Renewable Energy and Distributed Generation Task Force

Action Plan
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Introduction

The six countries of the Asia-Pacific Partnership on Clean Development and Climate—Australia, China, India, Japan, the Republic of Korea, and the United States of America—are cooperating to meet both their increased energy needs and associated challenges, including those related to air pollution, energy security, and greenhouse gas intensities.

The Partnership has established public-private Task Forces in eight key sectors: (1) cleaner fossil energy; (2) renewable energy and distributed generation; (3) power generation and transmission; (4) steel; (5) aluminium; (6) cement; (7) coal mining; and (8) buildings and appliances. The Task Forces are designed to meet Partnership goals through international cooperation to facilitate the development, diffusion, deployment, and transfer of existing, emerging and longer term cost-effective, cleaner, more efficient technologies and practices among the Partners through concrete and substantial cooperation so as to achieve practical results.

As a product of its first stage of collaboration, each Task Force has created an Action Plan which has been endorsed by the Policy and Implementation Committee. The Action Plans contain an initial set of priority activities for implementation. Some projects contained within the Action Plans may need to be refined or elaborated. Financial resources are needed for the implementation of the Action Plans. Some initial funding from some government and industry sources has already been identified for the implementation of projects. Partner countries will continue to work to mobilize further funding from both public and private sectors in order to bring about full implementation of the practical projects identified in the Action Plans and will continually develop new projects and add them to this set of activities.

Sector Review

The renewable energy and distributed generation (REDG) sector harnesses a wide range of resources and includes a diverse range of technologies at different stages of development. This diversity creates significant opportunities for the development and deployment of technologies and applications applicable to the specific needs of Partner countries. Because of the diverse technologies applicable to this Task Force, this Action Plan does not include a detailed sector review of each individual technology. Taking account of existing data and technology reviews, detailed sector reviews will be undertaken as future Task Force projects, if appropriate.

Renewable energy and distributed generation technologies will be critical to the future energy mix of all six Partner countries. Energy access, energy security, poverty alleviation and environmental considerations combined with increasing fossil fuel prices are key drivers for accelerating the uptake of affordable and reliable renewable energy and distributed generation.

Renewable energy technologies, such as hydro (large and small), solar, geothermal, wind and tidal can deliver power with virtually zero emissions. Distributed generation (including landfill waste methane-based generation) also has the potential to significantly reduce emissions and promote greater cost and network efficiencies. Advances in technology design, system planning and grid operations are demonstrating the financial viability of distributed utility applications.
The wide scale deployment of renewable energy and distributed generation technologies increases the diversity of energy supply, and can contribute to improving energy security and reducing fuel risks, particularly in remote and fringe-of-grid areas. These energy sources and distributed generation technologies, which are ideally suited to mid-sized and smaller scale applications can also assist in alleviating poverty by improving access to energy services, as well as increasing job opportunities and improving air quality and public health. In addition, alternative fuels such as biodiesel and ethanol potentially offer significant environmental benefits in the future. Similarly, these alternatives are also on the pathway to becoming cost-competitive and available for deployment on a large scale.

The emerging nature of many renewable energy technologies means that there can be market and technical impediments to their uptake, such as cost-competitiveness, awareness of technology options, intermittency and the need for electricity storage. The Task Force recognizes, and will complement, work that is currently being undertaken by many members of the Partnership and the broader international community to address these barriers to increase the wide-scale uptake of renewable energy.

A particularly important role for the Task Force is to identify barriers to technology transfer and financing associated with the deployment of REDG technologies. The Task Force will focus on the most promising and cost-competitive technologies and applications both on- and off-grid.

**Australia**

The Australian economy has been built on access to low-cost energy underpinned by large reserves of coal. In addition Australia has large reserves of gas and uranium. This has created a challenging environment for the renewable energy sector, requiring a progressive approach to resolving cost and technology issues.

Renewable energy resources such as sun, wind, biomass, hydro and geothermal are plentiful and the Australian renewable energy industry has world leading expertise in the development of renewable energy technologies and project management. Australia is a world leader in the construction and integration of technologies that constitute a remote area power supply system and in the urban deployment of distributed generation technologies. The industry has developed international best practice standards for applications such as hydropower and wind and Australian expertise has resulted in the development of high-quality dependable systems capable of operating in the harshest and most remote areas, including the Antarctic and the deserts of central Australia.

In addition to these practical industry strengths, Australia’s innovative research and development sector has proven skills in the development of next generation technologies such as high efficiency photovoltaics, bio-energy, control systems, and remote area power systems. Australia has established a reputation for distinction in a number of areas of renewable energy research and development including photovoltaics and hot dry rocks.

The Australian Government’s policy framework for energy is set out in the Energy White Paper *Securing Australia’s Energy Future*, released in June 2004. The Government committed to a number of new measures to support development and demonstration of a broad range of renewable energy and enabling (energy storage) technologies. These measures build on earlier grant, equity and rebate programs to boost the uptake of renewable energy and help the domestic industry to grow.
The Australian Government is working to remove impediments to, and promote the commercial uptake of renewable and distributed generation technologies and practices in the Australian energy market. Actions include a wind energy forecasting capability for the national electricity market, and supporting national work programs to advance wind energy policy, develop a national code of practice for distributed generation and improve electricity grid accessibility for renewable and distributed generation.

The Government’s Mandatory Renewable Energy Target commenced on 1 April 2001. The Renewable Energy (Electricity) Act 2000 requires the generation of 9,500 gigawatt hours of extra renewable electricity per year by 2010, resulting in an investment stimulus of over $3 billion and a 50% increase in generation of renewable energy.

Renewable energy currently accounts for 2.5% of total energy supply and approximately 8% of electricity generation. Over 70% of renewable generation is from large-scale hydro, which is now largely exploited. The Asia-Pacific Partnership provides the opportunity for Australia to develop new markets and share its significant expertise in the renewable energy and distributed generation sector.

**China**

China’s economy is growing rapidly, with energy consumption currently increasing at 9.5% per annum. Renewable energy currently accounts for 7% of China’s total primary energy consumption. Renewable energy is important for promoting the growth of China’s rural economy. Key renewable technologies in China include hydropower, wind generation, photovoltaic generation, biogas, ethanol and solar hot water. Priorities for action include technology advancement and industry development.

**India**

Per capita primary energy supply in 2003 stood at 0.52 TOE, which is one-third the global average. Just under 30% of this energy supply was met from traditional biomass sources, and another 3–4% from renewables, including large hydro. In the electricity-mix during 2005–06, the share of large hydro, other renewables and nuclear is 15%, 2.8% and 2.5% respectively, while the balance of 79.7% is fossil fuel based. In addition, crude oil supply growth rate is projected at over 4%.

While the medium term (2032) trend growth rate of the economy is 7%, energy supply is placed at 5.2%, and electricity at 7%. The aim is to triple the current share of renewable power to more than 8% by 2032, apart from contributions from large hydro. In addition, savings corresponding to just under 1% of electricity generated in 2032 are expected through installation of a 50 million sq m solar thermal collector area for hot water systems.

Biofuels are expected to substitute around 20% of diesel and kerosene consumption by 2032. Research and development work is in progress in alternate fuels and systems for the same target for stationary, portable and transport applications. Hydrogen-powered 2/3/4 wheeler systems would also be in demonstration phase by then.

These apart, renewable energy solutions for distributed generation and stand-alone systems are envisaged for supplementing rural, urban, industrial and commercial energy requirements. In this regard, solar, wind, small hydro and biomass including biofuel systems/devices are to be designed and developed for increasing their affordability, convenience and safety levels. Priorities for action include advanced biomass-based power generation. Conversion of biomass to gas and liquid fuels, development of engine designs for use of biomass based
liquid fuels and gas, advanced solar cell efficiencies, and distributed generation systems. Development of viable business models for distributed generation systems, feasible systems for conversion of urban waste to energy, efforts to use materials other than silicon in solar technology are other objectives towards achieving energy security.

**Japan**

Japan’s energy policy is based on three objectives: ensuring (1) energy security, (2) environmental protection, and (3) economic growth. Renewable energies are especially important from the point of energy security and environmental protection. The earliest legal instrument in this regard is the Law Concerning the Promotion of Development and the Introduction of Oil Alternative Energy (Alternative Energy Law), with main objectives of securing stable and adequate supply of energy, and providing a legal framework for the development/implementation of oil substitutes. For this purpose, the law capitalizes on various measures including, among others, active R&D activities through New Energy and Industrial Technology Development Organization (NEDO).

The policy initiatives to promote renewable energy were enhanced further in 1997, when the concept of “new energy” was introduced to accelerate the commercialization and market deployment of certain technologies under the Law Concerning Special Measures for Promotion of New Energy Use, etc. (New Energy Law). This law differentiates technologies by their economic potentials. It aims at providing financial assistances for technologies that are near commercialization but are facing difficulties from the point of cost and scale of the market. A relatively small amount of financial assistance given to these technologies is expected to help them penetrate into market and, as the market expands, to result in reduced cost and improved competitiveness. Currently, a variety of renewable technologies ranging from solar, wind, biomass, waste and temperature difference are applicable under this law.

In addition to the foregoing, a new law called the Special Measures Law on Use of New Energy, etc., by Electric Enterprises or the so-called Japanese version RPS (Renewable Portfolio Standards) was enacted in 2002 to increase the required contribution of renewables in electric power generation from 3.28 TWh in 2003 to 12.2 TWh by 2010. So far, all 38 electric power enterprises have achieved their obligations faster than expected.

The Long-term Energy Supply/Demand Outlook stipulated in the Alternative Energy Law is the primary tool to supervise these policies by investigating the historical performance and future prospects of the various policy measures. In this regard, although the Japanese RPS has so far succeeded in achieving recent targets, a challenge remains as to the thermal utilization of renewables, which has yet to be investigated in order to increase the share of renewables. The use of biomass is one of the focuses currently on the table, especially with regard to increasing its contribution in terms of both biofuels and other forms of thermal uses. This challenge is represented, for example, in the “Biomass Nippon” initiatives.

**Korea**

Experiencing two oil shocks in 1970s, the Korean government recognized the necessity of promoting alternative energies to replace oil. However, the intensifying global and local movement of the environmental protection forced the government to take policy measures to promote new and renewable energies. In this context, in 1987 the Korean government enacted the Promotional Law of Alternative Energy Technology Development. Since then, the law has been revised several times and many relevant programs have supported R&D and deployment activities in new and renewable energies (NREs). Thanks to these governmental
efforts, Korea supplied 2.13 % of total energy consumption with new and renewable energy in 2005.

