



Clean Energy Council



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partnership

Regional Export Opportunities for Australia's Clean Energy Industry

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Renewable Energy and Energy Efficiency Partnership (REEEP)
and
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The Renewable Energy & Energy Efficiency Partnership's (REEEP) goal is to accelerate the global market for sustainable energy by acting as an international and regional enabler, multiplier and catalyst to promote and develop sustainable energy systems. Accelerating the integration of renewables into the energy mix, while also advocating increased energy efficiency, not only acts to reduce a nation's carbon and greenhouse gas emissions, but also ensures further socio-economic benefits by increasing energy security, and reducing the energy poverty of a country.

REEEP works with Governments, Businesses, Industry, Financiers and Civil Society throughout the world in order to expand the global market for renewable energy and energy efficiency technologies. This experience ensures that REEEP is uniquely placed to contribute to international, national and regional policy dialogues.

With an International Secretariat, a network of eight Regional Secretariats, and more than 200 partners worldwide REEEP has the ability to affect change worldwide – helping to provide access to best practice in policy and finance to promote renewable energy and energy efficiency. The partnership has funded more than eighty high quality projects in forty countries that remove market barriers to clean energy in the developing world and economies in transition. These projects are beginning to deliver new business models, policy recommendations, risk mitigation instruments and regulatory measures.

The partnership's overarching goals are to:

- ❖ Reduce greenhouse gas emissions
- ❖ Deliver social improvements to developing countries and countries in transition, by improving the access to reliable clean energy services, and by making Renewable Energy and Energy Efficiency Systems more affordable
- ❖ Bring economic benefits to nations that use energy in a more efficient way and increase the share of indigenous renewable resources within their energy mix.

The REEEP South East Asia and Pacific Regional Secretariat is funded by the Australian and New Zealand Governments and nabCapital.



The Clean Energy Council is an amalgamation of the Australian Wind Energy Industry Association (Auswind) and the Australian Business Council for Sustainable Energy (BCSE). The Council represents over 400 businesses covering a quarter of Australia's total electricity production including gas, wind, hydro and bioenergy and involved across the spectrum of business in the low-emission energy and energy efficiency sectors, including solar PV, solar hot water, biomass, geothermal and cogeneration.

The clean energy sector is focused on tackling climate change within Australia. As stationary energy is responsible for 50% of Australia's emissions, with electricity production by far the largest contributor, any responsible remedy to climate change must tackle Australia's electricity mix. Clean energy technologies, particularly clean energy infrastructure and energy efficiency, are the key to stabilising, and reducing, Australia's greenhouse gas emissions.

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1. Executive Summary

At the recent Bali UNFCCC meetings, an unprecedented group of businesses outlined their priority areas of enhanced national and international action on mitigation, financing and investment, technology transfer and adaptation. As the AWG continues its work and prepares for the Conference of the Parties meeting in Poznan, Poland this December, the following elements that are fundamental to a post-2012 agreement:

- Technology transfer should be viewed as a mutually beneficial process – both developed and developing countries have experience to offer and the ability to accelerate technology deployment
- The shared objective should involve decoupling economic growth with greenhouse gas emissions

The Bali Action Plan specifically recognises “mobilisation of public- and private-sector funding and investment, including facilitation of climate-friendly investment choices.” This report outlines the opportunities for regional investment of clean energy technologies and services in the Asia Pacific region.

In February 2008, the Renewable Energy and Energy Efficiency Partnership (REEEP) was asked by the US State Department to carry out three regional preparatory meetings to provide regional feedback to the Washington International Renewable Energy Conference (WIREC 2008) Ministerial Meeting. Global consultation provided detailed input from the various high-level regional Renewable Energy stakeholders with regard to WIREC and the REEEP WIREC Report was able to identify a number of opportunities for Government to promote the deployment of renewable energy.

The ability of Asia to transit to a clean energy and low carbon pathway will be a decisive factor in determining the ability of the international community to achieve a sustainable energy future. Under a business as usual scenario, providing the people of the region with access to modern energy sources, and catering to the demands of rapidly growing economies will see Asia account for 29% of global GHG emissions by 2030. To avoid such high emissions growth will require a major shift by the countries of the region towards the development and deployment of clean energy sources. The IEA estimates that US\$20 trillion will be spent in the energy sector between now and 2030, with much of this occurring in developing countries. Most of this money will come from the private sector. This presents an enormous business opportunity coupled with the delivery of substantial social and environmental benefits

The report confirms the opportunities for commercial export opportunities in wind, biomass, biogas, biodiesel and ethanol production, solar thermal and PV, small hydro and geothermal. Although the policy environments are mixed, determined developers are learning to deal with these and other barriers, and are now being met by a growing cross-section of investors seeking good, commercially viable project opportunities.

While local banks have until recently been hesitant to provide debt facilities for renewable energy and energy efficiency, this is changing, perhaps encouraged by the active engagement of the major international banks and regional development finance organisations. Sourcing equity is still more of a challenge than for other sectors, but a number of specialist funds and a growing number of new entrants are offering increasing support to the market.

The demand for carbon generated through the Kyoto Protocol's Clean Development Mechanism is driving the renewable energy finance market globally. With Australia's accession to Kyoto this now opens considerable opportunities for local companies.

Regional Country Reviews

This report contains country reviews of the major energy users in the Asia Pacific region and provides an assessment of their future energy needs and opportunities for clean energy initiatives.

China has abundant renewable energy resources, including resources for the more mature technologies of hydro, wind, biomass and solar power as well as mid to longer term technologies such as geothermal energy and ocean energy. China's new policy requires 10% of the nation's total energy consumption to be renewable energy, including hydro, by 2010. Renewable Energy Law (2006) set targets for 15% of electricity to be sourced from renewables by 2020, including hydro power. Furthermore, it requires all power generators to derive 3% of power from renewable sources, excluding hydro power, by 2015.

Consequently China presents significant opportunity for investment. This is highlighted through the attention given by a number of global investment agencies in China's RE industry.

India now ranks 5th in the world in terms of primary energy consumption, is the 6th largest GHG emitter globally, and the fastest growing one after China. India is seen as a country with large renewable energy resources and is considered by some as the "next frontier" for the large scale development and deployment of renewable energy projects. At present the greatest opportunity for investment is in India's construction industry. The sector is growing at a rate of 9.2% and represents 10% of India's GDP. In recent years, India has emerged as one of the world's top destinations for green buildings and has implemented a number of home rating schemes and building codes which open up a wide range of opportunities in construction, architecture and engineering design, building materials and equipment manufacture.

Thailand, Indonesia, Malaysia, Philippines, and Vietnam are all experiencing increasing energy demands and in part are looking to renewable energy and energy efficiency initiatives as a way of supplying projected energy needs. Some of these countries will be transitioning from being net energy exporters to net energy importers and are now looking at renewable resources such as biomass, wind, solar and biofuels as a way of gaining energy security and meeting community expectations. Supportive Government policies and financial incentives are providing business and investment opportunities in the clean energy sectors in these countries.

Clean Development Mechanism

By ratifying the Kyoto Protocol, Australia is now under a legally binding obligation to meet its emission limitation target of 108% during the first commitment period. Australia may be able to meet that target wholly by domestic means, for example through implementing domestic emission reduction programmes. However, if it is likely to exceed its Kyoto target, it may take advantage of the flexible mechanisms and purchase credits from other countries. If the review of Australia's inventory report by the UNFCCC Compliance Committee does not raise any questions of implementation, and the other steps mentioned above are taken promptly, Australia will be eligible to participate in the flexible mechanisms by mid 2009. In the interim, Australian companies are able to participate in the CDM by gaining the approval of another Annex I Party. In the past this has been done by obtaining approval from governments such as the UK, the Netherlands or Sweden to participate under their authority

From a regional perspective, Asia, and in particular China and India have dominated the CDM market on the supply side, followed by other larger developing countries in Latin America such as Brazil and Mexico. While China and India attract the largest share of CDM

investments other Asian countries are becoming more involved in projects, in particular the Republic of Korea, Indonesia, the Philippines, Malaysia, Vietnam and Thailand.

Within the Asia Pacific region, 34 countries have established Designated National Authorities (DNAs) which are responsible for evaluating projects, based on approval processes related to national sustainable development criteria, and issuing letters of approval which are a prerequisite for a project to be registered by the Executive Board (EB) of the CDM.

Among the projects in the CDM pipeline, there are 2447 renewable energy (RE) and energy efficiency (EE) projects equalling almost 77% of the total project portfolio. At the date of writing, hydropower made up the largest share of CDM RE projects, representing 26% of the total CDM pipeline, followed by biomass projects 16% and wind energy at 13%. Between 2005 and 2006 CERs from renewable energy increased from 10% to 16% and transactions from energy efficiency and fuel switching projects grew from 1% to 9%. The growth in these project types is partly due to China's decision to prioritise these types of projects and develop policy frameworks to support them

Australian Market Capacities

Australia has a strong and diverse renewable energy industry. The industry has particular strengths in niche markets such as solar hot water, photovoltaics, biomass waste-to-energy conversion, small-scale wind turbines and stand-alone power systems. Australia has a leading edge in developing, manufacturing and deploying these technologies and Australia's consultancy services, project management and installation of renewable energy systems are increasingly being recognised world-wide. In addition to developing and supplying renewable energy products and services, there are several Australian companies now operating internationally as renewable energy investors, financiers and developers. Australia has also developed considerable expertise in the development, implementation and accreditation of renewable energy training programs.

Implementing energy efficiency strategies across the economy are the most cost-effective and immediate way to start reducing greenhouse gas emissions. The technical and economic potential for improving energy efficiency in all sectors of the Australian economy is very large. Global studies have repeatedly demonstrated the existence of 'no-regrets' opportunities for the implementation of energy efficiency measures, where investment approaches are highly profitable for individuals and organisations, even when the wider social benefits are ignored. This should make energy efficiency attractive to business, industry and households alike

Australian Government Activities

The new Australian Federal Government has made tackling climate change one of its main priorities and since coming into power it has introduced a range of measures to put Australia on a low emissions trajectory.

A number of Government Departments oversee initiatives that include clean energy education programs aimed at both Australian residential and business users; research and development grants to stimulate the development of clean energy technology; rebates and incentives to encourage the uptake of energy from clean energy sources; initiatives to attract private investment; and export programs to assist the growth of the Australian clean energy industry and maximize opportunities for Australia in the global clean energy market. These are outlined in the report.

