive that can drive sustained private investment in solar RD&D. As a result, levels of private solar RD&D may initially spike upon introduction of the program, but rapidly taper off following issuance of loans.

Additionally, the repayment obligation imposed under a loan structure may mean that loans (even on concessional terms) may only be economically feasible for solar companies approaching the demonstration stage in the innovation cycle. Unless a balloon loan or other significantly concessional structure were adopted, entities undertaking R&D (often university-based research institutions) may be unable to meet loan servicing requirements, such that funding is accessible only to Australian solar RD&D businesses in the latter stages of technology development.

Table 3 – Assessment results for concessional loan funding model

Effectiveness

Criterion	Score	Analysis
Investment leverage and effectiveness	1 (x3=3)	Although a concessional loan program will leverage initial private funding, particularly through a matched funding requirement, its ability to leverage ongoing private investment in the longer term may be limited as a loan program does not of itself provide any longer-term/sustained private financing incentive. Provision of loans at "soft" interest rates may make it easier for borrowers to access private debt finance, as follows: – the relatively low interest repayments due on soft loans reduce the financial burden of servicing the loan, freeing up capital against which to secure and service additional private debt finance; and – the ASI's lending to the borrower may reduce the perception of risk associated with lending to the borrower, potentially making it easier for the borrower to secure additional private debt finance; Like grants, loans demonstrate moderate potential to reduce the costs and promote the deployment of solar technologies as the initial capital injection provided by a loan may enable technology breakthroughs and/or help young businesses bridge the valley of death. These benefits may be limited in the longer term, however, as: – servicing the loan may be difficult for pre-commercial businesses, even where provided on a "soft loan" basis; and – a loan program alone may not provide the sustained incentive required to leverage the ongoing private investment into solar RD&D necessary to bring solar technologies to market.
In-kind contributions	2	The availability of a concessional loan may be conditional upon or pegged to in-kind contributions and/or matched private funding requirements, for example by imposing a condition that the value of the loan cannot exceed 50% of value of the total debt and equity finance and in-kind contributions secured by the borrower. This will create an incentive for the borrower to seek in-kind / equity contributions in order to increase the total loan value.

Criterion	Score	Analysis
Risk mitigation	1	In relation to risks faced by private sector lenders: – the exposure of private lenders to borrower credit risk will be reduced, as a concessional loan reduces the need for private/independent funding; – the capital injection provided by a loan does not, however, directly address the causes or sources of risks facing solar RD&D projects and businesses; – to the extent that the ASI's rights as a creditor rank equally with those of private sector lenders, the ASI and private lenders will be repaid pari passu, effectively reducing the pool of recoverable funds available to private lenders should the RD&D business fail; and – as mentioned above, the ASI's lending to the borrower may reduce the perception of risk associated with lending to the borrower (although government funding may also create an impression in the private sector that a business cannot survive without public support, increasing the perceived risks attached to private financing).
Performance measurability	0	It may be difficult to link an upfront, lump sum concessional loan to performance indicators other than its default/acceleration triggers. Although staged loan drawn down in accordance with particular milestones could provide a basis for specification and measurement of appropriate performance indicators, the feasibility of this approach would be subject to the borrower's financial needs which (particularly in the case of demonstration activities) may require significant up front capital rather than ongoing funding support.
ASI financial sustainability	1 (x3=3)	Although the ASI will be required to provide significant capital as loans to successful applications, these amounts should be repaid (although with limited interest given the soft loan structure and subject to borrower credit risk). The capital requirements of a loan program may necessitate ongoing Australian Government funding support (i.e. by making additional capital available to the ASI), in order to provide the funds required to be distributed as debt finance to successful applicants.
ASI risk exposure	1 (x3=3)	Although there is a risk that the RD&D business fails before the loan has been repaid, exposing the ASI to borrower credit risk, the ASI will be ranked equally with other lenders of the same class such that it is in a better position to recover relative to subordinated debt model. The ASI's due diligence investigations of prospective borrowers will enable the ASI to avoid taking undue risk exposure (by refusing loans to unacceptable applications) while instituting specific measures to mitigate the risks identified.
Total	**12/24**	

Suitability

Criterion	Score	Analysis
Technological applicability	2	A concessional loan-based funding model can be applied to all forms of solar energy technologies.
RD&D applicability	0	A concessional loan is not easily amenable to application across RD&D phases, as it represents a single, upfront debt finance capital injection. However, it may be possible to adapt the repayment schedule/maturity date to accommodate distinct RD&D stages and cycles. Pre-commercial RD&D businesses may have difficulty servicing the loan, regardless of whether the loan applies only "soft" interest rates.
Timeframe compatibility	1	A concessional loan, as a single, upfront, lump-sum payment is not easily amenable to application across a time frame. However, the repayment schedule may be adapted to expected technology commercialisation timeframes and the borrower's ability to service the loan. A concession loan funding mechanism may be linked to short-term policy objectives, for example through the application of eligibility criteria that reflect broader policy objectives, but it may be difficult to link the model to medium- to long-term policy objectives.
Policy complementarity	2	Concessional loans may be linked to tax concessions e.g. accelerated depreciation for assets/materials purchased using loan funding. In general, these loans will not create barriers to other ancillary support measures. Loans represent a highly flexible funding model and may likely be used in conjunction with other models, such as loan guarantees and grants.
Intellectual property management	1	Loans may be provided subject to certain intellectual property rights being allocated to the lender (e.g. licences to use reports, data and other research outcomes from supported activities). Although loans generally do not provide for the lender to take title to intellectual property rights in technologies developed, such rights could be used as a form of collateral to secure the loan. The divesting or transfer of intellectual property rights to borrower's technologies may conceivably be made an event of default under the loan contract, breach of which will entitle the ASI to accelerate the loan. Such a provision would create a strong incentive for the borrower to retain intellectual property rights to technologies developed.
Total	**6/10**	

Adaptability

Criterion	Score	Analysis
Adaptability	1	Soft loans may include triggers to enable them to be adapted to changing circumstances by refinancing or restructuring the debt. Any such refinancing or restructuring would, however, need to be subject to objective triggers and procedural requirements, in order to provide certainty as to when this would occur, and how it would affect the rights and obligations of lender and borrower.
Resistance to failure	0	Concessional loans, as loans structured on terms favourable to new or higher risk businesses, generally do not easily allow lenders to mitigate the risk of losing the outstanding loan where a borrower's business fails prior to the loan being fully repaid.
Total	**1/4**	

Complexity

Criterion	Score	Analysis
Financial complexity	1	Although a loan structure entails a degree of complexity, a loan-based funding model should not be unduly complex and borrowers are likely to be familiar with their basic structure.
Administrative complexity	1	As mentioned above, although loans entail a degree of complexity, they are not unduly complex. The ASI should not encounter particular difficulty in administering loans to solar RD&D businesses. Nevertheless, loans do require a different skill set from other models such as grants; notably in relation to appropriate due diligence, monitoring of borrower financial performance and project cash flows, and enforcement of security (including security-sharing arrangements in the case of multiple lenders). These administrative requirements will need to be considered by the ASI in selecting an appropriate solar RD&D funding mechanism.
Total	**2/4**	

4.6 Subordinated loans

Description of test model

The test subordinated loan funding model incorporates the following key features:

- a condition that the loan may not constitute more than sixty percent of the finance secured by the borrower for implementation of its solar RD&D programme;
- the loan will be provided at commercial interest rates plus an additional risk component (given its subordination and balloon structure – see below);
- the loan will be structured as a balloon loan, whereby the borrower is only required to repay interest instalments during the term, and the principal at loan maturity;
- the loan will have a relatively short repayment period, in order to mitigate the ASI's risk exposure as a subordinated lender (although this will increase the required monthly instalments, these will still be relatively low given the balloon structure); and
- the ASI's right to repayment will be subordinated.