In 2003, Korea launched “The Second Basic Plan of NRE” whose goal is to supply 5% of total energy consumption with NRE by 2011. To attain the goal, the Korean government has developed new policy tools: feed-in-tariffs, a Renewable Portfolio Agreement (RPA), and deployment of 100,000 solar PV systems. To promote R&D activities and dissemination of NREs with limited resources, a “Selection-and-Concentration Strategy” is being implemented. In this regard, PVs, wind power, and hydrogen/fuel cells are selected and a project management center was established for each one. This integrated approach was proposed to expand a market for NRE, creating a critical mass of demand. In addition to policy making and institutionalization, the Korean government is raising funds for investment, mobilizing available financial sources.

The responsible government agency, MOCIE, with its policy implementing agency, the New & Renewable Energy Center, is currently leading all the R&D and deployment activities in Korea. In the public and the private sectors, many research institutes such as the Korea Institute of Energy Research (KIER), Korea Institute of Science and Technology (KIST), Korea Energy Economics Institute (KEEI), and Korea Electric Research Institute (KERI) are working in concert to ensure that technological opportunities are commercialized and exploited as soon as possible. In addition, business entities are encouraged to actively participate to expand the market and to foster the relevant industry.

United States of America

In 2005 the United States had 118 GW of renewable electric generating capacity, or 11.1% of the 1060 GW total. Of this, 98 GW was hydroelectric and 20 GW was from other renewable sources, corresponding to 9.2% and 1.9% of total electric generation capacity, respectively. Of the 20 GW non-hydroelectric capacity, wind power accounted for 9.2 GW, biomass power for 7.2 GW, and geothermal power for 2.8 GW. Solar PV and solar thermal electric accounted for 0.2 GW and 0.4 GW respectively. Of the 7.2 GW of biomass power, 3.6 GW are deployed as highly efficient combined heat and power (CHP) projects at 425 sites. In addition to this renewably fuelled CHP capacity, 75 GW of highly efficient CHP/clean DG is deployed in the United States at over 2500 sites.

Though the amounts are small relative to total electricity generating capacity, the United States ranks high relative to other countries in renewable capacity: second in hydroelectric (behind China), third in wind power (behind Germany and Spain), first in biomass and geothermal, and third in grid-connected solar PV (behind Germany and Japan). The United States also produced 15 billion liters of ethanol (equal to Brazil’s production) and 250 million liters of biodiesel in 2005 (behind Germany, France and Italy).

Growth in these technologies was robust in 2005, mainly as a result of renewal by the US Congress of the production tax credit for manufacturers. The United States ranked third in the world in overall renewable annual investment in 2005, led by the highest global investment in wind (resulting in 2.4 GW installed) and third highest in grid connected solar PV (resulting in 65 MW installed).

Besides the production tax credit, renewable energy deployment at the federal level has been stimulated on the demand side by tax credits for purchases by both individual and businesses, and by directives for the government to increase the percentage of renewables in the electricity used by federal facilities. There are also numerous provisions favoring renewable
deployment at the state level, with renewable portfolio standards in effect for 19 states and the District of Columbia, net metering available in 40 states and the District, and state tax incentives in 19 states.

**Objectives**

As agreed in the Partnership Work Plan, the primary objectives of the REDGTF are to:

1. Facilitate the demonstration and deployment of renewable energy and distributed generation technologies in Partnership countries.

2. Identify country development needs and the opportunities to deploy renewable energy and distributed generation technologies, systems and practices, and the enabling environments needed to support wide-spread deployment, including in rural, remote and peri-urban applications.

3. Enumerate financial and engineering benefits of distributed energy systems that contribute to the economic development and climate goals of the Partnership.

4. Promote further collaboration between Partnership members on research, development and implementation of renewable energy technologies including supporting measures such as renewable resource identification, wind forecasting and energy storage technologies.

5. Support cooperative projects to deploy renewable and distributed generation technologies to support rural and peri-urban economic development and poverty alleviation.

6. Identify potential projects that would enable Partner countries to assess the applicability of renewable energy and distributed generation to their specific requirements.

**Vision and Goals**

At its first meeting, the following Vision was agreed by the REDGTF:

*The Task Force Partner countries will collaborate to increase access to, and accelerate the uptake of, affordable and reliable renewable energy and distributed generation across the Partnership countries to achieve sustainable economic, social and environmental development.*

Three aspirational, non-binding, goals underpin this vision. Partner countries will take concrete actions:

- To achieve measurable outcomes that accelerate deployment of renewable energy and distributed generation over the next five years;

- To close the remaining gap between the cost of renewable energy generation and conventional generation; and

- To identify market and policy barriers, and implement mechanisms to overcome such barriers, to enable Partner countries to achieve their deployment goals.
The Partner countries recognize that achievement of these goals will rely on their collective and cooperative action.

The Task Force notes that following limited outreach by the Partner countries, the first set of projects under the Task Force Action Plan has the potential to achieve deployment of an additional 1.8GW of renewable energy and distributed generation capacity within five years. Based on a range of appropriate capacity factors, this represents an additional 54 Petajoules (15 TWh) of renewable and distributed energy.

The Task Force expects that new Action Plan projects and replication of outcomes of existing projects will drive deployment well beyond this first level of deployment.

**Task Force Actions**

To achieve its objectives, the Task Force will focus its activities in three key areas—deployment, market enabling and research development and demonstration (RD&D) projects—that accelerate the uptake of affordable and reliable renewable energy and distributed generation.

For deployment projects the REDGTF increases visibility and provides a facilitation process that may assist industry in overcoming barriers to the uptake of existing and emerging commercially available renewable energy and distributed generation technologies in Partner countries. Commercial deployment projects also provide a practical opportunity for the Task Force to identify areas that have the potential to impede market growth.

The Task Force will share best practices, and undertake cooperative market-enabling projects, to reduce identified policy, regulatory, financial, technology transfer, intellectual property, attitudinal and educational barriers to accelerating the uptake of renewable energy and distributed generation.

Collaborative RD&D projects will help close the remaining cost gap for technology and produce solutions to technical challenges. Demonstration projects will provide an opportunity to share expertise, increase awareness and capacity, and reduce the technical and commercial risks that currently limit increased development and deployment of renewable energy and distributed generation technologies.

**Joint Activity With Other Task Forces**

The Task Force recognizes that in addition to access and energy security, a major driver for REDG is the need to reduce greenhouse gas emissions from the energy sector. For example, the market deployment challenges faced by renewable energy and distributed generation technologies are similar to those faced by other Task Forces. Similarly uptake of REDG technologies will be facilitated by the widespread adoption of energy efficiency and other demand side measures to reduce on-site energy delivery requirements. These common challenges and opportunities may result in projects involving joint activity with other Task Forces, particularly in regard to identification of financial, policy and technology transfer barriers.

The Task Force will seek and respond to opportunities to collaborate with other Task Forces to meet the goals of the Partnership.
Evolution of the Action Plan

This Action Plan represents the first step in the activities of the Task Force. It is apparent that there are many projects under development that would be consistent with the Vision and Goals. Therefore, new projects may be brought forward for consideration by the PRT on a continuous basis and will be considered for addition to this plan.

The Task Force will also monitor and review progress on implementation of projects and review the Action Plan to ensure it remains relevant to Partner countries.

Action Plan Framework

A project framework has been established to assist in the identification of projects for inclusion in the REDGTF Action Plan.

Projects are broadly interpreted to include any action of the Task Force including activities such as research development and demonstration, policy analysis and development, capacity building, deployment, etc. A Project Review Team has been established to assist the REDGTF in the review of projects for inclusion in the Action Plan. The project framework has been broken down into project categories, types and timeframe.

<table>
<thead>
<tr>
<th>Project Category</th>
<th>Description</th>
<th>Link to Task Force objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deployment Projects</td>
<td>Are focused on accelerating the up-take of existing, commercial REDG systems and services into Partner country markets.</td>
<td>Deployment projects broadly contribute to Task Force Objectives 1, 3 and 5.</td>
</tr>
<tr>
<td>Market Enabling Projects</td>
<td>Are focused on addressing policy, regulatory, attitudinal, financial, educational and other challenges to the uptake of REDG technologies.</td>
<td>Market enabling projects broadly contribute to Task Force Objectives 2, 3, 5 and 6.</td>
</tr>
<tr>
<td>Research Development &amp; Demonstration Projects</td>
<td>Are focused on applied research, development and/or demonstration of new technologies to reduce their technical and commercial risk and increase stakeholder confidence.</td>
<td>RD&amp;D projects broadly contribute to Task Force Objectives 1, 3 and 4.</td>
</tr>
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</table>

Project Types

The Task Force has agreed that there will be two project types:

- **Endorsement projects**: Commercial projects, undertaken and led by industry, that significantly contribute to the Task Force’s Vision and Goals.

- **Actionable projects**: Non-commercial projects (i.e. market enabling and RD&D) led by a Partner country-endorsed agency or company and supported by at least two (but generally more) Partner countries. Actionable projects would generally not occur without the active facilitation and financial support of the Partner countries.

Project Timeframe

The Task Force has agreed that projects will operate across the:

- **Short term**: within one to three years
- **Medium term**: within three to five years
- **Long term**: longer than five years.

**Action Plan Projects**

Projects have been included in this Action Plan based on a clearly demonstrated capacity to significantly contribute to the achievement of the Vision and Goals established by the Task Force. Projects are subject to availability of funding from a variety of sources.