While many of these measures are domestically focused the research and development and implementation strategies involved contribute to the overall growth and expertise of the

Australian clean energy industry and this flows through to an increase in the sophistication and competitiveness of the industry in the global market

Off Grid Investment and Microfinance

One billion people in the Asia-Pacific region do not have access to modern energy services for basic cooking, heating and lighting. Efforts to expand the provision of clean energy at the village level in the region depend less on technology and more on improved financing models to make energy accessible and affordable at the village level. Such models address the high up front costs of clean energy projects.

This challenge of lack of access to energy presents a large scale opportunity for financial institutions. Many such institutions are making available microfinance loans specifically designed to fund alternative sources of energy as presented in this report.

In addition, there are significant opportunities to attract financing from various sources such as carbon or clean energy investment funds, which have the flexibility to fund reduced scale, decentralised and renewable energy projects.

2. Regional Assessment of Projects and the Market

The purpose of this section is to provide an update on the clean energy opportunities within the Asian region that could be attractive to Australian project developers, suppliers and investors. It draws on desk studies and operating experience in the region, details the technologies that are in demand throughout the region and attempts to identify the market opportunities that this demand could offer. Background on the various markets is supported by the inclusion of recent media coverage.

A listing of reports that have been prepared over the last few years and current sources addressing in detail the energy situation and opportunities for clean energy that exist in the region are included on Page 105.

Market Background

Although in many countries in Asia the underlying markets for “clean technologies” are relatively immature, there is little question that rapid growth is occurring across the region¹.

China has been the main focus of development of clean energy within Asia in recent times. The speed with which the energy market in China is growing clearly parallels its growth in all sectors. The often-quoted general energy statistic is that China is adding some 2,000MW of new generation a week. Its efforts to satisfy an ever-increasing demand for energy to meet staggering growth in commercial and urban demand, while also working to provide basic access to energy in the remoter areas of the country, is being supported by all forms of funding-bilateral, multilateral, public finance, domestic banks and increasing private sector activity.

With growth rates such as this, it is inevitable that a major portion of new generation will be fossil fuelled. While the renewable energy law in China, which came into effect in January 2006, has not provided (foreign) investors with all the encouragement they may have hoped for, the wind market in particular is booming. Overall China has rapidly moved along the path of renewable energy development. By 2006 China's total renewable energy output equalled 8% of non-renewable energy generation or 200 million MT of coal equivalents, though coal generated power consumption continued to account for 69% of total energy consumption in China. China's goal is for renewable energy to account for 10% of all energy consumption by 2010. In the medium term China plans to develop 120,000 MW's of renewable energy by the year 2020; this would account for 12% to 16% of China's total installed energy producing capacity that year. In the long term China has set an objective of having 30% or more of its total energy requirements satisfied by renewable sources by 2050. China's ambitious growth target for renewable energy production will require an investment of approximately US\$250 billion by 2020.²

While local banks have until recently been hesitant to provide debt facilities for renewable energy and energy efficiency, this is changing, perhaps encouraged by the active engagement of the major international banks such as Credit Suisse, Rabobank, Standard Chartered, ANZ, HSBC and others. In parallel with these institutions, support is available from development banks and their private sector arms, and the government backed agencies such as DEG, Proparco, FMO, JBIC and Finnfund. Many of these groups are also showing increased interest in providing equity or quasi-equity within this market. Export credit agencies, historically more focused on significant inward investments, will also consider the smaller scale typical of clean energy developments.

¹ Comments drawn from *Laying the Foundations for Growth* – Mike Allen published in Environmental Finance March 2008

² www.chinastrategiesllc.com

Sourcing equity is still more of a challenge than for other sectors, but a number of specialist funds, such as FE Clean Energy, E+Co, Al Tassar, Infinity Energy and a growing number of new entrants are offering increasing support to the market. The more traditional private equity houses, Goldman Sachs, Merrill Lynch, Nomura and a number of insurance groups are making direct investments from dedicated pools of internal funds. This is all being led in no small way by the enormous quantity of funds made available via the carbon market, through multilateral bank initiatives and groups such as Climate Change Capital, Mitsubishi Securities and EcoSecurities.

There is little question that the demand for carbon, reflected in the growth of the Kyoto Protocol's Clean Development Mechanism, is helping to change the renewable energy finance market globally. With Australia's accession to Kyoto this now opens considerable opportunities for local companies.

What is very clear, however, is the continued immaturity of the renewable energy and energy efficiency markets, particularly where developers are concerned. It is suggested, for example, that more than 50% of the projects being submitted for CDM approval are being promoted by proponents for whom this is their first and only entry into this market. There is no real depth in developer's experience and capacity and this is unlikely to change until market pressures force consolidation. This provides many opportunities for new entrants into the market, whether they seek to lead independent developments or collaborate with existing players to whom they can bring much needed strengths. The need for strong strategic alliances is recognised in any market and, for the renewables and energy efficiency markets to mature, the situation is no different.

While outside Asia there is a preference to "let the market decide" many of the Asian economies have the political capacity to marry this quite effectively with public sector "guidance". The RE law in China is one example – not without its detractors but a strong and consistent message to the market. Singapore is taking a central position in the RE and EE market building on its traditional industrial strengths to establish itself as a regional hub. Since the announcement of these intentions during 2007, Norway's REC has confirmed a €3 billion investment to construct the world's largest solar PV manufacturing facility (some 1.5GW output per year) and Neste Oil Corporation of Finland has committed €550 million to build an 800,000 tonne per year biofuel refinery, both in Singapore. While these examples address different sectors within the market, they do reflect the commitment that is being made at a political (and economic) level to see real growth in the RE and EE markets in the region. The success in attracting investments within both examples re-emphasises that this is a commercially viable and attractive market for investment.

Regional governments, who are all openly encouraging measures to reduce the impact of climate change, need to continue the establishment of supportive policies and regulations to recognise the immature nature of the RE and EE markets, and be willing to work with industry and the finance sector to ensure consistent long term commitments to the growth of these markets.

The private investment sector is a less cohesive structure but clearly has strong interests in the market. Earlier tensions between RE and EE promoters pushing their interests with an evangelical zeal and reluctant investors, who saw nothing but unreasonably high transactions costs and indeterminate risks, are disappearing. However, with both sides being key to rapid future growth, there still remains a lot of scope to define the common ground.

Case Study 1: ReEx Capital Asia

In 2006 REEEP and DEG, the development finance arm of German KfW Bank, seed-funded ReEx Capital Asia, an investment banking boutique based in Singapore, specializing in the Asian Clean Energy sector. ReEx Capital Asia's main business is capital-raising; originating investment opportunities; and structuring deals and raising funds (debt/equity) for renewable energy infrastructure, biofuel production facilities, energy efficiency projects and green energy products/services companies.

Even though there is no lack of funds available and no lack of financially viable projects in Asia, the lack of transparency and the still immature nature of the green energy market makes it difficult for entrepreneurs and financiers to find each other. ReEx Capital Asia (ReEx) aims at filling this gap by connecting capital with clean energy investment opportunities. ReEx helps companies and project developers to raise finance through matchmaking with commercial banks, corporate investors, clean energy private equity funds and carbon funds.

Today ReEx Capital Asia has 25 investment opportunities in its pipeline and several are undergoing due diligence by partnering investors/lenders. ReEx Capital Asia has had the advantage of having a strong advisory board with individuals from major institutions (REEEP, DEG, EcoSecurities, E+Co, CVC Group) giving the company a lot of credibility from its inception. Not only has ReEx received financial support from DEG and REEEP but also benefited from REEEP's marketing activities which have promoted ReEx services.

The willingness of national governments, bilateral agencies or FI's to support the establishment of ReEx type operations on a risk shared (or grant) basis may be a key to its replication. Basing the operation in Singapore has provided an established and well regarded business environment that has seen increasing governmental support for the clean energy industry.

There appear to be many players eager to move from spectators to participants and perhaps this transition is where the new business models will emerge. Rather than simply promote RE and EE, move to promote it on a scale that brings real capacity to developers, offers true rewards to investors and moves the process from fiddling around the edges to a head-on confrontation with some of the real obstacles to rapid progress.

Perhaps ironically, the real pressure will come not so much from those sponsors who have struggled to find finance for their RE and EE projects but from those whose billions of dollars are locked into ever expanding carbon funds. The reality that the promised credits are scarce and there will be difficulty reaching even the most modest targets of CO2 reduction without some dramatic interventions in the financing of this market may be just the catalyst to real growth in this market.

Though the global credit squeeze will inevitably impact on all investment, the following article perhaps highlights some of the current perceptions about the potential that the Asian renewable energy market offers:

Media Extract 1: "Wall of money" set to flow into Asian renewable energy

October 29, 2007 (FT.com)

Green investors, pension funds and private equity managers have a "wall of money" poised to flow into renewable energy ventures in Asia where demand for energy is growing exponentially, say observers. Investable opportunities may remain frustratingly elusive but the sector could soon explode into life.

Few doubt that sustainable energy in Asia could be lucrative, offer acceptably safe returns and be environmentally appealing with energy consumption in the region currently rising at almost 30 per cent a year - if regional authorities were not so focused on typically cheaper traditional fossil fuels.

"We are kind of stuck at the moment. We've got quite high-risk capital coming in but not much in the way of investment one step up from that," says Melissa Brown, executive director of the Association for Sustainable and Responsible Investment in Asia.

"It's the classic Asian dilemma: immense potential but you don't know when you are going to get the commercial structures to make it work," adds Ms Brown.

Biofuel has fallen out of fashion, with controversy raging over its efficiency and its potential to damage food supplies. Some Asian governments, notably India and Thailand, have already said they want no food crops diverted into biofuels.

In Europe, wind and solar power as well as biomass generators have flourished because government targets, such as the European Union's goal that 20 per cent of all energy should come from renewable sources by 2020, have created opportunities. Asia's high-stakes energy scramble has a decidedly more hard-nosed, mercantilist edge with the energy demands of the big emerging economies needing immediate solutions. Biomass and mini power plants have been shunned by state energy companies.

Many green funds have merely been able to screen for "bad" companies. The Henderson Industry of the Future fund invests in Chinese solar cell manufacturers such as Suntech Power and JA Solar although Chinese solar panels are almost invariably shipped overseas. It also invests in wind turbine makers that now trade on high price/earnings ratios, such as China High-Speed which makes windmill gears.