Advantages and disadvantages

Like for a concessional loan program, a key advantage of a subordinated loan funding model is the right for the ASI to be repaid funds it lends to solar RD&D businesses. However, the risk and return profile of the subordinated loan model differs from that of the concessional loan in the following key respects:

- the subordinated loan model entails significantly higher exposure for the ASI to borrower credit risk, as the ASI's right to recover the loan will be subordinated to the rights of other creditors if the borrower becomes insolvent (meaning that it may be unlikely that the ASI will recover much, if any, of a defaulted loan – a key disadvantage); and
- in light of this increased risk exposure:
  - the repayment period under the loan has been significantly shortened in order that the loan will be repaid sooner; and
  - the ASI can reasonably charge a higher interest rate (i.e. commercial interest plus risk), to reflect the increased risk exposure entailed by subordination.

Nonetheless, the requirement for borrowers to repay loans reduces the risk of the ASI depleting or exhausting its funding, and makes a subordinated loan funding model relatively sustainable in the longer term.

A balloon loan structure (under which the borrower repays interest instalments during the term, and the principal at loan maturity) has been adopted to offset the financial impact on borrowers of the relatively high interest rate under this loan model. This structure may make the loan relatively accessible compared to other loans for entities undertaking early stage R&D, who could potentially meet the reduced ongoing interest-servicing requirements from their balance sheet, and repay the principal at loan maturity, at which time (and subject to appropriate alignment of the loan with the borrower's technology commercialisation pathway) the borrower may be in a position to realise a commercial return through which to meet its repayment obligations.

If the loan did not use a balloon structure, such that both interest and the principal were required to be paid in instalments during the loan term, pre-commercial solar R&D businesses may have difficulty servicing the loan, which would in turn increase the risk of borrower insolvency and the ASI's consequent loss of the loan (particularly given its subordination). This could potentially make the loan effectively inaccessible for entities undertaking earlier-stage R&D (relative to prospective borrowers closer to demonstration and ultimate commercialisation).

A further advantage of a subordinated loan funding model with a parallel private finance condition is its potential to immediately leverage short-term private finance, in the same way as a grant or concessional loan program applying the same or similar structures. This is enhanced by the subordination of the loan, as private financiers may be more willing to provide additional debt finance to the borrower in the knowledge that they will outrank the ASI as creditors should the borrower become insolvent.

A subordinated loan model is, however, unlikely to create a long-term incentive that can drive sustained private investment in solar RD&D, for the same reasons as outlined above in relation to grants and concessional loans.

Table 4 – Assessment results for subordinated loan funding model

Effectiveness

Criterion	Score	Analysis
Investment leverage and effectiveness	1 (x3=3)	Like a concessional loan, a subordinated loan will attract initial private funding particularly where a matched funding requirement is applied. Also, subordination of the ASI's right to repayment of the debt means private lenders will have priority in claiming as creditors should the borrower's business fails. This gives the ASI's loan the character of a quasi-equity injection and reduces any private lender's exposure to borrower credit risk. This may make it easier for the borrower to obtain private debt finance. Again like a concessional loan, the ability of a subordinated loan to leverage private investment may be limited in the longer term as the loan does not of itself provide any longer-term/sustained private financing incentive. Subordinated loans have a moderate potential to reduce the costs and promote the deployment of solar technologies in Australia, as: – the initial capital injection provided by a loan may enable technology breakthroughs and/or help young businesses bridge the valley of death; and – although interest repayments may be set at commercial plus risk rates, a "balloon loan" repayment structure entails substantially lower repayment obligations (initially of interest only), freeing capital with which to finance RD&D activities and costs.
In-kind contributions	2	Like for concessional loans, the availability of a subordinated loan may be conditional upon or pegged to in-kind contributions and/or matched private funding requirements, for example by imposing a condition that the value of the loan cannot exceed 50% of value of the total debt and equity finance and in-kind contributions secured by the borrower. This will create an incentive for the borrower to seek in-kind contributions in order to increase the quantum of the total loan.

Criterion	Score	Analysis

Risk mitigation	2	In relation to risks faced by private sector lenders:
		– the exposure of private lenders to borrower credit risk will be reduced, as a concessional loan reduces the need for private/independent funding;
		– subordination of the ASI's right to repayment means private lenders will have priority in recovering their debts, further reducing private lender exposure to borrower credit risk
		– the capital injection provided by a loan does not, however, directly address the causes or sources of risks facing solar RD&D projects and businesses;
		– despite the commercial + risk premium interest rates imposed by the ASI, the requirement under a balloon structure to make interest-only monthly repayments may:
		  – increase funds available for the borrower to commit to solar RD&D; and
		  – increase the borrower's ability to service private sector loans, which may ultimately make it easier to secure additional private debt finance; and
		– the ASI's lending to the borrower may reduce the perception of risk associated with lending to the borrower.

Performance measurability	0	It may be difficult to link an upfront, lump sum loan to performance indicators other than its default/acceleration triggers. Although staged loan drawn down in accordance with particular milestones could provide a basis for specification and measurement of appropriate performance indicators, the feasibility of this approach would be subject to the borrower's financial needs which (particularly in the case of demonstration activities) may require significant up front capital rather than ongoing funding support.
ASI financial sustainability	1 (x3=3)	Although the ASI will be required to provide significant capital as loans to successful applications, these amounts should be repaid with relatively high interest calculated at a commercial plus risk rate, although also subject to relatively high borrower credit risk, given the subordination of the loan. The capital requirements of a loan program may necessitate ongoing Australian Government funding support (i.e. by making additional capital available to the ASI), in order to provide the funds required to be distributed as debt finance to successful applicants.
ASI risk exposure	0 (x3=0)	Under a subordinated loan structure, the ASI will be significantly exposed to borrower credit risk. In the event that the borrower's business fails before the loan has been repaid, the ASI's right to recover will be subordinated against other creditors, reducing the likelihood of the debt being recovered. The ASI's due diligence investigations of prospective borrowers will enable the ASI to avoid taking undue risk exposure (by refusing loans to unacceptable applications) while instituting specific measures to mitigate the risks identified. By taking on the additional risk entailed by a subordinated loan, the ASI will receive a higher return (provided the borrower can service the debt) through application of a premium interest.
Total	**10/24**	

Suitability

Criterion	Score	Analysis
Technological applicability	2	A subordinated loan-based funding model can be applied to all forms of solar energy technologies.
RD&D applicability	0	A subordinated loan is not easily amenable to application across RD&D phases, as it represents a single, upfront debt finance capital injection. However, it may be possible to adapt the repayment schedule/maturity date be to accommodate distinct RD&D stages and cycles. Pre-commercial RD&D businesses may have difficulty servicing the loan, particularly the loan applies commercial plus risk interest rates.
Timeframe compatibility	1	A subordinated loan, as a single, upfront, lump-sum payment is not easily amenable to application across a time frame. However, the repayment schedule may be adapted to expected technology commercialisation timeframes and the borrower's ability to service the loan. Like a concessional loan, a subordinated loan funding mechanism may be linked to short-term policy objectives, for example through the application of eligibility criteria that reflect broader policy objectives, but it may be difficult to link the model to medium- to long-term policy objectives.
Policy complementarity	2	Subordinated loans may be linked to tax concessions e.g. accelerated depreciation for assets/materials purchased using loan funding. In general, these loans will not create barriers to other ancillary support measures. Loans represent a highly flexible funding model and may likely be used in conjunction with other models, such as loan guarantees and grants.
Intellectual property management	1	Loans may be provided subject to certain intellectual property rights being allocated to the lender (e.g. licences to use reports, data and other research outcomes from supported activities). Although loans generally do not provide for the lender to take title to intellectual property rights in technologies developed, such rights could be used as a form of collateral to secure the loan. The divesting or transfer of intellectual property rights to borrower's technologies may conceivably be made an event of default under the loan contract, breach of which will entitle the ASI to accelerate the loan (subject to the terms and conditions required by senior lenders). Such a provision, were it included, would create a strong incentive for the borrower to retain intellectual property rights to technologies developed.
Total	**6/10**	