**Project Proposals**

<table>
<thead>
<tr>
<th>Deployment</th>
<th>Type</th>
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</thead>
<tbody>
<tr>
<td>RDG-06-1</td>
<td>Building Critical Mass for Ultra High Efficiency Solar Power Stations (AUS)</td>
</tr>
<tr>
<td>RDG-06-2</td>
<td>Commercial Demonstration of a PEM Fuel-Cell for Power Generation (USA)</td>
</tr>
<tr>
<td>RDG-06-3</td>
<td>Biofuel Promotion for Environmentally Sustainable Energy and Water Services (USA)</td>
</tr>
<tr>
<td>RDG-06-4</td>
<td>APP MEGA Solar Project (AUS)</td>
</tr>
<tr>
<td>RDG-06-5</td>
<td>Deploy CHP Systems in China That Utilize Coke Oven Gas for Fuel Feedstock (20 systems) (USA)</td>
</tr>
<tr>
<td>RDG-06-6</td>
<td>Renewable Energy Rural Business Hubs in China and India (USA)</td>
</tr>
<tr>
<td>RDG-06-7</td>
<td>Facilitate Deployment of Highly Efficient CHP Applications, Including Fossil and Biomass-Fuelled Industrial, Institutional and District Energy CHP Projects in Partner Countries (USA)</td>
</tr>
<tr>
<td>RDG-06-8</td>
<td>Identification of High-Prospect Geothermal Energy Projects in China (AUS)</td>
</tr>
<tr>
<td>RDG-06-9</td>
<td>Analysis of Regulatory Barriers to Renewable Energy Uptake in Partnership Developing Countries (AUS)</td>
</tr>
<tr>
<td>RDG-06-10</td>
<td>Barriers to Clean Technology Investment Development and Deployment Between Australia and India (AUS)</td>
</tr>
<tr>
<td>RDG-06-11</td>
<td>Development of Economic Indices for REDG in the Asia-Pacific Region (ROK)</td>
</tr>
<tr>
<td>RDG-06-12</td>
<td>Creating an Enabling Framework for RE Deployment in the Partnership (USA)</td>
</tr>
<tr>
<td>RDG-06-13</td>
<td>Quality Renewable Energy Training Program in China and India (AUS)</td>
</tr>
<tr>
<td>RDG-06-14</td>
<td>International Scholarships for Photovoltaics and Solar Energy Engineering at University of New South Wales (AUS)</td>
</tr>
<tr>
<td>RDG-06-15</td>
<td>Capacity Building in Renewable Energy Promotion Policies &amp; Measures (JPN)</td>
</tr>
<tr>
<td>RDG-06-16</td>
<td>Feasibility Study and Development of Smart Energy Solution Using Various Renewable Energies (ROK, JPN)</td>
</tr>
<tr>
<td>RDG-06-17</td>
<td>Study on the Expansion Plan of Bio-Diesel for Transportation in the Asia-Pacific Region (ROK)</td>
</tr>
<tr>
<td>RDG-06-18</td>
<td>Market Development for Renewable Energy (USA)</td>
</tr>
<tr>
<td>RDG-06-19</td>
<td>Public–Private Sector Partnership on Hydropower in the Partners (USA)</td>
</tr>
<tr>
<td>RDG-06-20</td>
<td>Commercialization of Distributed Power Generation Using Hydrogen Fuel in India, Promoting Clean Air, Energy Security and Sustainable Economic Growth (USA)</td>
</tr>
<tr>
<td>RDG-06-21</td>
<td>Demonstration of Solar-Enhanced Fuels for Electricity and Transport Applications (AUS)</td>
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**RD&D**

<table>
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<tr>
<th>Deployment</th>
<th>Type</th>
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<tbody>
<tr>
<td>RDG-06-22</td>
<td>Flexible Biomass Gasification Technology for Distributed Power Generation (AUS)</td>
</tr>
<tr>
<td>RDG-06-23</td>
<td>Solar Photovoltaic Linear Concentrator Systems (AUS)</td>
</tr>
<tr>
<td>RDG-06-24</td>
<td>Development of Materials and Interface Engineering Technologies for Dye-Sensitized Solar Cells (ROK)</td>
</tr>
</tbody>
</table>

EN: Endorsement
AC: Actionable
Appendix A: Individual Project Plans

Deployment Projects


Project
Breakthrough photovoltaic concentrators producing ultra high efficiencies have been developed by Solar Systems (an Australian company) and deployed in a number of projects, on a relatively small scale in collaboration with the Australian Government. Beginning with an AUD$0.424 Billion, 154MW phase in Australia, this project aim to deploy at least 1GW of power stations technology across Australia, China and the United States, all producing power for less than 1/6th the cost of current solar power. The technology includes solar concentrator technology developed by Solar Systems and cell technology originating in the United States for extra terrestrial applications and enhanced and optimized by Solar Systems in collaboration with Spectrolab (a U.S. based Boeing company). Solar Systems will work with local partners to manufacture solar concentrators, and construct, own and operate power stations.

Participation
Project Manager: Solar Systems Pty Ltd
Phone: +61 3 9819 9544

The project will be initiated by Australian company Solar Systems. Solar Systems is in the process of establishing relationships with suitable private sector partners for manufacture of solar concentrators, construction, ownership and operation in China and the United States. It is anticipated that the Australian Greenhouse Office, the Energy Bureau of the National Development and Reform Commission of the People’s Republic of China and the United States Department of Energy will play facilitation and coordination roles.

Objectives
Manufacturing and deployment industries with the critical mass to be self sustaining, and the ability to deploy commercially competitive energy production systems will be established across the region. The success of the project will be demonstrated by the rate of deployment of power stations in the target locations. The first 150MW of the project is seeking financial support from Australian Governments. Subsequent phases will be expected to support their own capital requirements by producing power at a commercially viable tariff.

Milestones
- Contractual commitment of the first 154MW phase in Australia.
- Establishment of Partnerships for manufacturing, deployment, ownership and operation in China and the United States.
- Conditional commitment to: an additional 200MW in Australia; an initial 350MW in China; an initial 350MW in the United States.
- Commissioning of the first Australian systems.
• Unconditional commitments in China and the United States.
• Beginning manufacture in China and the United States.
• Commissioning of initial systems in China and the United States.
• Contracting and deploying follow-on systems—over and above the scope of the project.

**Location**
The initial 154MW in Australia will be deployed in northern Victoria. Subsequent Australian sites will be in New South Wales. The specific sites for initial deployment in China have yet to be identified but areas such as Tibet are being considered. Sites in California, New Mexico, Nevada, Colorado and Texas are currently under consideration in the United States. Deployment sites in other Partner countries may be considered in the future.

**Resources**
The project will require an investment of some Aus $2.4 Billion. 18% of this amount (Aus$425 million) is required for the first 154MW phase—this phase provides the initial momentum required to drive the costs down to a self-sustaining level. These funds are being sought from the Victorian and Australian Governments (Aus$125 million) and commercial partners. Private sector debt and equity funding will fund subsequent phases. Feasibility research done to date shows that private sector funding can be secured on a commercial basis backed by economic and market conditions in the three target countries. Over and above the financial assistance being sought from Australian Government bodies, the project will seek facilitation, planning and approval assistance from Partner Governments.
RDG 06-2: Commercial Demonstration of a PEM Fuel Cell for Power Generation

Project
The chlor-alkali industry, one of the largest chemical industries in India and growing at an annual rate of 3.3%, is expected to grow along with the growing Indian economy. This MW size proton-exchange membrane (PEM) fuel cell product captures hydrogen produced in the chlor-alkali industry to create on site electricity and provide plant operators up to 20% of electricity savings. The electricity produced from the fuel cell will displace electricity generated by a coal-fired power plant using high-ash Indian coal and will therefore lead to significant CO2 emission reductions and other environmental benefits.

Benefits to the United States and other Partner countries include demonstration of fuel cell technology in an industrial application, industrial links established between U.S. and Indian firms, potential additional investment opportunities depending on the results of the technology demonstration, and environmental benefits including greenhouse gas mitigation.

Participation
- Nuvera Fuel Cells Inc. of Cambridge, MA, USA is the technology supplier (*)
- Chlor-alkali industry from the Indian private sector (*)
- Financial institution (TBD) (**)
- U.S. Department of Energy’s National Energy Technology Laboratory -- has done extensive research work on fuel cell and will provide oversight to project implementation
- USAID/India will provide oversight to the activity

(*) The private sector (supplier- customer) will be the major stakeholders in the successful demonstration of the project

(**) The financial institution (TBD) will provide additional cost sharing that will help to bring down the overall cost of the electricity production close to the customer’s requirements

Goals and Objectives
Goal
Commercial demonstration of a PEM fuel cell in Indian industry.

Objectives
- Replace electricity generated by coal fired captive power plant leading to significant reduction of environmental impacts, including CO2 emissions.
- Up to 20% of electricity savings by on-site generation of electricity using Hydrogen, a by-product of chlor-alkali industry.
- Help in accelerating commercialization of fuel cells in the chlor-alkali sector.
- Contribute to the objectives of the Asia-Pacific Partnership through demonstration of a viable clean energy technology utilized for distributed generation.
**Deliverables, Outcomes, Milestones**

Technical and commercial demonstration of electricity generation using hydrogen from a PEM fuel cell.

Reduction in carbon dioxide emissions due to displaced electricity production in coal-fired power plant.

Support large-scale production of stationary power PEM fuel cells in the United States leading to reduction in capital cost.

Creation of market for PEM fuel cells in India.

**Location**

Central India—specific location TBD.

**Resources**

$1,000,000 of Partner countries’ funds requested to be used to meet the costs of Nuvera Fuel Cells Inc. associated with (a) deployment, testing and validation of the product; (b) management of demonstration project in India and; (c) business risk for expanding operations in the Indian market.

Leveraging expected from the United States Government funds will be in the order of 1:6.
**RDG-06-3: Biofuel Promotion for Environmentally Sustainable Energy and Water Services**

**Project**

The success of power sector reform in India will rely upon groundwater management improvements in the agricultural sector. Unreliable power supply and subsidized tariff structures lead to excessive water pumping by farmers who tend to pump water based on the power supply made available to them. Over-pumping contributes to higher energy consumption and rapid depletion of the groundwater table. Together these cause higher greenhouse (GHG) emissions. The proposed activity would remedy this situation ensuring efficient energy and water co-management through mutually complementing interventions such as biomass based distributed generation and energy-efficient water management activities. Interventions will take place at appropriate levels throughout this linked system. Multiple stakeholders (U.S. and Indian agencies, interest groups, private sector and investors) will be involved to support deployment of biofuels based distributed generation systems. Farm families will be encouraged to increase on-farm energy & water efficiency through education, extension, and incentives. Communities will integrate water conservation programs as part of planning processes and outreach campaigns.

Benefits to the United States and other Partner countries include creating business opportunities for biofuels and distributed generation vendors, promoting and demonstrating models for energy and water co-management, and mitigating greenhouse gases.