The stasis in renewables investment would not last forever, said Tim Dieppe, manager of Henderson's Future fund.

Investment in renewables climbed to more than \$100bn in 2006 from \$80bn in 2005, according to the recent United Nations Environment Programme report. Just 2 per cent of current global power generation comes from renewable sources but it takes 18 per cent of new investment. The US and the EU account for 70 per cent of new investment but Asia is "growing quickly", with China taking 9 per cent, mostly in wind and biomass, the report says.

"Asian governments can learn from Europe. If national grids will guarantee to take energy from a renewable plant for 25 years, all of a sudden you have a project that, tied with others, will interest a pension fund looking for a safe, decent yield. In the end it comes down to risk and return," says Ben Warren, a director in consultancy Ernst & Young's renewables team. Global investment in renewable energy will increase sevenfold over the next decade to more than \$750bn, the consultancy calculated recently. China's oil and gas investments in 50 countries clearly signal its worries over its ability to fuel an economic growth

rate taking it towards mass car and air-conditioner ownership. China now has a target of 10 per cent renewable energy by 2020 and India (quickly acquiring similar problems) has a target of 10 per cent by 2012.

"Every country will do it differently but the combination of pressures is going to produce something important. Three or four years ago there wasn't much investor interest. Now there's a lot," says Eric Usher, head of the UNEP's Renewable Energy and Finance Unit.

A score of big private equity funds are actively searching for renewable and clean technology opportunities in Asia, according to the New Energy Finance newsletter. Elsewhere, the Asia-Pacific Carbon Fund, backed by the Asian Development Bank closed at over \$150m this summer.

The Peony Fund is promoting clean technology in China with \$100m in seed money from Bill and Melinda Gates. Man Investments has raised more than \$300m for its China Methane Recovery fund.

In addition to independent private sector initiatives to establish funds within the region, the regional development agencies such as the Asian Development Bank (ADB) are playing an increasingly important role. On the back of their creation of a carbon facility, the ADB is providing support for the establishment of five new funds within the region as outlined below.

Media Extract 2: ADB to help create funds for clean energy projects

Apr 18, 2008 - Asia Pulse Data Source Islamabad

The Asian Development Bank will help establish five private sector funds targeting investments of up to \$1.2 billion (750 million euros) for clean energy projects in Asia, the bank said Thursday. The Manila-based bank said it will provide \$20 million (euro12.56 million) to each of the five private equity funds, for total seed money of \$100 million (euro63 million).

ADB believes the success of these funds will help demonstrate the credibility of private equity in the emerging clean energy sector in developing Asia, and mobilize capital to support other private equity funds, Mu-Shin Kim, Investment Specialist in ADB's Private Sector Operations Department, said in a statement. The funds MAP Clean Energy Fund, China Environment Fund III, GEF South Asia Clean Energy Fund, Asia Clean Energy Fund, and China Clean Energy Capital were selected from 19 fund managers who responded to ADB's call in July 2007 for the establishment of clean-energy focused private equity funds.

By 2030, global energy demand will likely rise 53 percent from current levels, with a large portion of the demand coming from developing countries in Asia, ADB said. The energy investment in the region is highly dependent on coal-fired power generation and significant resources need to be invested into clean energy and low-carbon alternatives over the next few decades, Kim added.

Coal is considered the dirtiest, most carbon intensive of all fossil fuels. Emitting 29 percent more carbon per unit of energy than oil and 80 percent more than gas, it is one of the leading contributors to climate change, according to the environmental group Greenpeace.

The MAP Clean Energy Fund (MAP) has the largest target size of the five funds, aiming to invest \$400 million in 10-15 projects across Asia, with a focus on Indonesia and Southeast Asia. Projects include geothermal ventures in Indonesia, wind projects in India and Pakistan, and bio-ethanol farms in the region without competing with food crops. The other funds target mobilizing investments ranging from \$100-250 million.

China³

China currently derives 90% of electricity from fossil fuels and 70% from coal. The hydro electricity sector is well developed and the use of wind power is developing rapidly. Large state owned generation enterprises control 90% of installed capacity.

In response to concerns including energy security, climate change issues and air pollution, China is encouraging development of the renewable energy sector. The 11th 5 year plan calls for renewable energy, including hydro, to account for 10% of the nation's total energy consumption by 2010.

Targets for 2010 in the plan include installed hydropower capacity of 190 million kilowatts (kW), wind power capacity of 10 million kW, bio-energy generation capacity of 5.5 million kW and solar energy capacity of 300,000 kW. This would produce a reduction of 3 million tons of sulphur dioxide emissions and more than 400 million tons of carbon dioxide emissions compared to installation of coal generated power.

In 2006, a Renewable Energy Law was inaugurated. The law and supporting legislation set targets for 15% of electricity to be sourced from renewables by 2020, including hydro power. This target has been estimated to require AU\$350 billion investment to achieve. A more specific target requires all power generators to derive 3% of power from renewable sources, excluding hydro power, by 2015.

China has abundant renewable energy resources, including resources for the more mature technologies of hydro, wind, biomass and solar power as well as mid to longer term technologies such as geothermal energy and ocean energy. Each of these resources offers potential to provide an energy equivalent to several hundred million tons of standard coal every year and can play an important role in the energy structure of China. Table 1 indicates estimates of useable renewable energy resources.

| Resource | Potential installed capacity | Potential annual power generation |
|------------------------------|------------------------------|-----------------------------------|
| Wind (land) | 600-1000 million kW | |
| Wind (offshore) | 100-120 million kW | |
| Wind (total) | 700 -1200 million kW | 1400-2400 billion kW |
| Solar | 2.2 billion kW | 2,900 billion kWh |
| Hydro (large scale) | 0.5 billion kW | 2,500 billion kWh |
| Hydro (small scale) | 120 million kW | |
| Geothermal (high temp) | 5.82 million kW | 30-40 billion kWh |
| Geothermal (low to mid temp) | 14.4 million kW | 86.4 billion kWh |

Table 1: Estimates of useable resources of renewable power in China⁴

Wind Energy

Areas with abundant wind energy resources nationwide are mainly distributed in the south eastern coastal areas, and nearby islands; northern areas including Inner Mongolia,

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⁴ NDRC

Xinjiang, the Hexi Corridor in Gansu; and the northeast and regions on the Tibetan Plateau. As wind generation costs are relatively competitive (see Figure 1), wind resources in China present great potential for development and wind power generation should become an important part in the future energy structure.

Estimated generating cost RMB per Kwh

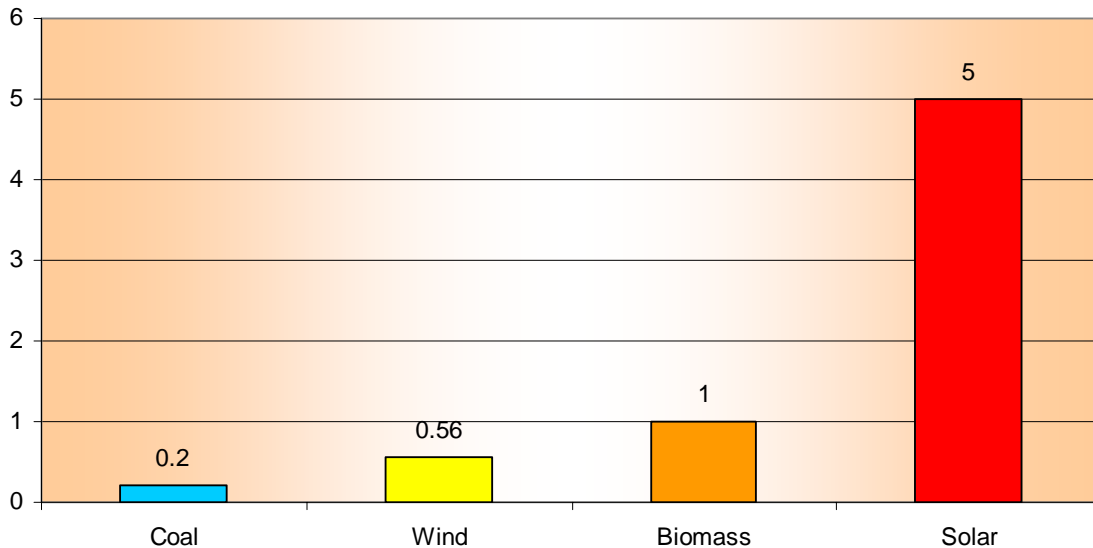


Figure 1: Estimated costs of energy generation

The development of grid-connected wind power generation in China started in the 1980s, sped up during the 10th Five-Year Plan from 2001-2005 and accelerated further from 2006. The total installed capacity rose from 1.26 million kW in 2005 to about 2.6 million kW in 2006 with an annual growth rate of 106%. China's installed wind power capacity ranked the 10th in the world in 2004 and had risen to the 6th by the end of 2006.

China's state development plan sets objectives for total installed wind power capacity of 5 million kW by 2010 and 30 million kW by 2020. During the 11th Five Year Plan Period, the state will construct about thirty 100MW large-scale wind power generation projects in prime wind areas including Eastern coastal areas, Northwest China, North China and Northeast China.

Special concessions for wind generation projects are an important factor for promoting large-scale development of wind power in China. Four phases of wind power concessions have been implemented successively since 2003. Investors are selected through bidding on conditions including the on-grid electricity sale price and rate of localisation of equipment. These concessions have resulted in implemented or planned capacity of 2.45 million kW, effectively lowered the on-grid electricity price, promoted diversified investment in wind power generation and increased the capacity of local production of wind power generation equipment.

Local manufacturers have been supported by vigorous promotional policies. With investment and technology transfer China is moving up the scale of wind power generation equipment manufacture. It has developed manufacturing technology for large-scaled wind power generation equipment below 750 kW; and direct-drive 1.2 MW wind power generation units have been put into trial operation. Some 1.5 MW wind-generation units have been largely locally produced and successfully installed. Development of wind power generation units of 3.2 MW and above is underway. Key components such as gear boxes, blades and engines etc are being produced for local and export markets. Domestic production accounted for 45% of the new wind power generation equipment installed 2006, a 10% increase on 2005.