Adaptability

Criterion	Score	Analysis
Adaptability	1	Subordinated loans may include triggers to enable be adapted to changing circumstances by refinancing or restructuring of the debt. As the ASI's right to recover will be subordinated against other creditors, refinancing or restructuring in the event of borrower financial distress may be particularly desirable, in order to avoid insolvency and consequent relegation of the ASI's debt. Any such refinancing or restructuring would, however, need to be subject to objective triggers and procedural requirements, in order to provide certainty as to when this would occur, and how it would affect the rights and obligations of lender and borrower.
Resistance to failure	0	Subordinated loans entail a particular risk of the risk of losing any outstanding loan amount where a borrower's business fails, as the lender will rank behind other creditors in recovering its debt.
Total	**1/4**	

Complexity

Criterion	Score	Analysis
Financial complexity	1	Although a subordinated loan structure entails a degree of complexity (including in relation to the effect of subordination), a loan-based funding model should not be unduly complex and borrowers are likely to be familiar with their basic structure.
Administrative complexity	1	As mentioned above, although subordinated loans entail a degree of complexity, they are not unduly complex. The ASI should not encounter particular difficulty in administering loans to solar RD&D businesses. Nevertheless, loans do require a different skill set from other models such as grants; notably in relation to appropriate due diligence, monitoring of borrower financial performance and project cash flows, and enforcement of security (including security-sharing arrangements in the case of multiple lenders). Subordinated loans also entail an additional layer of complexity, in the documentation of subordination arrangements. These administrative requirements will need to be considered by the ASI in selecting an appropriate solar RD&D funding mechanism.
Total	**2/4**	

4.7 Loan guarantees

Description of test model

The test loan guarantee funding model incorporates the following key features:

- the guarantee will be a partial loan guarantee for up to fifty percent of the value of private loans to Australian solar RD&D companies;
- the loan guarantee will be a guarantee of collection rather than of payment;
- the tenor of the guarantee will be matched to the tenor of the loan the subject of the guarantee up to a maximum duration of twelve years; and
- provision of the guarantee will incur fees commensurate to:
  - the risk exposure assumed by the ASI in acting as equity guarantor; and
  - the costs to the ASI of administering the equity guarantee programme.

Advantages and disadvantages

Like the equity guarantee model (and performance guarantee model, discussed below), a loan guarantee model has the following significant advantages:

- Under a loan guarantee model the ASI will not be required to make any significant initial outlay of capital in the way that it would under a grant, loan or fund-based model. Like other guarantee models, the ASI will take on a degree of risk exposure (in the case of loan guarantees that a borrower is unable to repay its loan). However, this assumption of risk will:
  - significantly mitigate the risk exposure of private lenders benefitted by guarantees, which should in turn make them more willing to lend to solar RD&D businesses (although the partial nature of the guarantee will help mitigate any moral hazard); and
  - allow the ASI to charge fees for guarantees commensurate to the risk it takes on.
- By charging fees for the provision of guarantees (calculated to cover the ASI's risk exposure and administrative costs in providing the guarantees), the ASI will be able to generate revenues with which to finance its continued operation.
- The incentive generated by a loan guarantee (primarily through its mitigation of private lender credit risk exposure) will endure as long as the ASI is willing to issue such guarantees. As a result, a loan guarantee funding model should be able to attract a sustained flow of private debt finance into Australian solar RD&D businesses, into the longer term.

A loan guarantee funding model does, however, have a number of disadvantages relative to other models:

- The ASI will be exposed to borrower credit risk, but in its limited role as guarantor to a private lender is unlikely to be able to exert significant control over borrowers to mitigate this risk. The ASI will, however, be compensated for this risk exposure through its guarantee fees. The ASI may need to obtain a back-to-back counter guarantee from the Australian Government to underwrite the ASI's performance of its obligations as guarantor.

– As guarantor to a private lender, the ASI is unlikely to be able to exert much control over the allocation or management intellectual property rights arising from borrower solar RD&D activities.

– The ASI's administration of an loan guarantee model will entail complexity similar to that of the equity guarantee model, in processing guarantee applications, executing guarantees, levying and collecting guarantee fees, and making payments on guarantees validly enforced (although guarantee fees collected will cover the ASI's costs in administering the programme).

Table 5 – Assessment results for loan guarantee funding model

Effectiveness

Criterion	Score	Analysis
Investment leverage and effectiveness	2 (x3=6)	A loan guarantee funding model may leverage ongoing private funding (i.e. immediately as well as through the medium- and longer terms) by significantly mitigating risk exposure when lending to solar RD&D businesses. Although, like an equity guarantee funding model, a loan guarantee funding model may potentially generate less initial private financing, this is likely to be offset by the more sustained flow of private debt finance that a loan guarantee model can generate.
In-kind contributions	0	Loan guarantees cannot easily be structured to include in-kind contribution requirements, as they protect debt finance provided by lenders rather than broader financing arrangements for borrower businesses and related projects.
Risk mitigation	2	The exposure of private lenders to the borrower credit risk is significantly mitigated by loan guarantees.
Performance measurability	1	It may be difficult to link loan guarantees to performance indicators other than the performance of the borrower in servicing the guaranteed loan, or other indicators on which the borrower is required to report to the lender. However, initial access to information, including in respect of borrowers under loans to be guaranteed, will be vital for the purposes of undertaking appropriate due diligence assessments of guarantee applications.
ASI financial sustainability	2 (x3=6)	The ASI will not be required to make significant initial capital outlay (subject to valid enforcement of guarantee), and will generate revenue from guarantee fees with which to finance its ongoing operations.
ASI risk exposure	1 (x3=3)	Loan guarantors are inevitably exposed to the credit risk of investee businesses: should the investee business fail to make a loan repayment, as guarantor the ASI may be required to pay on the loan guarantee. This risk exposure can be mitigated by providing only a partial guarantee (such that the maximum value of the guarantee is equal only to a specified proportion or percentage of the loan amount). This reduces "moral hazard" by deterring lenders from making high risk loans, as the proportion of the loan not covered by the guarantee will remain at risk. The ASI's risk exposure can be further mitigated by structuring the guarantee as a guarantee of collection, whereby it can only be called upon after the lender has first sough to collect from the borrower (as opposed to being triggered as soon as loan repayments are defaulted upon).

Criterion	Score	Analysis
Total	**18/24**	

Suitability

Criterion	Score	Analysis
Technological applicability	2	A loan guarantee funding model can be applied to all forms of solar energy technologies, subject to the willingness of lenders to provide debt finance for RD&D of particular technologies.
RD&D applicability	2	Loan guarantees can be used to protect loans to solar RD&D businesses at any stage of the RD&D process.
Timeframe compatibility	0	The tenor of a loan guarantee is likely to be limited to the tenor of the underlying loan, restricting scope for specific adaptation of the guarantee to solar RD&D timeframes.
Policy complementarity	2	A loan guarantee funding model will not create barriers to other ancillary support measures.
Intellectual property management	0	As guarantor, it may be difficult for the ASI to control over intellectual property management by borrowers.
Total	**6/10**	

Adaptability

Criterion	Score	Analysis
Adaptability	1	It may be difficult to adapt existing loan guarantees (i.e. guarantees already provided) to changes in policy, circumstances or conditions. Eligibility requirements for future loan guarantees may, however, be amended to accommodate such changes.
Resistance to failure	0	Should a borrower default on repayments of a loan subject to a loan guarantee, the lender (subject to collection requirements) may call for payment under the guarantee. ASI is taking on borrower credit risk by acting as loan guarantor (in return for a fee commensurate to the risk), so exposure to this risk is inherent in the model.
Total	**1/4**	