**Participation**

- The District Water Management Agency (DWMA)/ District Agriculture Dept. within the state of Andhra Pradesh would be a local counterpart Agency (*)
- Andhra Pradesh Forest Department would be a local counterpart Agency (*)
- Private sector (TBD) will have business opportunities for commercial production of biofuel and for provision of equipment and services to implement distributed generation projects
- Financial entities (TBD) will have investment opportunities (**)  
- International Crop Research Institute in Semi Arid Tropics (ICRISAT)
- Indian Oil Corporation
- USAID/India would manage the activity through an NGO or contractor and potential contributors incl. current partners (e.g., Winrock International India, the International Institute for Energy Conservation, USDOE’s National Renewable Energy Laboratory)

(*) GOI will have opportunity to integrate water-energy-biomass approaches within planning and activity implementation where appropriate

(**) Capital from private or development banks will be required for expansion of the industry
**Goals and Objectives**

**Goals**
Establish an integrated development model unifying biomass resources and energy for efficient water use practices

Enhance the development of the biofuel (initially biodiesel) market in India

**Objectives**
Reduce GHG emissions through fuel switching, water & energy conservation and carbon sequestration

Demonstrate water-energy-biomass interlinkages and effective management approaches

Create additional awareness of water-energy-biomass interlinkages and management approaches at international, national, state, and local levels

Conserve soil and water resources

Improve water and energy services

Empower local self-help and village forestry/watershed management committee

Stimulate alternative livelihoods approaches

Structure models for financial support by development or private banks

Create a platform for interaction on biofuels among major stakeholders (government, producers, financial institutions, NGOs, research facilities, industrial orgs)

**Deliverables, Outcomes and Milestones**

Improve provision and reliability of water and power supply and services

Estimated greenhouse reductions and energy savings

Restore rapidly declining groundwater table

Enhanced livelihoods options for rural farm families

Integrate water-energy-biomass approaches within institutional and agency planning processes

Engage financial institution interest in support of water-energy-biomass co-management

Promotion of biofuel development in one Indian state

Platform created to allow for additional scale up and replication

**Location**

Initially in Andhra Pradesh rural watersheds for production

Through a stakeholder platform activity, link to broader GOI initiatives to expand to metropolitan areas and larger markets
Resources

$750,000 over 4 years to be provided as a grant to support staff time, pay for facilities (nursery and processing equipment) and support study tours

$1,000,000 would be leveraged in-kind from use of facilities and staff time provided by Partner countries.
RDG-06-4: APP Mega Solar Project

Project
BP Solar and S-Energy of Korea aim to create a landmark, “REDGTF endorsement” project. The “APP Mega Solar Project” aims to install megawatt scale (MW) solar PV “units” at a number of locations across Korea through a series of financed, managed, and delivered project. BP Solar will leverage its presence and experience in five of the Partners countries to contribute to the Partnership’s goal to accelerate take up of REDG. S-Energy will bring local expertise and the project will also seek the participation of the emerging Korea PV manufacturing industry to assist in technology transfer and accelerate development. The project is scalable from 10MW to 100MW over a multi year period. As a distributed generator this solar project will bring value to the electricity network and local economy across the country in addition to the valuable technology transfer.

Participation
Project Managers: BP Solar (www.bpsolar.com.au) and S-Energy (http://www.s-energy.co.kr) will cooperate to manage and implement the project.

Participation: BP Solar, S-Energy, the wider Korean solar PV industry and the Partner countries through the sharing of best practice on policy information.

Objectives
Aspirational target for the project to generate 120GWh/year of clean electricity, power 20,000 Korean homes, avoid 120,000 tonnes of CO$_2$/year and 25MW of network peak upgrades, and create new skilled installation and manufacturing jobs (assuming maximum 100MW scale).

Performance indicators for technical success will be the achievement of the milestones listed below and the outputs above, plus: new domestic projects of this nature, the acceleration of the Korean solar PV industry and the expansion of feed-in tariff and other deployment policy across the Partner countries.

Milestones
Q2/06 Working partnership (already in place) between S-Energy and BP Solar
Q2/07 Securing and sharing of technology and project management and training local installers
Q3/07 and ongoing Agreement with the network suppliers on location of project units and access to deployment programs.
Q4/07 Completion of private financing
Q1/08 Completion of technology transfer and training programs
Q1/08 Completion of local installer training program and commencement of first multi-MW unit
Q4/08 Completion and “launch” of first landmark multi-MW (target 10MW) solar power plant
Q2/08-Q4/12 Installation of remaining units
Q4/37 Validate long-term performance with 3,000GWh and 3 million tonnes CO₂

**Location**
The solar PV power plants will be located on a number of sites across Korea to broaden the visibility and economic benefit and place the technology at points in the electricity network that will most benefit from its peaking load reduction.

**Resources**
**Cash:** The project will use innovative finance to privately fund the capital requirement, estimated to be approximately US$7 million per MW. No direct government funding will be required.

**In-kind:** BP Solar and S-Energy will bring significant in-kind value to the project, through its management of the project and through the transfer of knowledge and technology between Korea and Australia and other Partner countries where BP Solar has investments.
RDG-06-5: Deploy CHP Systems in China That Utilize Coke Oven Gas for Fuel Feedstock

Project
Deploy CHP systems in China that utilize coke oven gas for fuel feedstock (20 systems of approximately 5MW each). It is the Partnership that will enable this project to go forward. While government finances are not anticipated to be required, the Partnership goals and the agreements that underpin this Partnership will provide a context to the value this project proposes to deliver.

Participation
Shandong Jinneng Coal Gasification Chemical Company, Ltd. is the leading example of one who owns, operates, and manages this type of combined hear and power plant.

Solar Turbines Incorporated will provide the prime mover gas turbine as part of a complete generator set. We can provide other hardware, installation, and operating service agreements, as needed

As part of the technology transfer element of the Partnership, Solar is prepared to work with appropriate Chinese entities to offer training on project management, operation and maintenance, and logistics support for these CHP systems.

Objectives
Fits the Chinese government objective of preventing both criteria pollutant emissions and greenhouse gases into the atmosphere, improvement to the local air quality and human health conditions, and energy conservation policy to convert waste to useful energy for the local citizens.

These plants will provide electrical power as well as thermal energy to the coking and chemical process in the plant, generating energy from waste gas. Useful energy not used by the on-site consumer can be delivered to the local community.

Burning coke oven gas in such a gas turbine cogeneration plant will result in tremendous energy savings for the nation and great improvement for air quality and human health.

The amount of coke oven gas generated each year in China is greater than the natural gas delivered by the West-to-East pipeline.

Calculations for greenhouse gas reduction can be completed as each site is taken through a feasibility review. Initial calculations based on a 5Mwe sized system indicates a 1,214,400 metric tonnes of CO2e in annual savings once all 20 systems are operational.

Milestones
A first of its kind existing gas turbine combined heat and power system was commissioned in March 2006, in Shandong Province. It has been in operation for about 1,500 hours.

Location
Shandong Jinneng Coal Gasification Chemical Company, Ltd. is located in Qihe County about 10 miles west of Jinan City, Shandong Province. Key provinces where coke ovens exist are Shanxi, Shandong, and Hebei to name a few.
Solar anticipates that there are similar technical opportunities wherever coke ovens have coke oven gas as a by-product. India is a logical country to partner with to deploy similar systems for the same greenhouse gas reduction and energy security values.

**Resources**

The turnkey price for a replicable system is approximately USD $5.2 million and includes the major equipment of one gas turbine driven generator, one heat recovery steam generator, one fuel gas compressor, and one coke oven gas fuel polishing system. Other resources to be determined at site(s).

The Partner countries will be called upon to use their convening power to bring stakeholders together and work out agreements on details such as interconnection, feed-in structures for any excess electrons that can be delivered to the grid, and directives to the Coke Manufacturers to deploy CHP as a proven technology to cost effectively improve energy security and reduce environmental impact.
RDG-06-6: Renewable Energy Rural Business Hubs in China and India

**Project**
In 2006, USAID and the General Electric Company (GE) began a partnership to increase access to cleaner, more affordable energy services in rural India. USAID is contributing $600,000 to this program, while GE and its worldwide network of experts, technology centers and Partner countries will invest up to $2.7 million in direct and indirect funding. The initial combined effort will cover up to four pilot sites, with the intention of creating a business model that will result in an ongoing flow of commercial projects. Seven other distributed generation plants based on a “rural business hub” model and totaling 25 MW are also in development. These projects are expected to employ over 4000 people. This project proposal seeks to replicate the model to incremental projects in India and extend the model to China through the identification of additional potential private sector and government partners interested in promoting and investing in such projects.

Currently, 56% of India’s 700 million rural residents lack adequate and/or reliable power supplies. The GE Global Research Center in Bangalore has developed an integrated hybrid technology model utilizing renewable energy generation from GE Energy’s Ecomagination Portfolio and providing customized power solutions based on local fuel resources. The core power generation for the initial projects will be based on gasified biomass fueling Jenbacher JMS320 engines. These engines will be used in the project to generate combined heat and power to meet electrical, refrigeration and heating needs within rural communities. These clean technologies help reduce or even eliminate a community’s dependence on transported fuels. Providing access to more reliable power will also serve as the foundation for meeting other developmental issues, such as expanded health care services, enhanced agricultural productivity, increased access to clean water, and skill development and economic empowerment for the people of India.

This effort supports India’s “Power to All by 2012” and “Rural Electrification/Rural Business Hub” initiatives.

**Participation**
General Electric Company (GE) India Rural Electrification office—Program Manager

GE’s worldwide network of experts, technology centers and partners.

Participation is open to all Partners’ entrepreneurs and government.

**Goals and Objectives**
Development of rural business hubs as a sustainable model for poverty alleviation and economic connectivity.

Demonstrate a viable business model for renewable based rural electrification.

Clean energy and renewable technologies locally available and utilized in rural areas of India and China.

Reduction of GHG emissions.

Employment generation and capacity building skills enhancement.
**Deliverables, Outcomes and Milestones**
Additional project teams (developers, investors, technology providers, government agencies providing support) created to implement and expand this rural electrification model through additional commercial projects.

Government policy environments conducive to making commercial projects successful identified, and, where necessary, more effective policies (e.g., some Indian states have attractive guaranteed feed-in tariffs for renewables; these incentives encourage this activity and could be further focused on end-of-grid/grid extension renewable-based power generation) adopted.

150 megawatts of additional capacity to meet unmet demand and un-served areas in India and China.

Improved local infrastructure.