In building over 100 wind farms, China has also developed technology and experience in the design, construction and operation of wind power generation projects and actively promotes development of wind power generation technology and skills. However the required scale of growth should stretch local capacity and provide on-going opportunities for foreign inputs.

Current development suggest that the objective of increasing the installed wind power capacity to 5 million kW in 2010 can be achieved two years ahead of target by the end of 2008, suggesting that the objective of 30 million kW capacity in 2020 is a good prospect and over the longer term wind power generation can compete successfully to become the third largest source of conventional power generation after thermal and hydro power generation after 10-15 years. Further development of local production capacity is a key ingredient to achieving long term objectives.

Off-grid small-scale wind power generation is also important in China. By 2006, 350,000 small-scale wind power generators with a total capacity of about 70,000 kW had been introduced in remote regions. China has developed about 30 different small-scale wind power generation models with capacity ranging from 100 watt to 10 kW. In 2005 about 33,000 small-scale wind power generation units were produced of which about 5800 were exported to over 20 countries.

Opportunities for Australia in the wind sector have arisen in planning and project development. Roaring 40's, a joint venture between Hydro Tasmania and China Light and Power, has been one of China's leading wind farm developers. The scale of wind power development in China should provide significant on-going opportunities for Australian service providers and niche technology developers.

Solar Energy

Whilst photovoltaic power generation is considered a relatively mature technology, high generation costs and shortage of silicon materials remain barriers to wide-scale application in China. The current cost of photovoltaic power generation of about CNY 4-6 per kWh has discouraged on-grid commercial applications. However, strong international demand from European and Japanese markets since 2004 has led to the rapid expansion of manufacturing capacity for photovoltaic products in China.

Manufacturing capacity has been developed for crystal silicon dice and photovoltaic cells and panels and a number of internationally recognized manufacturing enterprises have come into being. Manufacturing capacity for high-purity silicon material, silicon ingot, silicon dice, cells and components of photovoltaic cells in China ranked third in the world by 2006. The global shortage and high price of poly-crystal silicon has encouraged investment in production of silicon, which is expected to come on stream over the next two years. It is estimated that by 2010 the output of photovoltaic products in China may break through 1,000 MW, making China the largest producer of photovoltaic cells worldwide.

The largest market application of solar photovoltaic products has been for remote area off-grid power. The "transmitting electricity to townships" programme from 2002-2004 provided finance of AU\$708 million (CNY 4.7 billion) for construction of small scale photovoltaic power stations, solar-wind hybrid power generation stations and small hydroelectric power stations in 1,065 towns and townships in 12 provinces and regions such as Inner Mongolia, Qinghai, Xinjiang, Sichuan, Tibet and Shaanxi. Photovoltaic power stations accounted for the major part of this financing, and have utilised 17,000 kW photovoltaic cells. Other applications of solar power generation products, such as road lighting and flagship urban construction, have contributed to growth in photovoltaic power generation in China. By 2006, the accumulated capacity of photovoltaic power generation reached 80,000 kW, 42% of which is off-grid photovoltaic power generation in remote regions. Use of photovoltaic power industrial fields such as telecommunication equipment and consumer goods is increasing.

The Chinese government is pursuing strategies to steadily develop the photovoltaic industry. Plans call for the construction of a further 0.2 million kW of photovoltaic power to provide basic domestic electricity for 2 million remote households of farmers and herdsmen (at present, a third of the Chinese population lives without power supply). The state will also emulate developed country experience in urban roof solar systems by promotion of photovoltaic power in urban areas on public welfare buildings, other buildings, and public illuminating facilities such as roads, parks and bus stations etc. The state will also carry out large-scale model projects of grid-connected photovoltaic systems to prepare for general application of such systems when costs fall to a sufficient level. The total capacity of photovoltaic systems across these 3 aspects is projected to reach about 0.4 million kW by 2010 and 1.8 million kW by 2020.

Solar Water Heating

Solar Water Heating (SWH) is the most extensive application of solar energy, providing hot water and playing an important role in improving the life quality of residents, especially in medium and small cities. The total heat collecting area of SWH in operation in 2006 was about 100 million square meters and the annual manufacturing capacity exceeded 20 million square meters, up 20% from 2005. The quantity of solar water heaters used and produced in China accounts for over half of the total quantity worldwide. Solar energy water heaters and related industries such as glass, metal, heat preservation materials and vacuum equipment have formed a rapidly expanding commercial sector with over 1,300 enterprises producing solar energy water heaters.

Vacuum hot tube technology was developed in China. The technology is now widely used in China and exported to many markets in Europe, Asia and Africa with an annual output exceeding 16 million m², accounting for over 90% of the world vacuum tube water heater market.

In recent years China has completed a number of projects integrating solar water heater and new buildings. The idea of designing and constructing solar water heaters in new real estate projects is becoming gradually accepted in the construction industry. Rural area construction programmes have also provided good opportunities for promotion and application of solar water heaters. The Ministry of Construction promulgated a technical regulation on integrating solar water heating system with constructions at the end of 2005. The National Development and Reform Commission and Ministry of Construction encourage local areas to issue policies on compulsory application of solar water heaters.

Opportunities exist for export of some high value products for assembly in finished form, licensing technology or involvement in local manufacture of equipment. UNSW and BP Solar have established business in China with these models.

Biomass

It is estimated there are currently about 280 million tons of utilisable biological resources in China, mainly agricultural organic wastes. The amount of waste biomass will increase with development. The total potential of biomass resources in 2050 is expected to reach the equivalent of 1 billion tons of standard coal.

The technology for utilising methane is fairly mature in China. A large market for rural household methane projects is supported by government bonds and funds invested in such projects exceed CNY 2.5 billion annually. Government promotion and policy since 2000 has also encouraged medium and large-scaled methane projects in situations such as livestock and poultry farms, food processing, wine factories and urban sewage treatment plants. Most regions have established methane service agencies with strong technical service and professional design and construction teams... The technology is making a significant

reduction in greenhouse emissions from China's rural sector and further expansion is planned in coming years (see Table 6).

| Year | Rural household methane tanks | Methane produced (cubic meters) | Large scale farm methane projects | Methane produced (cubic meters) |
|-------------|-------------------------------|---------------------------------|-----------------------------------|---------------------------------|
| 2006 | 22 million | 10 billion | 2000 | (not available) |
| 2010 Target | 40 million | 15.5 billion | 4000 | 336 million |
| 2015 Target | 60 million | 23.5 billion | 8000 | 670 million |

Table 2: Current capacity and future targets for methane production in China. Source - NDRC

Besides methane, application of technology for other bio-energy is still in the initial stages of industrial development. Power generation from agriculture and forestry biomasses, urban rubbish, and shaped fuel produced from biomasses etc is being undertaken with significant plans for expansion. By 2006, the installed capacity of power generation units utilising biomass nationwide exceeded 2.2 million kW, including 1.7 million kW of power utilising sugar cane, 50,000 kW power generation capacity utilising rice husks and 0.4 million kW power generation capacity through burning urban rubbish. In addition, there are some small-scaled model power generation projects utilising gasification of biomass. Projects which can effectively utilise waste landfill have other advantages in management of urban waste which can make them attractive to city authorities.

Policies on biomass generation promulgated in 2006 encouraged an upsurge in power generation projects using straw and forestry wastes. In July 2007 the Ministry of Agriculture promulgated the "Development Plan for Agricultural Biological Energy", proposing development of model projects utilising agricultural produce and waste for energy. Programmes would enhance key technology and industrialisation, provide a new source of power and peasant income and lead to improvements which reduce the cost of development and utilisation of energy from agricultural sources. The plan proposes that a market-oriented agricultural biological energy industry can be preliminarily achieved by 2015. Problems such as scattered resources, high costs for collecting raw materials, and continuity and guarantee of supply of raw materials need to be managed to achieve national targets for biomass power generation of 5 million kW and 30 million kW in 2010 and 2020 respectively.

China has also encouraged bio-fuel development and constructed 4 pilot biological fuel ethanol projects utilising grains during "the 10th Five-Year Plan", with an annual manufacturing capacity of 1.02 million tons. Ethanol-blended gasoline was trialled in several provinces. However, recent R&D focus on bio-fuels in China has been on production of fuel from non-grain raw materials (mainly sweet sorghum, cassava and wood cellulose etc.) and technology for producing biological diesel with oil-yielding crops such as *Jatropha curcas* etc. At present, small-scale testing on manufacturing of fuel ethanol with sweet sorghum and cassava and biological diesel with *Jatropha curcas* has been carried out. It is estimated that the annual manufacturing capacity of fuel ethanol will reach about 2 million tons, and that of biological diesel will reach 0.2 million tons in 2010. Some enterprises in China are also researching and developing technology on biological liquid fuels with non-grain raw materials such as straw and wood.

There should be opportunities for innovative Australian technology and services in the biomass energy and biofuels sector in China, particularly in association with carbon credit projects and in situations where food crop substitution is avoided.

Hydro Energy

Hydro energy resources are mainly concentrated in western and south-western regions, and deployment would require enhanced power transmission from west to east. In addition, there is about 120 million kW of small-scaled hydroelectric resources with great potential for development nationwide. China has strong capabilities and experience in hydro power development and aims to lift the total hydropower capacity to 300,000 MW by the end of 2020, from around 129,000 MW at the end of 2006.

Investment in New Renewable Energy

A number of investment agencies are giving attention to the renewable energy industry in China, including the World Bank, the Asia Development Bank, HSBC Bank and Citibank. International finance groups like Morgan Stanley have entered the market and domestic commercial banks such as China Merchants Bank and private funds are also financing projects. Such financing activities have bridged fund shortages in the initial project development stage and have become one of the driving forces for development of new energy industries and creation of new public companies such as Wuxi Suntech -Power Co. Ltd.

Investment in 2007 is estimated to have totalled about CNY 75 billion, a 25% increase from 2006.

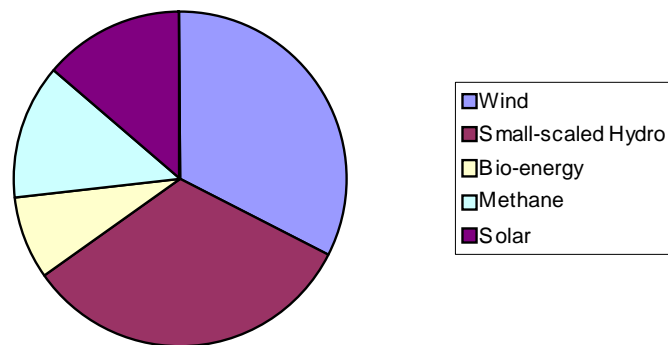


Figure 2: Renewable energy investment in 2007 in China

However, there is still shortage of funds for R&D on new energy technology with long technological R&D cycles and unclear investment returns. Commercial financing in this area is being strengthened by government support.