Complexity

Criterion	Score	Analysis
Financial complexity	2	A loan guarantee funding model should not be unduly complex for lenders to use: they need only address the eligibility requirements and manage their ongoing fee payments, and are likely to be familiar with the guarantee structure.
Administrative complexity	0	A loan guarantee funding model will entail a degree of complexity for the ASI: it will need to process applications for guarantees, execute guarantees for eligible applications, levy and

Criterion	Score	Analysis
		collect guarantee fees, and make payments on guarantees when validly enforced.
Total	**2/4**	

4.8 Equity guarantees

Description of test model

The test equity guarantee funding model incorporates the following key features:

- the guarantee will be a partial equity guarantee for up to sixty percent of the value of private equity investments in Australian solar RD&D companies;
- provision of such equity guarantee will be subject to a 1:1 matched investment requirement, such that in order for an equity investment to be eligible for a guarantee, the investor must make an equal non-guaranteed equity investment;
- the guarantee may be called upon in the event that the investee company becomes insolvent;
- the tenor of the guarantee will be seven years, extendable for five years subject to satisfaction by the investee of certain performance criteria; and
- provision of the guarantee will incur fees commensurate to:
  - the risk exposure assumed by the ASI in acting as equity guarantor; and
  - the costs to the ASI of administering the equity guarantee programme.

Advantages and disadvantages

A major advantage presented by an equity guarantee funding model is that it does not necessitate significant initial capital outlay by the ASI, in the way that a grant, loan or fund-based model will. Although the ASI will, as equity guarantor, be exposed to the risk of having to pay on the guarantee if the investee business fails, such a repayment obligation will only materialise where the investee becomes insolvent. Further, the partial guarantee structure and matched investment requirement mean that an investor seeking an equity guarantee will also need to be make a significant investment "at risk", which should help avoid moral hazard and, in the same way, the ASI exposure to high risk businesses.

Further, the ability to charge fees for provision of equity guarantees (which fees should be commensurate to the risk assumed by the ASI and its administrative costs) means that an equity guarantee funding model can generate a steady revenue stream with which the ASI can finance its ongoing operations.

The private funding incentive created by an equity guarantee funding model would continue to exist for as long as the ASI is willing to issue equity guarantees, meaning that, like a fund-based funding model (and other guarantee models – see below), an equity guarantee funding model is likely to be able to generate a sustained flow of private investment into Australian solar RD&D. This represents an advantage over grant and loan funding models, that are likely to generate a strong initial private financing incentive, but no longer term incentive for ongoing investment.

Disadvantages of the equity guarantee model include:

- as equity guarantor, the ASI will be exposed to the insolvency risk of investee businesses, but in its limited role as guarantor is unlikely to be able to impose significant controls on investee businesses in order to mitigate this risk (for example compared to a loan agreement that may includes borrower financial covenants and warranties to mitigate borrower insolvency risk and lender insolvency exposure), although the ASI will be compensated for this risk exposure through the fees charged for guarantees;

- the ASI may need to obtain a back-to-back counter guarantee from the Australian Government to underwrite the ASI's performance of its obligations as guarantor, which is likely to entail increased cost and complexity for the ASI;
- the ASI's position as guarantor is unlikely to allow much scope for management or control of any intellectual property rights arising from the activities of the investee company (although the investor benefitted by the guarantee may, as an equity investor, be in a position to exercise a degree of such control, depending on the extent of its equity investment); and
- the ASI's administration of an equity guarantee model will entail significant complexity, with the ASI being required to accept and process guarantee applications, execute guarantees to eligible applicants, levy and collect guarantee fees, and make payments on guarantees when validly enforced – although the ASI will be able to meet its costs in administering the model through the fees charged for guarantees.

Table 6 – Assessment results for equity guarantee funding model

Effectiveness

Criterion	**Score**	**Analysis**
Investment leverage and effectiveness	2 (x3=6)	An equity guarantee funding model may leverage ongoing private funding (i.e. immediately as well as through the medium- and longer terms): – significantly mitigating risk exposure for equity investments in solar RD&D businesses; and – requiring matched unguaranteed equity investments as a condition of eligibility for an equity guarantee. Although an equity guarantee funding model may potentially generate less initial private financing (for example compared to a grant model incorporating a matched funding requirement), this is likely to be offset by the more sustained flow of finance that an equity guarantee model can generate by attracting ongoing private investments (both guaranteed investments and matched non-guaranteed investments). An equity guarantee funding model has strong potential to reduce costs and promote deployment of solar technologies in Australia through strong, sustained leverage of private equity investment.
In-kind contributions	1	Although it may be possible for eligibility for equity guarantees to be conditioned on in-kind contributions from equity investors, such guarantees are more commonly conditioned on matched investment requirements.
Risk mitigation	2	The exposure of private investors to the risk of losing their capital investments is significantly mitigated by equity guarantees.

Criterion	Score	Analysis
Performance measurability	1	Equity investors in solar RD&D businesses are likely to have access to key financial and other investee business information. To the extent such information is not confidential, the provision of equity guarantees may be conditioned on the sharing of such information for the purposes of assessing the acceptability of the risk assumed by the ASI in providing the guarantee, and whether a guarantee may be eligible for extension. In this regard, initial access to information, including in respect of investee companies in whom guaranteed equity investments are sought to be made, will be vital for the purposes of undertaking appropriate due diligence assessments of guarantee applications.
ASI financial sustainability	2 (x3=6)	The ASI will not be required to make significant initial capital outlay (subject to valid enforcement of guarantee), and will generate revenue from guarantee fees with which to finance its ongoing operations.
ASI risk exposure	1 (x3=3)	Equity guarantors are inevitably exposed to the credit risk of investee businesses: should the investee business become financially distressed, as guarantor the ASI will be required to pay on the equity guarantee. This risk exposure can be mitigated by including a matched investment requirement (whereby the matched investment would not be subject to an equity guarantee). This reduces "moral hazard" by deterring investors from making high risk investments on the basis that their investments are fully covered by an equity guarantee.
Total	**19/24**	

Suitability

Criterion	Score	Analysis
Technological applicability	2	An equity guarantee funding model can be applied to all forms of solar energy technologies.
RD&D applicability	2	Equity guarantees can be used to protect equity investments in businesses at any stage of the RD&D process.
Timeframe compatibility	1	The tenor of an equity guarantee can be adapted to the expected timeframe for the development and demonstration of a solar technology. The ability to extend the guarantee enhances the its ability to accommodate longer timeframes where necessary (subject to applicable for extension).
Policy complementarity	2	An equity guarantee funding model will not create barriers to other ancillary support measures.
Intellectual property management	0	As guarantor, it may be difficult for the ASI to control over intellectual property management by investee companies.
Total	**7/10**	

Adaptability

Criterion	Score	Analysis
Adaptability	1	It may be difficult to adapt existing equity guarantees (i.e. guarantees already provided) to changes in policy, circumstances or conditions. Eligibility requirements for future equity guarantees may, however, be amended to accommodate such changes.
Resistance to failure	0	The failure of an investee business will result in investors in that business with equity guarantees calling for payment under those guarantees. The ASI is taking on this risk by acting as guarantor (in return for a fee commensurate to the risk), so exposure to this risk is inherent in the model.
Total	**1/4**	

Complexity

Criterion	Score	Analysis
Financial complexity	1	An equity guarantee funding model should not be unduly complex for investors to use: they need only address the eligibility requirements (including for a matched non-guaranteed investment) and manage their ongoing fee payments.
Administrative complexity	0	An equity guarantee funding model will entail a degree of complexity for the ASI: it will need to process applications for guarantees, execute guarantees for eligible applications, levy and collect guarantee fees, and make payments on guarantees when validly enforced.
Total	**1/4**	

4.9 Performance guarantees

Description of test model

The test performance guarantee funding model incorporates the following key features:

- the guarantee will require the guarantor to make fixed payments under the guarantee in the event that one or more specified performance indicators is not met by a particular solar technology being developed by an Australian solar RD&D company;
- the tenor of the guarantee will be five years, extendable for three years subject to satisfaction by the investee of certain performance criteria; and
- provision of the guarantee will incur fees commensurate to:
  - the risk exposure assumed by the ASI in acting as equity guarantor; and
  - the costs to the ASI of administering the equity guarantee programme.