**Location**
This project would include a set of currently unserved demonstration sites in rural China and peri-urban India, and commercial implementation on a larger scale in both China and India (specific locations TBD).

**Resources**
TBD
Market Enabling Projects

RDG-06-7: Facilitate Deployment of Highly Efficient CHP Applications, Including Fossil and Biomass Fueled Industrial, Institutional and District Energy CHP Projects in Partner Countries

Project
Combined Heat and Power (CHP) offers a cost-effective way to provide process heat and steam, increase electrical reliability and provide energy savings while decreasing the environmental impact of power generation and industrial or institutional operations. Despite the availability of CHP technologies and proven benefits and performance of these systems, projects often are not implemented, even when investment is compelling. Through collaborative education and outreach to energy users, utilities, policy makers and the design and construction communities, it is possible to identify and clear these barriers to efficient design of on-site energy systems.

Participation
Managed by EPA Office of Air and Radiation’s CHP Partnership Program

Participation of NGOs (Invited): International District Energy Association, Korean District Heating Association (KDHA), World Alliance for Distributed Energy China (WADE China)

Participation of U.S. Agencies: CHP experts in U.S. Department of Commerce, U.S. Department of Energy to be invited, leveraging existing efforts of all 3 agencies.

Objectives
Goals: Promote and streamline the immediate and ongoing deployment of large and district energy-scale new CHP projects in Partner countries.

Performance indicators: 500 MW of new CHP within participating countries within 3 years. Collaborative networks of CHP stakeholders within each Partner country provided information, training, framework to address remaining market, utility or regulatory barriers to deployment. Increased investor awareness of CHP as a hedge against energy cost increases and as a best practice for design in new construction and retrofit applications in strategic industrial and institutional sectors leads to ongoing deployment of CHP applications.

Milestones

Year 1
Analyses/reports on Partner country-specific technical, economic and strategic target markets and “low hanging fruit” opportunities for DG/CHP. Analysis of policy environment for CHP including utility, regulatory and economic impacts to projects in Partner countries. Interpretation of targeted CHP tools/resources into two languages specific to Partner countries with highest level of opportunity/interest, including CHP Catalogue of Technologies; Biomass Catalogue of Technologies, CHP Procurement Guide; CHP Emissions Calculator.

Year 2
Best practices workshops on CHP conceptual design, feasibility analysis, project development, policy framework and other interpreted Partnership tools for CHP collaborator community in all six Partner countries targeted at design/engineering community, equipment manufacturers, industrial and institutional energy users and policy makers/government officials.
Year 3  Workshops for ten identified strategic markets in major cities in Partner countries, to include CHP collaborator community in host country. Assistance with concept development for ENERGY STAR-style uniform performance thresholds and awards recognition program for exceptional performers.

**Location**
Multiple Partners, major urban or industrial centers.

**Resources**
$1,000,000 of U.S. funding will be required over the three-year period of the project.

In-kind participation of CHP stakeholders within Partner countries will be cultivated and is inherent to the project; success for the project would represent at least an additional $1 million of in kind people and resources from both the private and public sectors in each participating Partner countries.
RDG06-8: Identification of High Prospect Geothermal Energy Projects in China

Project
Petratherm Limited is a publicly listed, South Australian company developing geothermal energy in Australia utilizing unique techniques that it has developed with the University of Adelaide (in South Australia). It is proposing a project that would focus on the identification of highly prospective geothermal energy projects in China. The emphasis will be on geothermal prospectivity in the non-volcanic regions that comprise the bulk of China.

Participation
It is proposed that Petratherm Limited based in Adelaide, South Australia, lead and manage the project. It is also envisaged that key participants would include, University of Adelaide, Local Universities in China, Provincial Power Utilities in China and potentially private investors involved in the energy sector (Australian or International).

Objectives and performance indicators
The primary goal of the proposed co-operative project is to produce a portfolio of high prospect geothermal projects that have been ranked in terms of profitability, risk and “do-ability.”

Likely performance indicators are expected to include the number of high prospect projects (sites/tenements) identified, the quality of those projects and the total number of MW of generation capacity available from those projects.

Milestones
It should be noted that the project being proposed by Petratherm Limited is still in its early stages of definition. Notwithstanding, key milestones are expected to include a detailed project plan submitted by Petratherm—August 2006, a series of quarterly reports updating progress against the work plan—interim reports in January 2007, April 2007 and a final report in July 2007.

Location
It is envisaged that at the commencement of the Project that work would be undertaken in Adelaide, South Australia and Beijing in China.

Resources
It is estimated, based on Petratherm’s recent experience with exploration and development in South Australia, that approximately US $750,000 (or AUD $1,000,000) would required to complete the proposed work plan (to be completed in July 2007). It is proposed that the project would seek facilitation, planning and approval assistance from Partner country Governments and that the majority of funds would be provided by Petratherm Limited and commercial partners.
RDG-06-9: Analysis of Regulatory Barriers to Renewable Energy Uptake in Partnership Developing Countries

Project
One of the key barriers identified in relation to the increased uptake of renewable energy is the lack of mature markets and favorable policy, regulatory and legal frameworks to encourage the development of and investment in renewable energy. The purpose of the project is to provide an overview of the regulatory and policy situation in Partnership developing countries (China, India and Korea) in relation to renewable energy projects, with case studies of priority countries, especially those that are already taking positive steps to promote increased investment in renewable energy markets. The ultimate aim of the project is to encourage and enhance the capacity for emission reduction efforts in the target developing countries, by promoting legal and regulatory measures to create the enabling environments for the uptake of renewable energy.

Participation
Project Manager: Baker & McKenzie (Sydney office)
Level 27, A.M.P. Centre 50 Bridge Street Sydney, N.S.W. 2000
Phone: +61 2 9225 0296

The proposed work will be carried out by the Renewable Energy and International Law (REIL) Project, an international partnership formed in association with the Renewable Energy and Energy Efficiency Partnership (REEEP), Yale’s Center for Environmental Law and Policy and Baker & McKenzie’s Global Clean Energy and Climate Change Practice.

Objectives
The major objective of the Project is to identify and assess ways to remove the unintended barriers to renewable energy that exist in the laws of the target countries, whether purely domestic or as a result of the implementation of international treaty law, and to capture opportunities to use these laws to expand the renewable energy market further. The project will also examine other transnational and comparative policy and law to create a catalogue of domestic “best practices,” and thereby promote the enabling environments necessary to increase renewable energy market penetration in the target Partner countries.

Milestones
A written report setting out the results of the examination of existing regulatory and market frameworks in target countries. The report will provide detail on the legal, regulatory, institutional and policy frameworks in place, as well as the barriers and opportunities facing the renewable energy sectors in the target countries. Target date: September 2006.

In-country workshops to complement the written report and disseminate its key findings. The workshops would be coordinated around other Partnership workshops to maximize the exposure of these issues to the broader Partnership community. Target date: November 2006.

Location
The work would primarily be undertaken in Sydney, Australia, with short workshops conducted in India, China and Korea (exact locations to be confirmed). The workshops would be run in conjunction with industry associations and other relevant groups such as TERI, WISE, CREIA and CRED.
Resources
US$100,000
Project
The project will identify the market and policy barriers to enhanced collaboration between Australia and India in the investment, development and deployment of clean technologies. The challenges and opportunities presented by the need for clean coal technologies, renewable energy and distributed generation will be addressed. The findings of the project will serve to develop practical solutions to climate change by accelerating the development, transfer and deployment of clean technological solutions between the two countries.

Participation
Clean Technology Australasia Pty Ltd (CTA) will lead the project and be responsible for successfully achieving milestones, deliverables, and outcomes within the Project budget. The project will involve an extensive consultative process with input and contributions from key industry, finance sector and research and government representatives in Australia and India, including our existing partners; The Energy and Research Institute India (TERI), the TERI Business Council for Sustainable Development, the Australia India Business Council and key partner organizations involved in the Australian and Indian Clean Technology Fora organized by CTA. The consultation process will include personal meetings and written questionnaires. A list of participating organizations is provided in the Project Plan Detail below.

Objectives
The key goals of the Project are to:

- Provide a clear understanding of the business risks and opportunities to accelerate increased investment in Clean Technologies between Australia and India;
- Foster bilateral partnerships for research and development projects and private sector Joint Ventures that address the need for deployment of clean technologies between Australia and India; and
- Identify the market, technical and financial barriers for clean technologies across the range of Cleantech industry sectors, including renewable energy, distributed generation and cleaner fossil fuel.

Key project performance indicators to the completion of the project include:

- Obtaining, through a targeted consultation process, contributions and input from a representative cross section of knowledgeable and credible leaders from industry, finance and government to contribute to the project;
- Produce a report that identifies the issues, challenges and solutions to overcoming investment, development and deployment of clean technologies between Australia and India.
- Inform the development of a strategic plan that addresses the barriers identified in the final report.
### Milestones

<table>
<thead>
<tr>
<th>Description</th>
<th>Start</th>
<th>Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research and prepare background issues paper</td>
<td>Nov 2006</td>
<td>Dec 2006</td>
</tr>
<tr>
<td>Prepare and undertake consultative process with participants</td>
<td>Jan 2007</td>
<td>Apr 2007</td>
</tr>
<tr>
<td>Review and synthesize results from consultations</td>
<td>Apr 2007</td>
<td>Apr 2007</td>
</tr>
<tr>
<td>Prepare progress report to Task Force with preliminary findings</td>
<td>May 2007</td>
<td>May 2007</td>
</tr>
<tr>
<td>Prepare final draft report</td>
<td>Jun 2007</td>
<td>Jun 2007</td>
</tr>
<tr>
<td>Finish: Submit and present final report</td>
<td>Jul 2007</td>
<td></td>
</tr>
</tbody>
</table>

### Location

Clean Technology AustralAsia is based in Melbourne, Australia from where the project will be managed.

Consultations as a part of the Project will include (but not limited to) the following city locations: Australia: Melbourne, Sydney, Canberra, Brisbane, and Perth. India: New Delhi, Mumbai, Chennai, Bangalore.

### Resources

The total budget for this study will be approximately $250,000. The indicative cash requirements to be paid by the Task Force’s budget under the Partnership initiative are $150,000. Clean Technology AustralAsia will contribute an in-kind total of $100,000.
RDG-06-11: Development of Economic Indices for Renewable Energies and Distributed Generation in the Asia-Pacific Region

Project
Title: Development of Economic Indices for Renewable Energies and Distributed Generation (hereinafter, REDG) in the Asia-Pacific Region.