Figure 3: Shuangliao Wind Farm

Case Study 2: Datang Jilin Shuangliao Wind Farm Project⁵

The Datang Jilin Shuangliao Wind Farm Project involves the construction and operation of a 49.3MW grid connected wind farm in Shuangliao city, in the west of Jilin Province, China. The project will supply electricity to the Jilin Northwest Power Grid which is integral to and forms part of the North East China Power Grid. It will help reduce GHG emissions versus the high-growth, coal-dominated business-as-usual scenario.

The Project will assist China in stimulating and accelerating the commercialisation of grid connected renewable energy technologies and markets, thereby contributing to the implementation of national targets for renewable generation of 10 and 12 percent by the years 2020 and 2040 respectively. Furthermore the Project will demonstrate the viability of larger grid connected wind farms which can support improved energy security, improved air quality, alternative sustainable energy futures, improved local livelihoods and sustainable RE industry development. The specific goals of the Project are to:

- reduce greenhouse gas emissions in China compared to a business-as-usual scenario,
- help to stimulate the growth of the windpower industry in China,
- create local employment during the assembly and installation of wind turbines, and for operation of the windfarm,
- reduce other pollutants resulting from the power generation industry in China, compared to a business-as-usual approach.

The Project is estimated to lead to the displacement of 105,120 MWh/year of conventional generation, thus averting the use of 37,000 tons of standard coal per year. In addition to lowering CO₂ emissions, the project will yield substantial local environmental and public health benefits through annually averting 581.5 tons SO₂, 11.9 tons of CO, 471.4 tons of NO_x, and 5.2 tons of mercury contained within the flue dust.

Approximately 646,800 tCO₂e in emission reductions will be generated during the initial crediting period, or approximately 92,400t CO₂e per year. The CERs generated by these emission reductions will be sold to the UK based Climate Change Capital Carbon Fund.

Australian Company Roaring 40s is one of the joint venture partners for this project, obtaining host country approval from the UK.

Roaring 40s is a leading renewable energy company based in Hobart, Australia and is a joint venture between two world renowned energy companies: Tasmanian government-owned Hydro Tasmania and Hong Kong based China Light and Power. Roaring 40s has a strong commitment to renewable energy development in China as part of an effort to contribute to the management of global climate change concerns.

⁵ This information is sourced from the Project Design Document submitted to the UNFCCC and is available at <http://cdm.unfccc.int/Projects/DB/DNV-CUK1169448721.03/view>

Since entering the Chinese wind energy market in late 2005, Roaring 40s has become the largest foreign investor in the sector. In conjunction with relevant Chinese partners, Roaring 40s has three wind farms (3 X 50 MW) in operation in Jilin and Shandong and three wind farms (3 X 50 MW) under construction in Shandong. Roaring 40s also has plans to commence the construction of a number of further wind projects (over 800MW in total) in Shandong, Jilin, Hebei and other provinces within this year.

The major contributing factors to Roaring 40s success in China has been the support from national and provincial governments with regard to renewable energy developments and Roaring 40s capacity to seek out and secure strong and compatible partners to jointly develop projects.

Roaring 40s investment in the renewable energy sector in China has been strongly supported by both the Chinese and Australian governments. His Excellency Wu Banguo, President of National People Congress, witnessed the signing of Roaring 40s first wind project in May 2005 in Canberra. Roaring 40s second project, the Rongcheng wind farm, was signed in April 2006 as part of the commercial activities of the visit to Australia by his Excellency Wen Jiabao, Premier of China; and in March 2007, His Excellency Zheng Peiyan witnessed in Canberra the signing between Roaring 40s and Guohua for the Lijin, Hekou and Zhanhua wind farm projects. In addition to this high level support, in October 2006, Hon Mr Ian Campbell, Australian Minister for Environment, and Mr Wu Guihui Vice Director General for Energy of NDRC inaugurated Roaring 40s Shuangliao Wind Farm in Beijing.

Green Building and Energy Efficiency in China

China is the world's fourth largest economy and the second largest energy consumer. Building-related energy consumption accounts for 30% of the country's total energy use. This figure rises to 40% if manufacture and transport of building materials is considered. Buildings in China often use 2 to 3 times the energy required by equivalent buildings in developed countries. Half of the world's buildings constructed between now and 2020 are expected to be in China. It is believed that, if nothing is done to check the energy situation, building-related energy consumption in China will double by 2020.

The granting of the right to host the Olympics in 2001 gave impetus for green building in China. Concern over energy prices, energy security and climate issues have contributed to further attention to issues of building energy efficiency and major updates to the Energy Saving Law came into effect April 2008. Quantitative energy saving targets are now built into planning at each level of government, and energy efficiency is an important factor in the performance assessment of local government.

Under China's 11th five-year plan to 2010 efforts are being made to cut energy consumption per unit of gross domestic product (GDP) by 20 percent, or four percent each year. But, the consumption actually fell by just 1.23 percent in 2006 and renewed efforts are being made towards achieving the target.

Green building is given importance in the plan and other policies for longer term technology development. Frontline cities like Guangzhou, Shenzhen, Shanghai, and Beijing are under pressure to achieve 50% energy saving for all new buildings (based on the energy standards of 1980's). The government has launched an ambitious plan to renovate existing buildings to make them more energy-efficient. Twenty-five percent of the buildings in medium-sized cities and 10% of those in small cities are to be refurbished by 2020.

Regulations and Standards

Laws and standards relevant to green building include:

Law on Energy Saving Major

Updates to the law came into force in April 2008. These doubled the size of the legislation and extended its scope beyond the industrial sector to include construction and transportation. One very significant element is that the law includes provisions that performance reviews for local government officials will now include in assessments of their progress in saving energy.

The revised law provides a framework for strict local energy saving standards in the construction industry which will reflect the local situation. It requires property developers to include information on energy saving measures in the property quality certificate and sale contract. The law stipulates that projects which fail to meet energy conservation standards should not be given construction approval, that projects already under construction which fail to meet energy conservation standards should be halted, and that below-standard buildings cannot be sold.

The law also calls for incentives to encourage energy efficiency through taxation preferences and loans for energy saving technology. New energy saving building materials and equipment, and the integration of renewable energy systems in to buildings are encouraged.

Regulations on Energy Use for Buildings

China's Ministry of Housing and Urban-Rural Construction (MHURC) issued a range of design standards and guidelines relating to building energy efficiency. These cover aspects including building shell, lighting, HVAC (heating, ventilation and air conditioning), building-aspect, land use and conservation, energy use and efficiency, water use and conservation, building materials, management and recycling, indoor environment quality, maintenance and operational management of buildings.

Standards for energy efficiency are set according to 5 climatic zones, an important consideration given wide climatic variations. Each individual standard tends to be narrow in scope and refer to other standards. This is in part a reflection of the way that Chinese developers often construct only a building shell, which occupiers fit out with HVAC and other equipment. Building standards enforcement is stronger in major urban centres than in secondary cities and smaller centres.

Assessment Systems for Green Buildings

In 2006 the Ministry of Construction developed the "Evaluation Standard for Green Building" (GB/T 50378-2006), which is similar to LEED in structure and rating process. The standard is being used to evaluate building performance data and a three-star Green Building certificate will be awarded to the qualified buildings.

The US LEED system is also being used. At the end of 2007, there were reported to be 5 Chinese projects certified under LEED, with another 51 projects registered.

Green Olympic Building Assessment System (GOBAS) is another green building rating system, which was developed from the Japan's Comprehensive Assessment System for Building Environment Efficiency (CASBEE).

Market Characteristics

Footprint of Green/Energy Saving Building

In order to achieve China's goal in energy saving and sustainable development, the Ministry of Construction (MOC) proposes a target for new building and existing building: the new building will reach the standards of green building and intelligent building by the rate of 50% by 2010 and 65% by 2020. One third of existing building – around 13 billion square meters requires renovation of energy saving.

MOC statistics indicate that by 2007 China had built 1.06 billion square meters of energy efficient buildings, but the figure represents only 7 percent of the total floor space of existing buildings in urban China, statistics from the Ministry of Construction show. According to a survey by the ministry in 30 regions, the four municipalities of Beijing, Shanghai, Tianjin and Chongqing are doing relatively well in implementing energy saving codes, but other regions are a long way behind in technological standards and government supervision.

Urban Regeneration

The concept of regeneration has recently captured the attention of some of China's urban planners. There is an emerging recognition that China's model of massive scale clearance and rebuilding has caused unsustainable urban development and waste in investment and resources.

Some decision makers of urban planning have realised the importance of integrating China's cultural heritage, environmental protection, community oriented design and sustainable construction. Regeneration is seen as a method of aligning social and economic goals with an improved physical environment. However, local urban planners and designers lack experience in regeneration experience and techniques.

Building Consultancy Services in China

Most of local building consultancy and project management enterprises in China have strong linkages with governmental agencies, since they used to be affiliated under these departments. According to China National Association of Engineering Consultants (CNAEC), growth in the sector has been rapid and there are now around 500,000 engineering consultants in China.

However, the building consultancy and project management section are still under developed. Issues such as insufficient authority for consultants in project decisions and cost control, low remuneration and the presence of unqualified consultants remain. Foreign consultancy companies find opportunities in more prestigious projects and multilateral or bilateral donor financed projects.

The registration systems for engineering consultants, engineering consultancy enterprises and architects are under the control of Chinese governmental agencies. This has placed limits on foreign involvement in the sector.

Market Access & Barriers

China provides major opportunities for foreign companies in all aspects of the construction industry. However, market penetration presents many challenges and takes a concerted effort over time.

For building equipment and materials, China's cost structures frequently require a degree of localised manufacture. Options to contract manufacturers, license technology or establish joint ventures or wholly owned subsidiaries should be considered. These options may complement manufacture of key components or high end models in Australia and assist Australian companies to obtain globally competitive cost structures.