Advantages and disadvantages

A performance guarantee funding model shares the following advantages exhibited by equity and loan guarantee models:

- The ASI will not be required to make any significant initial outlay of capital in the way that it would under a grant, loan or fund-based model. Like other guarantee models, the ASI will take on a degree of risk exposure (for performance guarantees, the risk that the relevant solar technology will fail or under-perform), but this assumption of risk will:
  - mitigate private investor exposure to such technology risk, which should in turn create an incentive for them to invest in solar RD&D businesses (in addition to the incentive of sharing in the upside of the successful development of a new solar energy technology); and
  - allow the ASI to charge fees for guarantees commensurate to the risk it takes on.
- By charging fees for the provision of guarantees (calculated to cover the ASI's risk exposure and administrative costs in providing the guarantees), the ASI will be able to generate revenues with which to finance its continued operation.
- The incentive generated by a performance guarantee, through its mitigation of technology risk exposure, will endure as long as the ASI is willing to issue such guarantees. This should enable a performance guarantee funding model to attract a sustained flow of private investment into Australian solar RD&D businesses into the longer term.

A key consideration (and disadvantage) in structuring individual performance guarantees will be determining the performance indicators (incorporating performance thresholds) for the relevant technology, and the payments to be made in the event that these indicators are not met. The former will entail appropriate technical input, in order to properly assess the anticipated performance of the technology and the level of risk that such performance will not be achieved. The latter will need to reflect the loss the investor taking the guarantee will incur should the technology fail or underperform, while also retaining an appropriate level of risk for the investor in order to avoid moral hazard.

Further disadvantages common to guarantee structures include:

- The ASI will be required to assume a degree of risk, in this case the risk that the relevant solar technology will fail or under-perform, but will not be able to take any direct action to control this risk (as the ASI will not have any role in the technology development process). The ASI will, however, be compensated for this risk exposure through its guarantee fees.
- the ASI may need to obtain a back-to-back counter guarantee from the Australian Government to underwrite the ASI's performance of its obligations as guarantor, which is likely to entail increased cost and complexity for the ASI.
- As guarantor to a private lender, the ASI is unlikely to be able to exert much control over the allocation or management intellectual property rights arising from borrower solar RD&D activities.
- The ASI's administration of a performance guarantee model will entail a particularly high degree of complexity, as a result of the need to determine appropriate performance indicators and payment amounts, as well as the processing of guarantee applications, executing guarantees, levying and collecting guarantee fees, and making payments on guarantees validly enforced (although guarantee fees collected will cover the ASI's costs in administering the programme).

Table 7 – Assessment results for performance guarantee model

Effectiveness

Criterion	Score	Analysis
Investment leverage and effectiveness	1 (x3=3)	A performance guarantee funding model may leverage ongoing private funding (i.e. immediately as well as through the medium- and longer terms) by mitigating investor exposure to the risk that a novel solar energy technology will fail, and incorporating a matched funding requirement. Although, like other guarantee funding models, a performance guarantee funding model may potentially generate less initial private financing than, for example, a grant program (subject to the impact of a matched funding requirement tied to the guarantee), this may be offset to a degree by the ability of this model to generate a more sustained flow of private finance.
In-kind contributions	2	Eligibility for performance guarantees may be conditioned on in-kind contributions from investors seeking such guarantees.
Risk mitigation	1	The exposure of private investors to technology risk can be significantly mitigated by a performance guarantee.

Criterion	Score	Analysis
Performance measurability	2	Performance guarantees necessarily closely linked to performance indicators: payment on a performance guarantee may be called for where applicable performance indicators are not met. Initial access to information, including in respect of technologies the subject of performance guarantees, will be vital for the purposes of undertaking appropriate due diligence assessments of guarantee applications.
ASI financial sustainability	2 (x3=6)	The ASI will not be required to make significant initial capital outlay (subject to valid enforcement of guarantee), and will generate revenue from guarantee fees with which to finance its ongoing operations.
ASI risk exposure	1 (x3=3)	Performance guarantors are inevitably exposed to the risk of a guaranteed technology failing, or failing to perform to the guaranteed level: should the technology fail to perform as expected, as guarantor the ASI may be required to pay on the performance guarantee. This risk is likely to be particularly high for novel solar technologies at the earlier stages of the R&D cycle. This risk exposure can be mitigated by providing only a partial guarantee (such that the maximum value of the guarantee is equal only to a specified proportion or percentage of the loan amount), and/or by incorporating a matched funding requirement such that an investor must make an equal investment at full risk.
Total	**17/24**	

Suitability

Criterion	Score	Analysis
Technological applicability	2	A loan guarantee funding model can be applied to all forms of solar energy technologies, subject to the willingness of lenders to provide debt finance for RD&D of particular technologies, although the performance indicators farming the guarantee may vary between technologies.
RD&D applicability	1	Performance guarantees are best suited to demonstration activities, but can also be adapted to cover earlier R&D performance.
Timeframe compatibility	2	The performance indicators used to condition performance guarantees can be tailored to expected RD&D timeframes.
Policy complementarity	2	A performance guarantee funding model will not create barriers to other ancillary support measures.
Intellectual property management	0	As guarantor, it may be difficult for the ASI to control over intellectual property management by investee companies.
Total	**7/10**	

Adaptability

Criterion	Score	Analysis
Adaptability	1	It may be difficult to adapt existing performance guarantees (i.e. guarantees already provided) to changes in policy, circumstances or conditions. Eligibility requirements for future performance guarantees may, however, be amended to accommodate such changes.
Resistance to failure	0	Should a guaranteed technology fail to achieve applicable performance indicators, the ASI may be required to pay on the performance guarantee. The ASI is taking on this technology risk by acting as performance guarantor (in return for a fee commensurate to the risk), so exposure to this risk is inherent in the model.
Total	**1/4**	

Complexity

Criterion	Score	Analysis
Financial complexity	0	A performance guarantee funding model may entail a relatively high degree of complexity for investors, as result of the need to determine and agree appropriate performance indicators conditioning the guarantee.
Administrative complexity	0	A performance guarantee funding model will entail a particular complexity for the ASI: it will need to determine appropriate performance indicators and payments amounts, process applications for guarantees, determine and agree appropriate performance indicators, execute guarantees for eligible applications, levy and collect guarantee fees, and make payments on guarantees when validly enforced.
Total	**0/4**	

Annexure 1

ASI Solar RD&D Global Benchmarking Report
Funding Model Assessment Criteria

Effectiveness

Investment leverage and effectiveness: assess:

– the ability of the model to leverage national and international private sector investment in Australian solar RD&D activities in the short, medium and longer terms; and

– features of the funding model that may affect the quantum of private sector investment leveraged through public funding provided by the ASI under the model.

In-kind contributions: is the funding model capable of attracting and incorporating in-kind contributions from other public and private stakeholders?

Risk mitigation: is the funding model capable of effectively mitigating the risks and other barriers, whether real or perceived, that may otherwise deter or impede private investment in solar RD&D in Australia?

Performance measurability: can the funding model be clearly and effectively linked to objective and transparent targets or performance indicators, as a basis for:

– determining the success of the model in funding Australian solar RD&D projects; and

– making decisions as to further funding opportunities, repayment requirements and other financing issues.