As the current oil price hike is expected to continue in the future, renewable energies is gaining their market share, reflecting the improved economic feasibility. However, most renewable energies, except for wind, hydro, biomass, are still costly energy options, compared to the conventional energy sources. In this regard, development of economic indices is under consideration, which can be referred to as criteria in prioritizing development and deployment of renewable energy R&D and deployment. Economic indices can also be used in developing and implementing cost-effective policy tools for each member country and the Asia-Pacific region as a whole.

Participation
Manager
Kyung-Jin Boo, Korea Energy Economics Institute (KEEI)
665-1 Naeson-dong, Euiwnag-si, Kyunggi-do, South Korea
Tel.: 82-31-420-2139, kjboo@keei.re.kr

Partners
The United States of America (possibly, EIA/DOE or NREL)
Institute of Energy Economics Japan (IEEJ), NEDO or NEF (New Energy Fund)
Relevant institutes in other Partner countries (Australia, China and India)

Objectives
Database of economic indices for renewable energy resources, supply/demand, assessment of production costs and benefits.
Policy recommendations to maximize the cost-effectiveness of renewable energy development and deployment.

Milestones
Year 1 Fact-finding (information gathering) and analysis of resource potential for REDG
Year 2 Integrated data-base building of economic indices for REDG
Year 3 Recommended policy tools to promote commercialization of REDG and updating the DB thereafter.

Location
The project will operate primarily in Korea, networking with other Partner countries.

Resources
Total 1.2 M USD
- Cash: 0.6M (from Partner countries), in-kind: 0.6M
* Budget is to be allocated among participants and may vary according to the participants’ consultation.
RDG-06-12: Creating an Enabling Framework for Re-Deployment in the Partnership

Project
This project will help to improve the quality of both the resource information and the tools for assessing the technical and economic potential for renewable energy development, which will greatly enhance opportunities for broad deployment of RE and DG technologies in the Partner countries. It will also develop improved tools for applying resource information together with other data (e.g. technology and system cost, load profiles, land-use, etc.) to provide more credible and accurate information on the economic potential and competitiveness of renewable energy relative to other alternatives. This will include a review of current integrated economic assessment methods and tools, ranging from screening analysis to modeling capabilities and collaborative work to enhance the quality of these tools in use across Partner countries.

Participation
This project will be managed by the Office of Energy Efficiency and Renewable Energy at the U.S. Department of Energy. It is anticipated that representatives from each Partner country will participate in this activity with a specific focus on relevant energy and planning Ministries and technical institutions and agencies with capabilities in the areas of renewable energy resource assessment, economic assessment and optimization tools, and policy formulation and evaluation.

Objectives
To improve the quality and access to resource and economic assessment information to inform renewable energy policy and project development and promote the use of renewable energy policy best practices. This will result in establishment of best in class resource and economic assessment methods and collaborative plans for their broad use across Partner countries by end of 2007 and availability of high quality renewable energy resource and economic assessment data and tools for priority regions across the Partner countries by the end of 2010. The overall project will help to establish a credible information base upon which viable, and sustainable, renewable energy markets can be fostered.

To promote the use of renewable energy policy best practices that will create effective enabling environments for renewable energy development. This will result in a common understanding and acceptance of policy best practices across Partner countries and initiation of work to implement these policy best practices by the end of 2007 and adoption of policy best practices (to the extent possible as consistent with country priorities) across Partner countries by the end of 2010.

Milestones
Establish general agreement on best in class methods for resource and economic assessment among Partner countries. (December 2006)

A detailed summary of available resource and economic assessments (wind, solar, biomass, hydro, geothermal, CHP) across the Partner countries and the quality of these data. Report will also identify recommended near-term priorities to fill gaps in data and tools by country. (February 2007)
A detailed report on best-in-class resource and economic assessment methods and tools for optimizing resource use and implementation of improvements to these tools to better support policy and project development needs. (Six months for evaluation, 12 months for implementation activities after project initiation.) (September 2007)

Collaborative plans across Partner countries developed to disseminate and apply these best in class resource and economic assessment tools and methods (including training) to address key gaps and inform policy and investment decisions. (July 2007)

Report on renewable energy policy best practices for Partner countries. This report will be based on a review of the impacts and experiences with renewable energy policies and programs employed across the Partner countries. (September 2007)

Initiation of technical assistance for select high impact renewable energy policies and programs in Partner countries. (December 2007)

**Location**
This project is not site specific but it is anticipated that all activities will occur within Partner countries.

**Resources**
$2,000,000 from Partner countries.
RDG-06-13: Quality Renewable Energy Training in China and India

**Project**

China’s and India’s demand for energy is increasing rapidly. Renewable Energy is seen by both the Indian and Chinese governments as an important component in satisfying future energy demand. Nevertheless, delivering affordable and reliable renewable energy services and achieving the contribution targets being set for RETs to future power generation will be challenging without an extensive pool of competent (knowledgeable and skilled) practitioners to design install and maintain RE systems and services. This project will progress the systematic development of national training competency standards in RE/DG in China and India, to achieve country-wide coverage and pave the way for future quality oriented training implementation within the mainstream vocational training sector.

**Participation**

The Project Manager will be Mr. Geoff Stapleton, Managing Director, Global Sustainable Energy Solutions Pty Ltd. Other partners in the project are: Institute for Sustainable Power Inc, USA; IT Power China Pty Ltd., China; IT Power (Australia) Pty Ltd., Australia; IT Power India Pty Ltd. (India); Indian Institute of Technology Bombay, (India) and Electrical Engineering Research Institute of The China Academy Of Sciences, China

**Objectives**

The project will have two separate streams for the two countries:

**China**

The overall goal of the project is the establishment of ISP Office in China- thereby providing China with the framework for accrediting RE training courses. The key indicators are: ISP China Office able to successfully undertake all activities required by an ISP Licensee and is self funding after 2 years time; and all required committees are operating. The Project Manager will work closely with China to determine appropriate implementation arrangements.

**India**

The overall goal is a comprehensive strategy document addressing the implementation requirements for quality-oriented training in Renewable Energy and Distributed Generation in India, including milestones and deliverables for action over the proceeding five-year period. The key indicators are: completion of four workshops to introduce draft strategy to at least 50 Indian stakeholders; completion of a strategy document describing an approach for achieving quality-focused prioritized RE Training in India in the timeframe to 2030; a number of Indian Training Institutions offering quality-focused RE and/or DG training programs within five years from project completion.
**Milestones**

**China**
- Start: January 2007
- Establishment of ISP Office in China: March 2007
- Promotion of ISP to stakeholders: May 2007
- Formation of Committees and the Development of Chinese Approved Tasks Analyses: December 2007
- Ongoing operations of the office: December 2008

**India**
- Project Kick-Off Meeting: January 2007
- Strategy Outline for Partnership endorsement: January 2007
- Draft Strategy and Implementation Plan: June 2007
- 4 x stakeholder workshops in India: September 2007
- Final Strategy and Implementation Plan: October 2007

**Location**

The project will be undertaken in China and India with coordination and management from Australia. A number of participatory workshops with stakeholders from across the country will be undertaken in key regional cities in China and India.

**Resources**

Cash from Partner countries; $483,000. In Kind from committee members $38,000.
RDG-06-14: International Scholarships for Photovoltaics and Solar Energy Engineering at University of New South Wales

**Project**
The project comprises support for three areas of scholarship activity:

- **A**—Full tuition fees for 5 international PhD students from Partner countries to carry out research in the field of photovoltaics and solar energy engineering.
- **B**—50% tuition scholarships for two intakes of 40 Masters students from Partner countries to complete a Masters program.
- **C**—Tuition fees for two years (of a four year course) for three intakes of 20 undergraduate engineering students from a Chinese university.

**Participation**
School of Photovoltaics and Renewable Energy Engineering UNSW,
Chinese University, China Scholarship Council (potential)

**Objectives**
Bring international research and undergraduate students from Partner countries to UNSW’s premier photovoltaic research group. Enhance the photovoltaics knowledge and teaching resource base in Partner countries; improve the quantity and quality of photovoltaics teaching manufacturing and research in Partner countries.

**Milestones**

<table>
<thead>
<tr>
<th>Description</th>
<th>Start Date</th>
<th>Milestone Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish shared (2+2) teaching arrangement with Chinese partner university</td>
<td>Sep 2006</td>
<td>Jul 2007</td>
</tr>
<tr>
<td>Students enroll in PhD program in Photovoltaics and Solar Energy</td>
<td>Mar 2007</td>
<td>Jun 2010</td>
</tr>
<tr>
<td>First Masters intake</td>
<td>Mar 2007</td>
<td>March 2008</td>
</tr>
<tr>
<td>First intake 20 undergraduate scholarship students</td>
<td>Mar 2008</td>
<td>May 2008</td>
</tr>
<tr>
<td>Second Masters intake</td>
<td>Jul 2008</td>
<td>Apr 2010</td>
</tr>
<tr>
<td>Second intake 20 undergraduate scholarship students</td>
<td>Mar 2010</td>
<td>May 2010</td>
</tr>
<tr>
<td>Third intake 20 undergraduate scholarship students</td>
<td>Mar 2012</td>
<td>May 2012</td>
</tr>
</tbody>
</table>

**Location**
The Project Manager is to be based at the UNSW Kensington campus, Sydney, Australia, where the research training and UNSW teaching activities will occur.
Resources
A—Cash: US$441,000 (Australian Government); In-kind: US$60,000 (UNSW)
B—Cash: US$1,464,000 (Australian Government); In-kind: US$180,000 (UNSW)
C—Cash: US$1,940,000 (Australian Government); Possible support from the China Scholarship Council to be determined; In-kind: US$240,000 (UNSW)

Project
This is a training and information exchange program targeted to China and India to assist formulation of renewable energy promotion policies and measures in consideration of best-matched practices in national and local context.

The training seminar would take place once or twice a year for one to two weeks at a time, including site tours.

The trainees would be primarily from China and India including those from local area.

Total number of the trainees would be 10-30 depending on the budget and the contents of the program.

Participation
Management
The Institute of Energy Economics, Japan
Inui Bldg., Kachidoki, 1-13-1, Chuo-ku, Tokyo 104-0054 Japan
Tel +81-3-5547-0214

Participation
Agency of Natural Resources and Energy, METI, Japan

Renewable energy related agencies of the five other Partner countries.