The MOC issues licenses for foreign service companies operating in the fields of construction, engineering design and urban planning. The decrees governing issuance of these licenses have been considered trade barriers by foreign construction, architecture and engineering service companies. They set requirements for capital registration, professional qualifications and the minimum percentage of foreign professional staff to be employed in foreign invested design enterprises. Foreign design, architecture planning and engineering services companies must partner with a local Chinese institute. High quality or specialised local design institutes play a leading role and these are affiliated to government departments and are not open to merger or acquisition by foreign firms.

Australian firms must ensure they devote enough time and resource to building relationships with local authorities and business partners to overcome the relatively lack of transparency in the market.

As in other markets, China's construction sector has a strong focus on initial costs and this can impede efforts to implement energy efficiency measures which provide savings over time. Residential and low to mid range office and retail projects are usually sold off during the construction stage in China so the longer term goal of energy savings is not a priority for developers. At the higher end of the residential, retail, and office market, green certification like LEED can be a convincing market differentiator and selling point. Whilst this trend can be expected to gather momentum, the key driver for energy efficient building may be government regulation rather than market demand. Development of local voluntary standards based on international models like LEED is at an early stage and when this is consolidated such a standard should provide a significant incentive for demand.

Green Projects

Some examples of green building projects are listed under some of the major cities below.

Beijing - Four demonstration buildings have been constructed or are in the planning stages in Beijing to promote the development of green building technology.

- **China-USA energy efficiency demonstration building** - The new Ministry of Science building in Beijing is the first green building in China which meets internationally acknowledged energy efficiency criteria. The building uses 70 percent less energy than similar federal buildings and saves 10,000 tons of water a year through rainwater collection. Although more than 400 people work there, the building uses the amount of energy generally required for only 200.
- **Renewable energy utilisation demonstration building** – This building, owned by Tianpu Group, was constructed with the support of Beijing Municipal Science and Technology Commission. The building, with an area of 8000 square meters, uses several advanced renewable energy technologies, including solar hot water technology, solar photovoltaic power generation technology, solar absorption heating and air conditioning technology, as well as ground source heat pumps.
- **Advanced energy technology demonstration building at Beijing university of Technology** - This building has a floor space of 5000 square meters and will house the Ministry of Education's 'Key Laboratory of Enhanced Heat Transfer and Energy Conservation'. Eleven advanced energy technologies will be integrated into the building including: ground-source heat pumps; energy efficient lighting; heat recovery; thermal energy storage; photo-catalytic air cleaning; anti-fouling technology; thermal insulation; solar concentrating photovoltaic power generation; wind power; energy consumption testing and humidity control.
- **Super low energy consumption building at Tsinghua University** - A super low energy consumption building of 2800 square meters using advanced technologies for clean energy and energy conservation. This includes solar energy, new heat storage technology, natural ventilation, green lighting technology and insulation.
- **Modern MOMA (Museum of Modern Art) or 'Linked Hybrid' building.** Designed by US-based Steven Holl Architects, and envisaged as a "city within a city", the Linked

Hybrid will feature one of the world's largest geothermal cooling and heating systems. The building is applying for LEED accreditation.

- **Hot Spring and Leisure City** - Designed by the Australian firm SDG Design Group, this water sport resort features a number of energy efficient technologies such as roof-pipe cooling, advanced ventilation and an opening roof.
- **Water cube Swimming Centre** – Designed by Australian architects PTW, the centre has a number of energy efficient features.

Shanghai

- **Dongtan Eco-City** - The Shanghai Industrial and Investment Corporation commissioned Ove Arup & Partners to create a master plan for one of the 11 eco-cities. Dongtan, at Shanghai's Chongming Island, east of Shanghai has been proposed to be the world's largest eco-city. It will measure 8,400 hectares and will be largely water and energy self-sufficient.
- **Shanghai Ecology Demonstration office building** - Winner of the 'Green Innovation Design Award' and the 'Top 10 best Construction Achievement Award'. It uses 75% less energy than comparable buildings. Twenty percent of the total construction energy will be sourced from renewable energy. Volatile Organic Compounds (VOCs) will not be used in the interior environment and much recycled material will be used.

Guangzhou

- **Guangzhou University City**
- **Guangzhou International Convention Exhibition Centre**

Shenzhen

- **Shenzhen Qiaoxiang residential project** – A residential area of 500,000 square metres with 200,000 thousand square metres of solar energy systems.
- **Shenzhen Fraser Hotel (TaiGe service apartment)** – received a LEED silver rating.
- **Shenzhen Vanke Real Estate Development Company** – is working with The Netherlands Housing Department to design a residential housing project which will include energy saving technology from The Netherlands.

Opportunities for Australian Suppliers

Services

- Architecture and Design
- Interior Design

Products

- HVAC (heating, ventilation and air-conditioning)
- Building integrated solar systems
- Energy efficient lighting
- Openings – windows, louvres, doors and skylights
- Smart house technology
- Water saving and storage systems
- Insulation systems
- Green wall materials

Key Organisations

National

- National Development and Reform Committee
- Ministry of Housing and Urban-Rural Construction (MHURC)

- Ministry of Science & Technology

Guangdong

- Guangdong Development & Reform Commission
- Guangdong Construction Department
- Guangdong Economic & Trade Commission
- Shenzhen Energy Group
- Guangzhou Institute of Energy Conversion,

Shanghai

- Shanghai Green Building Council (SHGBC)
- Shanghai Municipal Housing Authority
- Shanghai Energy Efficiency Building Materials Office.
- Shanghai Commercial Building Committee

India

Green Buildings

The construction industry in India is rapidly growing and represents 10% of India's GDP. The sector is growing at a rate of 9.2% compared to the world average of 5.5%. India has major construction capabilities in the areas of buildings, infrastructure development and highway projects. The growth of construction industry provides impetus to other manufacturing sectors like cement, iron & steel, power, chemicals, etc.

In recent years, India has emerged as one of the world's top destinations for green buildings.

A major impetus to the Green Building movement in India was construction of the Green Business Centre building in Hyderabad in 2003. The building was the first Green building project in India and was developed with a successful model of public-private partnership between the Government of Andhra Pradesh, Godrej & Boyce Manufacturing Company and the Confederation of Indian Industry (CII), with the technical support of USAID. The building achieved a platinum LEED rating and raised awareness amongst stakeholders in the construction industry. Advisory services provided by the Centre to assist green building

developers have also made a major contribution.



India's green building footprint has grown from 1858 square meters in 2003, to spread to projects covering 12.54 million square meters by mid 2008. A variety of green building projects have been completed or planned - residential complexes, exhibition centres, hospitals,

educational institutions, laboratories, IT parks, airports, government buildings and corporate offices. The Indian materials and equipment manufacturers are now faced with a challenge to provide green features to meet the growing demand for Green Buildings. The Indian Green Building Council (IGBC) estimates the demand for green building materials and equipment will reach \$4 billion a year by 2010.

National shortages of power and water are significant factors encouraging Indian focus on Green Building. In an environment where developers and occupiers have traditionally needed to consider installation of expensive back up power generation equipment to cater for disruptions to grid power, energy efficiency has particular attractions. Major drivers for the Green Building sector are coming from the private sector, encouraged by the promotional efforts IGBC, the introduction of an Indian LEED rating system and investor and occupier demand for more efficient and amenable working and living space. The fact that market demand rather than regulation is driving the sector is a promising sign for on-going growth. India's strong skills base in engineering and information technology also augurs well for development.

Regulations & Policy

LEED India

The LEED (Leadership in Energy and Environmental Design) green building rating system developed by the US Green Building Council is an international rating system followed by more than 24 countries. LEED has been adapted by the Indian Green Building Council to suit local conditions and priorities. LEED India for New Construction (LEED India NC) deals with high performance commercial buildings and LEED India CS (Core & Shell) deals with situations where owners and developers do not control all aspects of building fit out due to activities of tenants eg shopping malls and IT parks.

The LEED-India rating system has incorporated changes like more emphasis for water conservation and adoption of local codes and guidelines such as National Building Code of India, Ministry of Environment and Forests guidelines for large projects and the Energy Conservation Building Code issued by India's Bureau of Energy Efficiency.

Certification levels of basic certification, silver, gold and platinum apply according to points ratings for site sustainability, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality and innovation.

At mid 2008 the IGBC records indicate 224 buildings have been registered for LEED, and 23 have been certified, providing a green building footprint of 135 million square feet.

LEED India Rating System & Energy Efficiency

Energy efficiency in design has been achieved by a number of buildings in India by adopting the LEED India green building rating system.

A LEED rated building consumes 30-50% lower energy as compared to a conventional building. Energy performance of three 'LEED Platinum' rated buildings have been monitored for about 3 years and energy savings achieved are shown in the Table below:

| Building | Built-up Area (Sq.ft) | Consumption of Conventional Building (kWh) | Consumption of LEED Designed Building (kWh) | % Reduction | Annual Energy Savings (Rs in Lakhs) |
|-----------------------------|-----------------------|--|---|-------------|-------------------------------------|
| Wipro Technologies, Gurgaon | 1,75,000 | 48,00,000 | 31,00,000 | 40% | 102 |
| ITC Green Centre, Gurgaon | 1,70,000 | 35,00,000 | 20,00,000 | 45% | 90 |
| CII Godrej GBC, Hyderabad | 20,000 | 3,50,000 | 1,30,000 | 63% | 9 |

Table 3: Monitoring of energy savings in LEED rated buildings

IGBC Green Homes Rating System

On 2 May 2008, IGBC launched a Green Homes rating system. The IGBC-Green Home rating system is India's first ecological rating programme developed exclusively for the residential sector, and addresses national priorities such as conservation of natural resources, infrastructure, water and energy efficiency, handling of domestic waste, health and well being of the occupants. The rating system aims to achieve water savings of 30-

50% and energy savings of 20-30%, as well as improved day lighting, enhanced ventilation and effective waste management.

Fifty pilot projects with a built-up area of more than 47 million sq ft have signed up for the rating system. The system is a voluntary, consensus-based, and market-driven, and based on accepted energy and environmental principles which strike a balance between known established practices and emerging concepts. It includes certain credit points using a prescriptive approach and other credits on a performance based approach.

Construction categories include individual homes, gated communities, high rise residential apartments and retrofit of existing residential buildings. Different levels of green building certification are awarded based on the total credits earned. The system is designed to be comprehensive in scope, yet simple in operation.