ASI financial sustainability: assess the ability of the model to help the ASI becoming financially self-sufficient, particularly through generation of a sustainable revenue stream, and whether the model poses a risk of the ASI significantly depleting or exhausting its funding resources.

ASI risk exposure: identify and assess the risks (whether legal, commercial, technical or otherwise) arising from the funding model, and any potential mitigation measures that may be adopted to reduce or resolve those risks.

Suitability

Technological applicability: is the funding model capable of being applied to all and any emerging solar energy technologies relevant to the Australian context, including both high and low risk technologies and projects? Are there factors or features that may limit its applicability to certain technologies (whether due to the nature of the technology, its risk profile, its level of development or other factors)?

RD&D applicability: is the funding model capable of being applied discretely to each phase in the solar RD&D process (i.e. the separate research, development and demonstration components) and what, if any, adjustments or modifications are necessary to adapt the model to each stage?

Timeframe compatibility: can funding timeframes under the model (including for provision and repayment of funding) be adapted to align with timeframes for:

- the anticipated completion of RD&D stages for different solar technologies; and
- the achievement of Australia's broader solar energy strategies and objectives?

Policy complementarity: to what extent can the funding model be supported by ancillary financial support measures, such as tax and other fiscal concessions, in order to maximise the leverage achieved under the model?

Intellectual property management: does the funding model provide a basis for the transfer, protection and security of the intellectual property rights generated by funded RD&D activities, including for the purposes of allocating intellectual property rights between multiple stakeholders?

Adaptability

Adaptability: can the funding model be adapted (including through re-financing) to accommodate changes in key parameters affecting solar RD&D projects, including changes in:

- Australia's solar energy policy, strategy or objectives;
- the availability of public and private funding earmarked or committed for specific Australian solar RD&D projects;
- solar energy technology prices;
- solar energy technology breakthroughs or breakdowns;
- solar energy technology performance requirements or expectations;
- timelines for the delivery of Australian solar RD&D objectives and outcomes;
- stakeholder support and involvement in Australian solar RD&D initiatives (whether by addition or removal); and
- other relevant or supporting policies and programs, or linkages between the funding model and such policies and programs.

Resistance to failure: is the funding model able to tolerate failure of solar RD&D activities, including through the recovery of funding previously provided to solar RD&D projects which subsequently fail?

Complexity

Financial complexity: assess the complexity of the funding model for financiers and funding recipients, and whether this may present a barrier to the effective leveraging of private sector investment or the implementation of solar RD&D activities receiving funding.

Administrative complexity: assess the degree of administrative complexity entailed by the funding model, and whether this may present a barrier to the effective and efficient implementation of the ASI funding programs.

Annexure 2

A selection of historic and current Australian RD&D initiatives in solar and renewable energy

Government	Measure	Period	Nature of Assistance	Information
Federal	Australian Centre for Renewable Energy (ACRE)	2009 – 2010 Being established	Advisory	– Operated under the Ministry for Resources and Energy, this measure is part of the larger $5.1 billion Clean Energy Initiative. – It is a $567 million program – a one stop shop for renewable energy businesses – that consolidates a number of existing Government programs, such as the Renewable Energy Demonstration Program (REDP). – ACRE focuses on research and development funded through other bodies - such as the ASI and the Australian Research Council – and takes technologies to further development, pilot or small-scale demonstration stages. – The REDP is a competitive grants program (launched February 2009), that provided funding of $235 million to 4 innovative projects to assist in demonstrating renewable energy for power generation on a commercial scale in Australia. An interim ACRE Board is reported to be in charge of making recommendations on the most prospective solar applications.
Federal	Commercialisation Australia	Commenced January 2010	Skills and Knowledge Grants: up to $50,000 Proof of concept: $50,000 - $250,000 Early Commercialisation: $250,000 - $2 million	– This is an Australian Government Initiative that assists researchers entrepreneurs, and innovative companies to convert intellectual property into successful commercial ventures. – Assistance is delivered by means of business advice and on a merit based co-contribution basis. – This initiative is applicable to individuals, early growth stage and spin off companies with majority of business activities, employees or assets within Australia.

Government	Measure	Period	Nature of Assistance	Information
Federal	Innovation Investment Fund	The Government invites applications annually. Round 3 applications closed in May 2010	Venture capital fund of $200 million (Round 3) – Up to $20 million in capital provided, must be matched one to one with privately sourced capital.	– This is an AusIndustry initiative, aimed at assisting companies in early stage development to commercialise their products through the establishment of new fund managers to provide equity and finance. – This initiative supports new innovation funds and fund managers with expertise in early stage venture capital investing, by co-investing with the private sector in venture capital funds. – It should be noted however, that this initiative does not invest directly in ventures. The underlying purpose of this program is to establish a domestic venture capital market to drive innovation and commercialise the outcomes of Australia's strong research capability.
Federal	Clean Energy Innovation Centre – Enterprise Connect Network	Commenced in 2009	Business reviews; ongoing mentoring; grants of up to $20,000 (will contribute to half the cost of approved projects)	– The Clean Energy Innovation Centre is part of a $50 million Enterprise Connect Initiative. – The Centre offers various forms of assistance, and is targeting clean energy technologies, the development and supply of methods, and equipment and technology used to reduce energy demand or increase energy efficiency. – The Centre provides clean energy specialists located all across Australia.
Federal	Climate Ready Program	Commenced July 2008 - Appears to be currently closed for application	$50,000 – $5 million on a matching funding basis	– This is an AusIndustry initiative and is one of the three components of the $240 million Clean Business Australia Initiative. – The initiative supports research and development, proof of concept and early stage commercialisation activities with regard to small-scale renewable energy technologies.

Government	Measure	Period	Nature of Assistance	Information

Federal	R&D Tax Concession	Applications are received based on individual company reporting periods	Allows companies to deduct up to 125% of qualifying expenditure incurred on R&D activities when lodging their corporate tax return	– This is an AusIndustry initiative that aims to increase the amount of R&D in Australia by providing a market driven tax concession which allows companies to deduct up to 125% of qualifying expenditure. A 175% Incremental (premium) Tax Concession and R&D Tax Offset are also available in certain circumstances.
				– This Tax Concession targets R&D activities that are systematic, investigative and experimental, and involve either innovation (novelty) or high levels of risk.
				– However, the R&D Tax Concession is due to be replaced by the R&D Tax Credit that was tentatively scheduled to commence as of 1 July 2010 but failed to do so due to Parliament adjourning before the Tax Laws Amendment (Research and Development) Bill 2010 could be brought to a vote before the Senate. Some information regarding the new R&D Tax Credit is summarised below.
				  – The target of this Tax Credit is similar to the target of the above mentioned Tax Concession, except that it requires the activity in question to involve both innovation AND high levels of risk.
				  – The scope of eligible participants has also increased, i.e. not only does it involve companies incorporated in Australia, but also Australian residents, foreign corporations who conduct R&D via a permanent establishment in Australia, and public trading trusts with a corporate trustee.
				  – In terms of the grant amount, companies with an annual turnover of less than $20 million can claim a 45% refundable tax credit (the equivalent of a 150% concession). All other companies may claim a 40% standard tax credit (the equivalent of a 133% deduction).

Government	Measure	Period	Nature of Assistance	Information
Federal	Cleantech Australia Fund	Commenced September 2007	The current fund is made up of $20 million provided through the Australian Government's Innovation Investment Fund (IIF) program and $30 million from VicSuper, a superannuation fund committed to sustainability.	– A $50 million venture capital fund which had its first close in September 2007, comprised of both public and private investors. – The fund focuses on investments in eligible companies that are commercialising clean technologies; those which generate superior commercial benefits to customers whilst simultaneously addressing significant environmental concerns such as climate change, water scarcity, water quality and resource constraints.
NSW	Renewable Energy Development Program	Commenced July 2007	Variable funding provided in rounds	– This program is part of the $700 million New South Wales Climate Change Fund. – It is a competitive grants program that provides $40 million over five years to assist in the demonstration and commercialisation of renewable technologies that will generate electricity or displace grid electricity use in New South Wales for stationary energy purposes.