Objectives
Share the experiences and deepen the understanding of know-how to enhance the market of renewable energy from the point of social-economic significance and policy formulation.

Performance Indicators
Regional or local initiative to support renewable energies

Milestones
Training programs once or twice a year

Location
Japan and/or other hosting countries

Resources
USD 150,000 per one training seminar from Japanese government

In-kind (n/a)
RDG-06-16: Feasibility Study and Development of Smart Energy Solution Using Various Renewable Energies

**Project**

Japan – The feasibility study on the development of independent electricity supply system for the distributed region (Small scale).

Korea – The engineering study on the development of energy supply system including the electricity and the heat considering connection with utility grid.

The development of Smart Energy Solution (SES) management system will be sought as well.

**Participation**

**Management**

New Energy Foundation, Japan  
Shuwa Kioi-cho Park Building 6F, 3-6 Kioi-cho, Chiyoda-ku, Tokyo, 102-8555, Japan  
Tel: (03) 5275-9824, hydropower@nef.or.jp  
Mr. Tetsuya Kawamura, Director International Affairs Dept. Hydroelectric Power Development Centre

Hyosung Corporation, South Korea  
8F, Bangbæe Bldg. 1006-2, Bangbæe-Dong, Seocho-Ku, Seoul, 137-850, Korea,  
Tel: +82-2-707-4320, hslee@hyosung.com  
Dr. Lee Hahk-Sung, Vice President

**Participation**

Agency of Natural Resources and Energy, Japan  

China or India  
Renewable energy related agencies of the five other Partner countries

**Objectives**

Feasibility study of the best combination of various renewable energies (Japan).

The draft manual that makes it possible quantitatively to assess the potential of various renewable energies (Japan).

The draft manual for Smart energy solution system considering demand side requirements including heat and electricity (Korea).

The general-purpose smart energy solution management system that makes various distributed generators operated and managed (Korea).

**Milestones**

Year 1: Smart Energy Solution Project commencement

Year 2: Detailed system design for the electric system only and the CHP system  
Development of a Smart Energy Solution Management system  
Reporting draft manual for feasibility study
Year 3 Reporting draft manual for total smart energy solution system
Demonstration of SES management system.

Location
Korea, Japan and other participants’ places

Resources
Total 0.66M USD (Korea: 0.44M USD, Japan: 0.22M USD)

Total Cash: 0.48M USD, Total in-kind: 0.18M USD

* Budget is to be allocated among participants and may vary according to the participants’ consultation.
RDG-06-17: Study on the Expansion Plan of Bio-Diesel for Transportation in Asia-Pacific Region

*Project*
Due to the concerns on stable supply of rapeseed and soybean oils for conventional biodiesels, the study on the biodiesel production using the conventional raw materials such as Jatropha is underway. There exists the significant gap among the countries in Asia-Pacific region, in terms of the infrastructure for biodiesel use and distribution. It is needed to strengthen the infrastructure through the analysis measure on biodiesels made from conventional and new raw materials, standardization of handling criteria, standard preparation etc.

*Participation*
**Manager**
Jin-Suk Lee, Korea Institute Energy Research (KIER)
71-2 Jangdong Yuseong-Gu Daejeon South Korea
Tel.: 82-42-860-3553, bmjslee@kier.re.kr

**Partners**
Japan (Kyoto University)
China (Guangzhou Institute of Energy Conversion)

*Objectives*
Standardization of analysis technology and characteristics analysis of biodiesel depending on the materials.

Solutions to biodiesel’s problems regarding its climate condition and share of the results of demonstration research on its application on each country’s vehicles.

Sharing experience with building the infrastructure for distribution of biodiesel.

*Milestones*
Year 1 Standardization of analysis technology and characteristics analysis of biodiesel
Year 2 Identification of solutions to biodiesel’s problems regarding its climate condition.
Year 3 Share of experience of infrastructure building for the distribution of biodiesel.

*Location*
Daejeon, Korea and other participants’ places

*Resources*
Total: 4.5 M USD
Cash: 2.7 M (from Partner countries), in-kind: 1.8 M

* Budget is to be allocated among participants and may vary according to the participants’ consultation
Transmission and distribution losses estimates for India are as high as 30-50%, and the many communities that currently receive poor quality and unreliable power provide a key opportunity for intervention. Increasing the share of distributed generation in the total electricity mix will have a significant impact on both clean energy supply, as well as emissions reductions. In addition, locating power generation closer to the consumer reduces technical losses and may result in commercial loss reduction as well. Utility restructuring taking place throughout the world is changing the way electricity is generated and distributed. Consumers are bypassing centralized power generators/suppliers to generate their own power through distributed generation for higher power reliability and better power quality. These distributed power generation systems have significant potential for reducing T&D losses and GHG emissions, especially when cleaner, alternative fuels and technologies are used. This project plans to introduce new concepts and technologies in India to support the distribution reforms being implemented by the GOI. These new concepts and technologies will focus on promoting widespread installation and use of smaller, more efficient distributed power generation systems, closer to the users. The tapping of India’s renewable energy resources (small hydropower, wind, biomass cogeneration/gasification, solar) has been meager to-date, but conditions are ripe for market expansion, which could be stimulated through the financing and establishing green power projects. Policy and regulatory frameworks to advance green power development in Indian states is of considerable interest to the Government of India (GOI) and could help to develop the market. In addition, other potential technologies include fuel cells, microturbines, and municipal waste product utilization.

Participation
- The private sector (TBD) will be a major player in the supply of equipment and services, and will work very closely with the various stakeholders.
- Financial institutions will play in funding pilot projects and subsequent commercial projects.
- Other potential partners may include current USAID/India partners (e.g., Winrock International India, the International Institute for Energy Conservation) and the Bureau of Energy Efficiency.
- Collaboration with the U.S. Foreign Commercial Service.
- USAID/India would provide contract activity management.

Goals and Objectives
Goals
Enhance the market for renewable energy and distributed generation technologies in India.
GHG emissions reductions following establishment of market conducive to deployment of clean, RE & DG technologies.

Objectives
Facilitate market development for effective penetration of clean energy/environment industry in evolving Indian market.
Identify niche areas advantageous to clean energy deployment in Indian market.

Undertake preparation of required financial documentation for bankable projects.

Identify appropriate clean energy technologies that can be effectively implemented in Indian context.

Support projects for deployment of renewable energy and distributed generation technologies.

**Deliverables, Outcomes and Milestones**
- Support for market transformation; including analytical and technical support, financial analysis, and information for decision making;
- Support pilot projects for demonstration of new clean energy/renewable energy technologies;
- Sustained intervention of clean energy and environment industry in India; and
- Estimated emissions reductions and other benefits, such as cost and service quality.

**Location**
Three states in India to be determined.

**Resources**
$2 million over a three-year period to support consultants, host training events, support study tours, and seed fund capital costs of demonstration projects.

$5 million during the three-year period is expected to be leveraged (based on current leveraging success of USAID/India activities in the energy and environment sector).
RDG-06-19: Public Private Sector Partnership on Hydropower in the Partner Countries

Project
This project will support the Renewables and Distributed Generation Task Force in its effort to create an enabling environment for renewable and DG technologies in the Partner countries. The project will focus across Partners on identification of specific barriers impeding investment in hydropower in each of the member countries. Partner countries have identified more than $200B in hydropower investment that will be necessary in their efforts to expand energy generation. Since far less hydropower has come on line than has been planned over the last several years, this effort will take a unique private public sector view and seek to find solutions. This effort will identify and review the specific reasons for the shortfall, and will serve to meet the ultimate mission of the Task Force to put megawatts of power on line. Industry believes that barriers inhibiting investment can be resolved by high level government and private sector involvement—and believes Partner countries can offer this power to convene the requisite parties.

Participation
This project will be managed by the US Hydropower Council and its India office, with support from the US Department of Commerce, and the U.S. Department of Energy, (may include the USAID India mission) and may include other trade groups and or industry members from other Partner countries. It is anticipated that US Hydropower’s Advisory Board in India will participate to ensure that relevant ministries and institutions in India are also aware of this effort. Invitations to the Advisory Board for public and private sector representatives have begun, and it is anticipated that the Partnership may be helpful getting key representatives to participate. An inaugural event will take place in Delhi in October 2006 and stakeholder events will take place in key states September to December 2006. Plans for a hydropower initiative in China will be developed in the 2007-2008 timeframe.

Objectives
The project will focus on public/private sector work in three areas.

- Identifying priority hydropower projects in the public and private sector in each of the Partner countries’ markets.
- Use public and private sector input to identify the main barriers to project investment/deployment.
- Use a pilot project in India that focuses on hydropower projects and priority projects already in the pipeline to help remove barriers facing projects in key states.

Milestones
Phase 1 By working with the current pipeline of hydropower projects in key states in India that are being inhibited, this project will help to identify specific barriers and work with public and private sector to develop solutions to the barriers. Outreach to the private sector in all Partner countries will add additional projects that will require this support and advocacy.

Phase 2 Add additional key states with projects in the pre-feasibility stage and work with them to achieve financial closure.
Phase 3 Identify other Partnership priority projects and define similar plans to be replicated in those markets.

Location
The first phase of this project will take place in key states in India. A second phase will incorporate additional Indian states. This project will be replicated in China.

Resources
The total U.S. Government budget for this effort is $2,000,000. Industry will contribute investment for the projects and it is anticipated that in-kind resources in the form of time from the private sector and Partner government personnel may also be provided to support this effort.

Project
Distributed power generation in India using hydrogen internal combustion engine generators, promoting clean air, energy security and sustainable economic growth.

Participation
Manager
Energy Conversion Devices, Inc
2956 Waterview Drive
Rochester Hills, MI 48309
Tel.: 248-293-0440

Partners
Targeted partners in the chlorine caustic industry: India.
Potential partners in the cane sugar production industry: India.
Local manufacturer of the generator sets (gensets): India.
In-country agencies: India.
Financing from nongovernmental organizations (NGOs) and agencies: various countries of affiliation.

Objectives
To achieve installed capacity of hydrogen-fueled generators totaling 0.2 megawatts (MW) within six months of project endorsement.
To achieve installed capacity of hydrogen-fueled generators totaling two megawatts within three years of project endorsement.
To leverage existing identification by the Indian government of six states as preferred candidates for distributed generation: West Bengal, Assam, Orissa, Jharkhand, Bihar and Uttar Pradesh.
To increase by 1,000 to 2,000 the number of homes or small businesses with access to clean, reliable electricity.