National Codes and Standards

The Ministry of Power, Bureau of Energy Efficiency has launched the 'Energy Conservation Building Code' (ECBC). This code is voluntary and applicable to buildings or building complexes that have a connected load of 500 kW or a contract demand of 600 KVA, whichever is greater. This code addresses the minimum performance standards for energy efficiency in a building covering:

- Building Envelope, including thermal performance requirements for walls, roofs, and windows;
- Lighting System, including day lighting, and lamps and luminaire performance requirements;
- HVAC System, including energy performance of chillers and air distribution systems;
- Electrical System
- Water heating and Pumping Systems, including requirements for solar hot-water systems.

The Code provides options for compliance with the performance requirements for each subsystem and system or building-level performance compliance. Simulation exercises indicate that ECBC-compliant buildings use 40 to 60% less energy than similar baseline buildings. The Code has 5 variations which relate to different climatic zones in India.

India has a National Building Code but state governments play a key role in setting the building regulations and as a result these vary according to jurisdiction. They are generally not as comprehensive or stringent as the voluntary LEED standards.

A major focus of regulations for residential and commercial buildings is water use. For example, water harvesting is mandatory in the southern state of Tamil Nadu.

Commercial developers must generally endeavour to implement energy efficiencies in new buildings. In many states, owners of industrial buildings have to demonstrate energy savings achieved in their annual reports.

Energy Efficiency in Buildings

US Department of Energy research suggests that whilst the Indian population growth rate is expected to grow at 1.3%, the energy consumption rate is expected to grow at 4.3%. This trend places strain on the energy sector to meet the demand and represents a major greenhouse emissions issue. Commercial buildings are one of the major consumers of energy and are the third largest consumers of energy, after industry and agriculture. Buildings annually consume more than 20% of electricity used in India. Hence energy efficiency in the building sector assumes tremendous importance.

The potential for energy savings is 40-50% in buildings, if energy efficiency measures are incorporated at the design stage. For existing buildings, the potential can be as high as 20-25% which can be achieved by implementing house keeping and retrofitting measures. The incremental costs incurred for achieving energy efficiency is 5-8% vis-à-vis conventional design cost and can have an attractive payback period of 2-4 years.

Green Building Potential in India

The rapidly developing construction of Green Buildings in India promises to open up a wide range of opportunities for domestic and international players in construction, architecture and engineering design, building materials and equipment manufacture.

IGBC's projected growth potential for Green Buildings in India is shown in the following table:

| Year | Projected Certified Green Buildings (Nos. per year) | Estimated Market Potential in Million US\$ |
|-------------|--|---|
| 2006 | 20 | 80 |
| 2007 | 50 | 200 |
| 2008 | 150 | 500 |
| 2012 | 1000 | 4000 |

Table 4: Projected numbers of certified LEED rated buildings (IGBC)

Green Building Materials & Equipment in India

Availability of materials and equipment is one of the major issues to be addressed. The scale and cost structure of the Indian market makes it likely that opportunities for direct imports will be limited in extent and longevity. Strategies for localising segments of production through licensing or investment will often be required to gain a lasting position in the market.

There are many examples of products with untapped market potential - composting toilets, waterless urinals, low VOC adhesives & sealants, green certified carpets and wood, high albedo roof paints, heat resistive paints, fly ash blocks, insulation materials, high efficiency chillers, variable frequency drives, high efficiency cooling towers, building management systems, lighting controls, BIPV (Building Integrated Photo Voltaics), and new technologies like wind towers.

IGBC estimates a potential market for Green Building materials and equipment of nearly US\$4 billion by the year 2010. The estimated business potential for green materials & equipment are shown below:

| Green Building Materials & Equipment (Product-wise) Business Potential in India by 2010 | | | | |
|--|------------------------------------|--|--|---|
| SI No | Materials & Equipment | Potential for Green Buildings Million US\$ per year | Potential for Non Green Buildings per year in million USD | Total potential Million US \$ per year |
| | Select Materials | | | |
| 1 | Fly ash based blocks | 90 | 810 | 900 |
| 2 | Recycled flooring tiles | 10 | 90 | 100 |
| 3 | CRI Certified Carpet | 10 | 90 | 100 |
| 4 | Recycled materials for false | 10 | 90 | 100 |
| 5 | Low VOC Paints | 10 | 90 | 100 |
| 6 | Recycled Particle & Gypsum boards | 10 | 90 | 100 |
| 7 | Recycled Aluminum works | 10 | 90 | 100 |
| 8 | FSC Certified Wood | 15 | 135 | 150 |
| 9 | Energy efficient Windows | 10 | 90 | 100 |
| 10 | High performance Glazing & Glass | 15 | 135 | 150 |
| 11 | High Albedo roofing paints | 10 | 90 | 100 |
| 12 | Eco Friendly Modular | 25 | 225 | 250 |
| 13 | Bamboo Products | 15 | 135 | 150 |
| | Select Equipment | | | |
| 1 | HFC Based High Efficiency chillers | 50 | 450 | 500 |
| 2 | Variable Frequency Drives | 10 | 90 | 100 |
| 3 | Building Automation System | 30 | 270 | 300 |
| 4 | Solar PV | 10 | 90 | 100 |
| 5 | High efficiency light sources | 10 | 90 | 100 |
| 6 | Waterless Urinals | 5 | 45 | 50 |
| 7 | Composting toilets | 5 | 45 | 50 |
| 8 | Living machines | 5 | 45 | 50 |
| | Total | 365 | 3285 | 3650 |

Table 5: Projected demand for materials and equipment by 2010 (IGBC)

Green Building Services in India

International innovation and expertise can play an important role in development of Green Building in India. US inputs in the design of the Hyderabad Green Business Centre and development of Indian LEED standards are an example. There is potential for:

- Architectural and green design services
- Energy modelling systems and demand management services
- LEED-accredited professional services
- Building management systems

As with product supply, local partnerships are often necessary. For example, in the architectural sector, partnership with Indian firms or establishment of a local presence may be required to win work and to utilise Indian cost structures for detailed design of Australian concepts. Integrating elements of India's internationally competitive services sector into Australian company supply chains may enhance capacity and global competitiveness.

The Confederation of Indian Industry and Indian Green Building Council have initiated work together with the government of Victoria to research joint opportunities for setting up green building projects. The findings of the collaborative research are expected to be submitted at a global meeting to be held in Australia in 2008, 'SB08'.

Key Indian Organisations

Indian Green Building Council (IGBC) (<http://www.igbc.in>)

IGBC, which is part of CII-Godrej Green Business Centre is represented by stakeholders of construction industry - corporations, government, architects, material manufacturers, professional institutions, etc. The vision of the council is to serve as single point solution provider and be a key engine to facilitate all Green Building activities in India. Specific objectives are as follows:

- To create awareness of sustainable building.
- To promote the new LEED system, which has been tailored to Indian conditions.
- To develop LEED-accredited professionals in India.
- To facilitate the construction of 100 green buildings per year by 2012.

Bureau of Energy Efficiency (<http://www.bee-india.nic.in/>)

The Bureau is a statutory body under the Ministry of Power. Its primary role is to reduce the energy intensity of the Indian economy through encouraging energy efficiency in sectors including agriculture, buildings, industry and power distribution. The Bureau is a central agency which co-ordinates activities with units in State governments. It has developed the Energy Conservation Building Code.

The World's largest solar kitchen

The solar kitchen has been set up at Taleti, near Mount Abu, situated at a height of 1219 m above sea level in Rajasthan. It boasts a six-module solar steam cooking system and a total of 84 parabolic dish concentrators shell type receivers. Each oval parabolic concentrator has a reflective surface area of 9.2 square meters, and reflects sunlight on the receivers by special white glass pieces. Steam is collected in the header pipes, which is then directed via insulated pipes to cooking vessels in the kitchen.

The system generates temperatures of up to about 650 degrees, and 3500-4000 kg of steam per day. The food is cooked in 200-400 litres capacity cooking pots, producing an average of 20,000 meals a day, and up to 38,500 meals per day during periods of peak solar radiation maximum.

A total of AU\$5 million has been spent on this endeavour. The programme is part of a special demonstration project of the Ministry of New and Renewable Energy (MNRE), Government of India.



Thailand

Current Energy Status

Thailand's primary energy demand is projected to grow at 4.6 percent annually over the next 25 years; mainly from increased demand for oil in the transport and industrial sectors. A number of key issues face Thailand:

Reducing the economy's high reliance on natural gas for electricity generation will be a major challenge, and this is likely to be addressed by increasing use of coal. In addition to increasing domestic oil and natural gas reserves and diversification of alternative energy sources, Thailand aims to enhance energy conservation measures to reduce energy demand in all sectors.

Another way to secure Thailand's electricity supply is through power interconnection with either Lao PDR, Cambodia, and Viet Nam, through the Greater Mekong Sub Region Initiatives; of which a number of hurdles still need to be overcome (for example, lack of transmission facilities to effect transfers, regulatory protocols, cross-border tariffs, etc.)

It is estimated that investment up to US\$ 200 billion is required over the period to 2030 to construct the necessary infrastructure to meet Thailand's projected energy demand.

In 2006, the peak power demand was 21,064 MW. The projected peak demand for 2007 was some 22,500 MW. As of April 2007, the total installed capacity of the power systems is 27,788.5 MW comprising EGAT power plants of 15,794.6 MW (56.8%) and the power purchased from private companies including the power purchased from neighbouring countries of 11,933.9 MW (43.2%). This installed capacity can be categorized by power plant types as;

- hydro power plants of 3,764.2 MW (13.6%),
- thermal power plants of 9,666.6MW (34.8%),
- combined cycle power plants of 12,806.0 MW (46.0%),
- gas turbine and diesel power plants of 972.4 MW (3.5%),
- renewable power plants of 279.3 MW(1.0%)
- the Thailand-Malaysia interconnection 300.0 MW (1.1%).

Clean Energy Regulatory Framework

Since 1992, the Thai Government has issued numerous laws and decrees to promote and support energy-efficiency programmes. Amongst these are those that promote energy conservation programs and provided for the establishment of the 1993 Energy Conservation Promotion Fund (ENCON Fund) which was designed to provide financial support for energy conservation and renewable energy programs. Later decrees have provided specific procedures for conducting preliminary and detailed energy audits, and submitting energy conservation targets and plans.