Government	Measure	Period	Nature of Assistance	Information
NSW	NSW Technology Vouchers Program (TechVouchers)	Commenced January 2010	TechVouchers of up to $15,000 and TechConnectors of up to $50,000	– This Program encourages collaboration between Small-to-medium enterprises (SMEs) and public sector research organisations in New South Wales. SMEs in New South Wales must have a turnover of less than $30 million and less than 200 employees. – The $1.4 million research fund is aimed at benefiting both the industry and public research sector by providing companies with an initial project with some seed funding to help them engage with research facilities; provide expert technical guidance that will help SMEs identify the most suitable research partner; and supporting public sector research facilities by making it easier for them to engage SMEs. – The Program is aimed at research projects and research or demonstration of technical products.
NSW	NSW Energy Challenge Prize	Commenced July 2009	$5 million prize	This $5 million international prize for clean energy innovation is aimed at supporting research and innovation in clean energy. In order to qualify, research was required to be partnered with a company that is headquartered in New South Wales and a New South Wales university.
Queensland	Queensland Renewable Energy Fund	Commenced in 2007 and has been finalised. Further funding rounds TBA	Funding is assessed via loan of up to 100% or grant of up to 50% of project capital value.	– This $50 million Fund aims to support the development and deployment of renewable energy generation technologies in Queensland. – Projects will only be eligible if they involve renewable energy technologies that are beyond the proof of concept staged provide a minimum capacity of 100 kW. – The Fund only applies to Australian based organisations that have projects relating to Queensland.

Government	Measure	Period	Nature of Assistance	Information
South Australia	Renewable Energy Fund	Commenced June 2009 Expires June 2011	Varying grants from a $20 million Fund over two years.	– The Renewable Energy Fund supports RD&D in renewable energy technologies. – Entities seeking finance from this Fund must be an incorporated company with a history in delivering similar projects and be financially viable. – This Fund is overseen by the Renewable Energy Board that is supported by the Renewable Energy Commissioner.
Victoria	Energy Technology Innovation Strategy (ETIS)	Commenced April 2008 Applications closed in August 2009	$72 million grants program	– The ETIS is a $72 million grant s program for renewable and sustainable energy. – It supports the development of large scale, pre-commercial demonstrations of sustainable energy technologies. – The ETIS is administered by the Department of Primary Industries. – $30 million funding round opened for applications August 2010, targeting sustainable energy R&D ($10 million) and pilot demonstration projects ($20 million). Applications close 30 September 2010.
Victoria	Sustainability Fund	Commenced in 2002	Varying competitive grants program	– The Fund is managed by Sustainability Victoria, and receives funding from the Victorian Landfill Levy for purposes of fostering environmentally, *inter alia*, sustainable uses of resources. – The Fund supports projects that prioritise innovation and best practice in resource use, among others.

Government	Measure	Period	Nature of Assistance	Information
Western Australia	Low Emissions Energy Development Fund	Commenced in 2007 3rd Round closed on 24 March 2010	Competitive grants program that variable funding in rounds on matching 3 for one dollar basis	– The Fund supports the development of low emission technologies to reduce greenhouse gases. – Its focus is on renewable technologies, and in order for a project to qualify, it must have not commenced and it must be seeking more than $200,000. – The Fund will contribute $30 million in technologies where WA has a clear natural and competitive advantage, e.g. renewable energies such as solar.

Annexure 3

Tax concessions and credits for RD&D in Australia

Tax concessions and credits are designed to reduce the tax liabilities of eligible entities. The Australian Government currently offers a broad-based and non-industry specific Research and Development Tax Concession (R&D Tax Concession).[30] Under this concession, companies involved in R&D are allowed to deduct up to 125% of eligible expenditure incurred on R&D activities from assessable income. In certain circumstances, this maximum deduction claimed by companies may be extended by an additional 50% (known as the "175% Premium R&D Tax Concession").[31]

There are also a number of other relevant R&D-specific tax concessions offered to certain categories of tax-liable entities and for specific purposes, including (but not limited to):

– the R&D Tax Offset, which complements the R&D Tax Concession by giving certain eligible small companies a refundable tax offset to improve cashflows of initial growth phase companies; and

– the R&D Tax Concession 175% International Premium, which gives companies conducting R&D on behalf of foreign companies or multinational corporations an enhanced 175% deduction from R&D expenditure and seeks to encourage foreign investment into Australian R&D.

Tax concessions would allow solar R&D businesses to claim a deduction of R&D-related expenditure. Ultimately, this may lead to a decrease in the tax liability payable by eligible businesses, which would:

– free up additional capital to be directed towards solar technology R&D and improve the probability of a technology breakthrough; and/or

– allow solar R&D businesses to retain higher levels of profit, to act as a capital buffer or be otherwise invested at a latter stage in the solar project cycle.

Case study 13: Possible amendments to current R&D Tax Concession Regime

The Tax Laws Amendment (Research and Development) Bill 2010 and the *Income Tax Rates Amendment (Research and Development) Bill 2010* is currently being considered before Parliament. If these Bills are implemented, the existing R&D Tax Concession framework may be replaced by a new R&D Tax Credit regime.[32] The new regime, as drafted, would provide:

– a refundable tax credit equivalent to a 150% tax concession for eligible R&D entities with an aggregated turnover of less than A$20 million p.a.; and

– a non-refundable tax credit equivalent to a 133% tax concession for all other eligible R&D entities.

[30] http://www.ato.gov.au/businesses/pathway.asp?pc=001/003/113

[31] http://www.ato.gov.au/businesses/content.asp?doc=/content/47404.htm&pc=001/003/113/001/001&mnu=&mfp=&st=&cy=1

[32] http://www.ausindustry.gov.au/InnovationandRandD/RandDTaxCredit/Pages/RandDTaxCredit.aspx

At the moment, no tax concessions exist specifically in relation to the renewable energy sector, despite submissions in support of such measures to the Australian Government by industry stakeholders (such as the Clean Energy Council).[33]

Accelerated or enhanced depreciation of assets

Essentially an alternative type of tax concession, accelerated or enhanced depreciation of assets related to solar technology RD&D may lessen the tax liability payable by a business and free up larger portions of public and private funding for RD&D.

The Australian Government (through the Australian Taxation Office) does not currently allow accelerated depreciation of R&D assets generally, though it did previously. The Australian Government does, however, allow for eligible R&D depreciating assets (such as plant) and capital works to be depreciated over their effective lives at 125%.[34]

[33] http://www.theaustralian.com.au/business/renewable-energy-sector-to-seek-4bn/story-e6frg8zx-1225855222019

[34] This applies to the period during which assets and capital works are used for R&D.