Measures of Success
Number of generators installed and functioning, readiness of hydrogen distribution network.
CO$_2$ emissions avoided.
**Milestones**

*Initial Milestones*

**Pre-Deployment**

- Deployment sites vetted and selected  
  Feb, 2007
- Partner contracts signed

**Initial Deployment**

- Cumulative 0.2 MW installed, running, tested  
  Mar, 2007
- Cumulative 0.4 MW installed, running, tested  
  Dec, 2007

**Ongoing Deployment**

- Cumulative 1.2 MW installed, running, tested  
  Dec, 2008
- Cumulative 2.0 MW installed, running, tested  
  Dec, 2009

**Location**

The project will be located in rural communities in India in states identified by India as targets for renewable energy and where good hydrogen fuel partners are nearby.

**Resources**

The project will use total cash resources of between $5.05MM and US$7.05MM, and total in-kind resources of between US$2.1MM and US$3MM.
RDG-06-21: Demonstration of Solar-Enhanced Fuels for Electricity and Transport Applications

**Project**

Our vision is to vastly increase the deployment of solar energy in the Asia-Pacific region and increase the capability of industry to support this outcome. To do so we need to demonstrate improved cost effectiveness of solar technology. The technology of choice is concentrated solar energy to enable solarization of fossil fuels. Such an approach provides the key ability to transition. This project will build on work already conducted by the key Partner countries in the area of solar reactors and solar tower design and construction. At present solar reforming reactors use steam and natural gas to produce syngas (SolarGas™) or hydrogen for gas turbine fuel. However in most instances when gas is extracted from the ground, CO$_2$ is also extracted and released as a waste product. This project will develop new reactors and catalysts that are able to use CO$_2$ as one of the reactants, thus making use of a waste stream and minimizing water use. This will mean coal seam methane (also known as coal bed methane) can be solarized. A demonstration plant will be constructed using a multiple array of solar towers. It is anticipated that this will be based on a coal seam gas resource and the resulting SolarGas used to feed a nearby gas turbine. The precursor to this project—the solar tower SolarGas facility at CSIRO—has been accepted as an IPHE-accredited project.

**Participation**

*Management*—The project management will be carried out by CSIRO Energy Technology

*Participation*—The key country partners identified at this stage are China’s Thermal Power Research (TPRI) Institute and Japan’s Tokyo Institute of Technology (TIT). Each country will also provide industry input for component manufacture, with the Australian company Solar Heat and Power Pty Ltd likely to provide heliostat input. The Australian National University will provide research input.

**Objectives**

We will demonstrate the complete process of solar energy to end-use application in an actual working environment, such that no significant further work would be required to begin substantial deployment of the technology.

As a success indicator, we will have begun the process of constructing one or more successive plants, at a commercial scale, either as an extension of this demonstration or as a new site.

**Milestones**

Year 1  Research and engineering design and testing of key components

Year 2  Testing of key components at National Solar Energy Centre

Year 3  Construction of multi-tower plant at a suitable site (to be selected)

Year 4  Bankable report complete and used to begin raising support for a large-scale extension of the demonstration plant constructed in this project.
Location
The majority of the early work in this project will be carried out at CSIRO’s National Solar Energy Centre in Newcastle, NSW, Australia, with specific component development also being conducted at TIT and TPRI. During this phase, the preferred demonstration site will be selected. This will be in Australia or China, near a major gas source in a good solar location. There is some attraction in linking this technology to a site where coal gasification (perhaps along with an IGCC plant) is being conducted to make use of the coal seam gas and the syngas turbine.

Resources
Cash—US$5,500k anticipated to come from the supporting mechanisms provided by participating governments.

In-kind—US$2,000k from the participating Partner countries’ institutions and companies.
**RD&D Projects**

**RDG-06-22: Flexible Biomass Gasification Technology for Distributed Power Generation**

**Project**

Many biomass gasification technologies currently being developed or demonstrated are largely based on the experience of coal gasification. These gasifiers will often be operated at high temperature (and high pressure), incurring capital and operating costs higher than those for coal gasification. These large gasifiers would also require the biomass fuels to be collected and transported to centralized locations. However, aside from some special cases of relatively densely populated biomass resources, biomass fuels are often distributed in rural areas. The costs of collection and transportation of (wet) biomass are often another important factor limiting the economic competitiveness of this renewable energy source. Considering the special thermochemical features of biomass fuels, this project aims to develop a flexible biomass gasification technology to separate the whole gasification into 2 steps: pyrolysis (the initial step of gasification) and subsequent reforming/gasification. The mild pyrolysis of biomass acts as a fuel pre-processing step to convert biomass into bio-oil and char, which can be much easier and cheaper to transport than the original bulky biomass. The subsequent reforming of bio-oil and gasification of char will then produce gaseous fuel suitable for (solid oxide) fuel cells or gas engines for distributed power generation. Representing a paradigm change in biomass utilization philosophy, the technology will be applicable for both distributed and densely populated biomass resources. In particular, this technology will greatly reduce the transportation costs and will be particularly suitable for distributed power generation in rural areas where biomass fuels are grown.

**Participation**

*Project manager*
Prof. Chun-Zhu Li, Monash University, Australia
Department of Chemical Engineering, Monash University, Australia
Tel: +61 3 9905 9623

*Other participants*
Prof. Jun-ichiro Hayashi, Hokkaido University, Japan

Mr. In-Gu Lee, Bioenergy Research Centre, KIER, Korea

Dr. Hongwei Wu, Curtin University of Technology, Australia

Prof. Minghou Xu, Huanzhong University of Science and Technology, China

Participation of India’s research sector is likely and the project will also involve the direct participation by industry partners.

**Objectives**

The ultimate aim of this project is to demonstrate the key technological aspects of the proposed biomass gasification technology for distributed power generation, to speed up the commercial uptake of biomass as a reliable and cheap renewable energy source across the Partner countries.
**Milestones**
The project includes both research/development and demonstration activities: The concept of the proposed technology will be proved within the first three years.

The key technological aspects of the technology will be demonstrated within five years, ready for further commercial activities. Early uptake of this technology by industry may also be possible.

**Location**
The project will be carried out in laboratories of the participants.

**Resources**
*Cash*
US$3,030,000 requested from REDGTF programs (in Korea, Australia, Japan and China).

*In-kind*
US$ 4,168,000 would be contributed by the participating Partner countries’ organizations.
RDG-06-23: Solar Photovoltaic Linear Concentrator Systems

Project
The aim of this project is to develop improved solar photovoltaic linear concentrators that are commercially competitive in a wide variety of markets. The technical goals are to reduce the cost and increase the efficiency of linear photovoltaic concentrators, and to resolve some significant technical impediments. Potential markets include (1) the supply of solar concentrator photovoltaic (CPV) electricity from large ground-mounted parabolic trough arrays and (2) the supply of both solar concentrator heat and photovoltaic electricity (CHPV) from parabolic trough systems mounted on the roofs of buildings, in which circulating water that removes excess heat from the solar cells is used to provide hot water and space heating within the building.

Participation
The Project will be managed by the Australian National University (R&D http://solar.anu.edu.au/) and Solar Heat & Power (commercialization http://www.solarheatpower.com/). Partners in India have been identified. It is anticipated that partners in China and United States (and possibly Japan and Korea) will join the project.

Objectives
The key objective is to resolve the remaining barriers to the widespread deployment of photovoltaic trough concentrator systems. Principal barriers include (1) the difficulty of supply of high-performance, low cost solar cells suitable for parabolic trough concentrator systems, (2) the technical problem of moving shadows cast by gaps between mirrors and structural elements on strings of solar cells, and (3) the integration and qualification of the system.

Milestones
30/6/08 Develop a solution to the problem of the supply of high-performance, low-cost solar cells for parabolic trough concentrator systems
31/12/08 Develop low-cost shadow-tolerant CPV and CHPV receivers incorporating these cells
30/6/09 Integrate these receivers with low-cost parabolic trough solar concentrators
31/12/09 Demonstrate retrofitting of CPV and CHPV receivers to existing parabolic trough solar thermal concentrator systems
30/6/10 Conduct extensive performance and qualification testing
31/12/10 Transfer the technology to other Partner countries for use in demonstration systems

Location
R&D will take place in Australia at the premises of the Australian National University (Canberra) and Solar Heat and Power (Sydney). Testing and demonstration will initially occur in Australia and India, and later in China and United States and possibly also Korea and Japan.
Resources
An Australian government contribution of $1.6 million in cash over four years is requested. The Australian partners will provide matching in-kind contributions. It is anticipated that other Partner countries will join the project early in 2007 in order to contribute to the R&D, and to provide field testing and technology demonstration, with support from their own governments of approximately $4 million (also with matching in-kind contributions).
RDG-06-24: Development of Materials and Interface Engineering Technologies for Dye-Sensitized Solar Cells

Project
During the past decade, refinements in the chemical components of the cells, improvements in cell physics, and device engineering have led to remarkable enhancement in the performance of the dye-sensitized solar cells. The opportunities and potential payoff here are significant: low-cost, large-area, flexible, high-efficiency solar cells. The basic research goal is developing highly efficient materials and engineering interface to improve conversion efficiency and thus obtain robust, scalable efficiencies of over 13% in cheap, dye-sensitized solar cells through the international collaborations between Partner countries.

Participation
Manager
Nam-Gyu Park, Korea Institute of Science and Technology (KIST)
P.O. Box 131, Cheongryang, Seoul 130-650 South Korea
Tel.: 82-2-958-5365, npark@kist.re.kr

Partners
Japan (Kyushu Institute of Technology)
United States (National Renewable Energy Laboratory)

Objectives
To develop materials and interface engineering technologies for dye-sensitized solar cells through the international collaboration of Partner countries.

Milestones
Year 1 Development of interface control and carrier transport evaluation technique
Year 2 Design and synthesis of materials for dye-sensitized solar cell: TiO$_2$ nanostructure and Dye materials
Year 3 Fabrication and evaluation of high efficiency (~13%) dye-sensitized solar cells.

Location
Korea Institute of Science and Technology (KIST), Seoul, Korea

Resources
Total: 2.7 M USD (from Partner countries) in cash

* Budget is to be allocated among participants and may vary according to the participants’ consultation.