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Models | Programs

Country | Region	Name	Link
Australia	AusIndustry Programs	http://www.ausindustry.gov.au/Pages/AusIndustry.aspx
Australia	CVC REEF – CVC Renewable Energy Equity Fund	http://www.cvc.com.au/cvcr/index.php
Australia	LETDF – Low Emissions Technology Demonstration Fund	http://www.ret.gov.au/energy/energy%20programs/low_emissions_technology_demonstration_fund/Pages/LowEmissionsTechnologyDemonstrationFund.aspx
Australia	National Renewable Energy Target scheme	http://www.climatechange.gov.au/government/initiatives/renewable-target.aspx
Australia	Research and Development Tax Concession	http://www.ato.gov.au/businesses/pathway.asp?pc=001/003/113
Australia	Solar Flagship Program	http://minister.ret.gov.au/TheHonMartinFergusonMP/Pages/!budget_renewable.aspx.html

Country | Region	Name	Link
Australia	Cleantech Australia Fund	http://www.cleantechventures.com.au/funds-under-management/cleantech-australia-fund/
Austria	Wirtschaftsservice GmbH's Double Equity Guarantee Program	http://www.awsg.at/portal/
Canada	Department of Natural Resources Canada's Photovoltaic Program	http://canmetenergy-canmetenergie.nrcan-rncan.gc.ca/eng/renewables/standalone_pv/publications/2008075.html
Canada	TEAM – Technology Early Action Measures	http://www.team.gc.ca/english/
Europe	CIP – Competitiveness and Innovation Framework Programme	http://ec.europa.eu/cip/
Europe	European Investment Bank's Risk Sharing Financing Facility	http://www.eib.org/products/loans/special/rsff/index.htm?lang=-en
Europe	GEEREF – Global Energy Efficiency and Renewable Energy Fund	http://geeref.com/
Europe	RSFF – Risk Sharing Finance Facility	http://www.eib.org/products/loans/special/rsff/index.htm
Europe	SME – The Small and Medium Enterprise Guarantee Facility	http://ec.europa.eu/enterprise/policies/finance/data/enterprise-finance-index/figures-eu-financial-instruments/guarantees/index_en.htm
Europe	The European Investment Fund's EU Guarantees	http://www.eif.org/EIF_for/sme_finance/index.htm
France	OSEO's Sofaris Biotechnology Fund	http://www.oseo.fr/aides-entreprise/sofaris.htm
Germany	Kfw – Startgeld Program	http://www.kfw-mittelstandsbank.de/EN_Home/Loans/The_individual_loan_programmes/KfW_StartGeld.jsp
UK	Carbon Trust UK	http://www.carbontrust.co.uk
UK	Self Energy UK's Energy Performance Guarantee	http://www.selfenergy.co.uk/energy-performance-guarantee/
USA	CalCEF – California Clean Energy Fund	http://www.calcef.org/
USA	California Solar Institute's grant solicitation for the Research, Development, Demonstration, and Deployment Program	http://www.calsolarresearch.ca.gov/Current-Solicitations/solicitations-second.html
USA	Department of Energy's Photovoltaic Manufacturing Initiative	http://www07.grants.gov/search/search.do?&mode=VIEW&oppId=53920
USA	Department of Energy's Solar Energy Technologies Program	http://www1.eere.energy.gov/solar/
USA	ETF – Emergency Technology Fund	http://www.moiti.state.ma.us/massadvt_incentives_emergingtech.asp

Country | Region	Name	Link
USA	Pennsylvania's Green Energy Revolving Loan Fund	http://www.trfund.com/financing/energy/pagelf.htm l
USA	Solar Insure's Performance Guarantee Program	http://www.solarinsure.com/about-us
USA	The Department of Energy's Loan Guarantee Program	http://www.lgprogram.energy.gov/
USA	The Reinvestment Fund	http://www.trfund.com/index.html
USA	The Solar Technology Roadmap Act, H.R 3585	http://giffords.house.gov/Summary%20of%20HR %203585.pdf

Institutions | Departments | Databases | Networks

Country | Region	Name	Link
Australia	Australian Bureau of Agricultural and Resource Economics	http://www.abare.gov.au/
Australia	Australian Research Council (ARC)	http://www.arc.gov.au/
Australia	Australian Solar Institute	http://www.australiansolarinstitute.com.au/
Australia	Centre for Sustainable Energy Systems	http://solar.anu.edu.au/
Australia	Clean Energy Council	http://www.cleanenergycouncil.org.au
Australia	Clean Energy Innovation Centre	http://cleanenergyinnovation.net.au/
Australia	CSIRO – Commonwealth Scientific and Industrial Research Organisation	http://www.csiro.au/
Australia	Department of Climate Change and Energy Efficiency	http://www.climatechange.gov.au/
Australia	Department of Employment, Economic Development and Innovation – Office of Energy (QLD)	http://www.cleanenergy.qld.gov.au/
Australia	Department of Environment, Climate Change and Water (NSW)	http://www.environment.nsw.gov.au/
Australia	Department of Infrastructure, Energy and Resources (TAS)	http://www.dier.tas.gov.au/
Australia	Department of Primary Industries (NSW)	http://www.dpi.nsw.gov.au/
Australia	Department of Primary Industries (VIC)	http://new.dpi.vic.gov.au/
Australia	Government of South Australia – Climate Change (SA)	http://www.climatechange.sa.gov.au/
Australia	Government of Western Australia – Office of Energy (WA)	http://www.energy.wa.gov.au/

Country | Region	Name	Link
Australia	Origin Australia	http://www.originenergy.com.au
Australia	The ARC Centre of Excellence for Advanced Silicon Photovoltaics and Photonics	http://www.pv.unsw.edu.au/Research/advancedsilicon.asp
Australia	The ARC Centre of Excellence for Solar Energy Systems	http://solararc.anu.edu.au/
Australia	Victoria-Suntech Advanced Solar Facility	http://www.swinburne.edu.au/chancellery/mediacentre/media-centre/news/2010/06/advanced-solar-facility-opens-in-melbourne
Austria	IIASSA - International Institute for Applied Systems Analysis	http://www.iiasa.ac.at/
Canada	The Business Development Bank of Canada	http://www.bdc.ca/en/Pages/home.aspx
Denmark	Eksport Kredit Fonden	http://www.ekf.dk/weoffer/ekf_climate
Denmark	RISOE - National Laboratory for Sustainable Energy	http://www.risoe.dk/
Europe	RES LEGAL	http://www.res-legal.eu/
France	OSEO	http://www.oseo.fr/oseo/oseo_in_english2
Germany	DRL – German Research Institute	http://www.dlr.de/
India	TERI - The Energy and Research Institute	http://www.teriin.org/
International	IEA – International Energy Agency	http://www.iea.org/
International	IPCC – Intergovernmental Panel on Climate Change	http://www.ipcc.ch/
International	IRENA – International Renewable Energy Agency	http://www.irena.org/
International	ISEP – International Society for Environmental Protection	http://www.isep.at/
International	REN21 – Renewable Energy Policy Network	http://www.ren21.net/
International	SWERA Programme	http://swera.unep.net/
International	WEC – World Energy Council	http://www.worldenergy.org/
Japan	NEDO – New Energy and Industrial Technology Development Organisation	http://www.nedo.go.jp/english/
Norway	CENBIO – Bioenergy Innovation Centre	http://sintef.org/Projectweb/CENBIO/
UK	Carbon Trust UK	http://www.carbontrust.co.uk
UK	ETI – Energy Technologies Institute	http://www.energytechnologies.co.uk

Country | Region	Name	Link
USA	DSIRE – Database of State Incentives for Renewable and Efficiency	http://www.dsireusa.org/
USA	NREL – National Renewable Energy Laboratory	http://www.nrel.gov/
USA	US Advanced Research Projects Agency – Energy	http://arpa-e.energy.gov/

Private Venture Capital Firms

Region	Name	Link
Australia	CVC Group	http://www.cvc.com.au/
Canada	EnerTech Capital	http://www.enertechcapital.com/
Germany	Fraunhofer ISE – Institute for Solar Energy Systems	http://www.ise.fraunhofer.de/
Japan	Solar Frontier	http://www.solar-frontier.com/
USA	Angeleno Group	http://www.angelenogroup.com/
USA	Kleiner, Perkins, Caufield & Byers	http://www.kpcb.com/
USA	MissionPoint Capital Partners	http://www.missionpointcapital.com
USA	Nth Power	http://www.nthpower.com/
USA	PowerFin Partners	http://www.powerfinpartners.com
USA	The Westley Group	http://www.westlygroup.com/
USA	Vendanta Capital	http://www.vedacap.com/

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