The ENCON Act was considered a major step for Thailand in the promotion and implementation of energy efficiency (EE) and renewable energy programs. It was established by collecting a small levy on petroleum products. The annual inflow to the ENCON Fund is about 1,500 million Baht (US\$37.5 million). Through the ENCON Fund, the government has been able to promote and support hundreds of EE programs and projects since 1995.

To reduce the investment costs of the Electricity Generating Authority of Thailand (EGAT) in power supply, there are regulations to promote private sector investment. These include the independent power producer (IPP), small power producer (SPP), and very small power producer (VSPP) programs.

The IPP program encourages the private sector, using conventional energy resources, to play an even stronger role in the electricity supply industry of the country. As of September 2006, the total installed capacity of IPPs was 3,136 MW (approximately 15 percent of total capacity).

In order to address Thailand's heavy dependence on imported oil, the government devised a National Energy Strategy in 2005. Amongst other measures this focuses on

- Establishing a regulatory framework for electricity and natural gas industries;
- Enhancing energy supply for national energy security;
- Promoting energy saving and energy efficiency;
- Promoting renewable and alternative energy, and diversifying fuel types and sources;
- Instituting market-based pricing structures to reflect true costs in a transparent manner and promote competition;
- Setting a mandate on clean energy to lessen negative impacts on the environment; and
- Promoting public and private participation in policy for sustainable development.

Energy Efficiency

There are three types of programs included in the ENCON Act: compulsory, voluntary, and complementary.

The compulsory program, implemented primarily by the Department of Alternative Energy Development and Efficiency (DEDE), requires that designated factories and buildings conduct energy audits and submit energy conservation targets, plans, and reports every three years. The voluntary program, implemented primarily by the Energy Policy and Planning Office (EPPO), promotes and supports energy efficiency and renewable energy programs, such as energy conservation in tobacco curing and ceramic kilns. It also promotes energy conservation technology, enhances marketing of energy efficient equipment, demonstrates and disseminates PV grid connections for households and government buildings, PV-pumping for village water supply, and biogas from animal slaughter houses. Additionally, the EPPO supports a wide range of R&D projects. The complementary program aims to promote and increase competency of human resources in energy-related fields and to raise awareness on energy conservation through public campaigns.

Renewable Energy

The Thai Government has also been trying to promote the utilization of renewable energy as another means to diversify energy sources. It aims to establish a 3-5 percent Renewable Portfolio Standard (RPS) for all new generating capacity installed, and the targeted share for renewable power generation has been proposed at 6 percent of total generating capacity by 2011. However, widespread diffusion of renewable resources has been hampered by their high cost relative to other energy sources, high initial capital costs, and the limitation of available renewable resources, especially biomass.

The SPP and VSPP programs were launched to support renewable electricity production from biogas, biomass, municipal solid waste (MSW), wind, solar, and other renewable energy sources. The SPP program was established to encourage interested investors using conventional and non-conventional energy or renewable energy as fuel. The range of capacity for SPP bidders is between 10 MW and 100 MW, and SPP investors receive electricity price subsidies from the government of about 0.17 Baht per kWh.

At March 2007, the total number of SPPs was 121 companies with 2,835 MW of generation, but, as noted above, only some 279 MW of renewable generation is included in this total as SPPs also include co-generation installation with gas and/or coal firing.

The Thailand Power Plan 2007 to 2021 provides for limited additional renewable energy. In the period 2008 to 2010 solar PV, wind and small hydro are shown to account for just 81.7 W of additional capacity; SPPs will provide 88MW (2009), 3 x 200MW (2012, 2013 and 2014) though the source of fuel is not indicated.

The VSPP program promotes distributed renewable energy generation. It is restricted to power generated from renewable resources with capacity less than or equal to 10 MW. The government subsidy for VSPP is an increment to the electricity purchase price, depending on the type of renewable energy, and as such is called an “adder”.

Higher purchase prices for electricity sold to the national grid by SPPs and VSPPs from renewable energy facilities announced at the end of 2006, investment subsidies for “new” technologies, soft loans, provision of information and advice have resulted in a large number of new projects.

At the end of 2007 proposals had been received from 265 renewable energy SPPs and VSPPs to produce 1,716 megawatts of power with sales to the grid of 1,116 MW. Apart from the usual fuels (paddy husk, wood chips, bagasse), there is increasing fuel diversity with projects using palm oil waste, coconut shells, biogas from waste water, municipal waste, and solar energy. Many wind farm proposals are expected this year. If one includes large hydroelectric projects, the share of renewable energy in electricity generation is expected to rise from 6.5% in 2008 to 17% in 2015 and 27% in 2021.

Sustainable Energy Technologies in Thailand

Wind Energy

Thailand started the study of wind-energy development as early as 1983, followed by installation of a wind turbine pilot plant on Phuket's Phromthep Strait in 1992. It later added a solar-cell generator to help improve efficiency of its electricity generation and finally added bigger wind turbines due to technical problems in maintenance of the previous turbines. Its total installed capacity is 180MW. Aside from smaller scale wind turbine installations there is no real wind energy market established in Thailand. Recent reports indicate that an additional 700 MW of installations is planned for generation, together with units for direct use of wind energy for pumping.

There is considerable potential for large scale wind energy in Thailand, especially in the centre and western regions and a wind atlas has been created for Thailand suggesting a potential of some 1,600 MW. However, there are some constraints affecting wind energy in Thailand. These are summarised as:

- the absence of specific financing schemes designed to support wind energy development
- the absence of grid for connection in many rural areas
- the lack of wind data which is sufficiently accurate and industry standards to allow wind site identification

- the fact that some existing wind turbines are not functioning, which provides a negative reinforcement of the effectiveness of wind installations
- a low level of technology capacity in wind energy and no local manufacturing or distribution capacity.

The World Bank has suggested that wind turbine manufacture could be possible in Thailand, though of course this would have to be driven by a sustained local installation market. A limited number of small capacity units (up to 5 kW in output) are reportedly being manufactured in Thailand for demonstration purposes.

Solar

Solar PV has found early use in rural electrification and in 2006 a feed-in tariff was introduced to encourage installations up to 76 MW with the expectation that an RPS will be in place to see grid connected PV reach 250 MW by 2011. In 2007 Thailand had a total PV manufacturing capacity of 165 MWp split amongst six companies. Of this output 53MWp was amorphous silicon panels. With a concern over the quality of PV products appearing in the Thai market, the EU is sponsoring a programme to encourage public-private cooperation in moving the Thai PV industry towards the international standards, practices and quality management process in manufacturing, testing, installation and maintenance in line with the international PV-GAP.

Solar Thermal

It is estimated that there is a total installed capacity of solar thermal water heating units of some 62,000 m² with 6,800 m² added in 2006. Looking at the residential, commercial and domestic hot water demand suggests that solar water heating installations of up to 1.5 million m² could realistically be employed in Thailand. Annual electric water heater sales are of the order of 200,000 with some 1.5 million units installed nationally. It is hoped that the opportunity to reduce some of the 3,700 GWh/yr of electricity that these consume and the potential to offset up to 450,000 tonnes of CO₂ per year may encourage the government to look more seriously at the potential solar water heating could offer. There are concerns however that costs remain high due to relatively low sales volumes (which reduce competition), that there are problems with the quality of installation and after sales service and that there is no specific policy to support their utilisation, despite the clear focus on energy efficiency in general.

Hydro

Thailand's estimated hydropower potential is 1770 TWh/yr, and there has been significant progress in unlocking this potential using small scale systems. The government has made development of small hydro a priority and created incentives for a planned 350 MW of new capacity.

The Department of Alternative Energy Development and Efficiency (DEDE) (formerly the Department of Energy Development and Promotion, DEDP) and the Provincial Electricity Authority (PEA) are institutions involved with mini- and micro-hydro. The DEDP installed a total of 128 MW, using 23 hydropower systems with capacities ranging from 200 kW to 6 MW. Aside from mini-hydro, the DEDP has also installed many village-level hydropower plants, and there is considerable potential for village-scale small hydro in east and central Thailand.

A 2004 study of the production costs of electricity generated from 728 planned small hydro projects found that of the estimated costs of 100 selected projects would be commercially viable operating as non-subsidised, non-firm Small Power Producers. One of the barriers to harnessing hydro electric energy in Thailand is that installations under government schemes have to be at the request of villages, but few villages are informed of this option.

Other barriers are as follows:

- the high up front capital cost of hydro systems
- a lack of capacity in small hydro project development
- a lack of targeted government policies
- the distance between resource and load centres in some cases
- a continuing reliance on importing expertise, materials and equipment, which maintains high costs that in turn impede development
- the location of some potential hydro stations on ancestral lands of cultural minorities, which can make gaining access difficult.

In addition, only a couple of systems are installed each year, which is only enough market for a single equipment manufacturer. This lack of competition and economies of scale results in lower quality and higher prices.

The Nam Theun 2 Hydropower Project (NT2) is due to begin operation in 2010. This plant being constructed in Laos with the help of an IDA loan and will have a capacity of 1070 MW, with 995 MW being dedicated for export to Thailand providing approximately 5636 GWh of generation annually..

Biomass

Though there are many and diverse sources for biomass that could be used for energy, in many cases the businesses with biomass residue streams have been unaware of opportunities for value adding to their businesses and were understandably reluctant to invest in technologies they knew little about. However, with commercial viability possible even without any subsidies and at capacities exceeding 20 MW, the now-established targets and subsidies for biomass and renewables are expected to deliver at least 900 MW of new biomass capacity by 2011. The following table summarises a recent estimate of the biomass potential in Thailand.

| <i>Biomass resource</i> | <i>Economic potential (MW)</i> |
|--|---------------------------------------|
| <i>Bagasse</i> | 1,900 |
| <i>Biogas (cassava, pig, food waste)</i> | 1,185 |
| <i>Wood residues</i> | 950 |
| <i>Rice husk</i> | 100 |
| <i>Corn cob</i> | 54 |
| <i>Distillery slop</i> | 49 |
| <i>Coconut</i> | 43 |
| <i>Palm oil residues</i> | 43 |
| <i>TOTAL</i> | 4,324 |

Table 6: Estimated Biomass Potential in Thailand

Biogas

The bulk of commercial biogas potential is in the cassava processing industry where there is an estimated 300 MW of possible development and financing is apparently no longer a key constraint given the activities of a number of developers in this market. Within the next 10 years it is expected that US\$100 million will be invested in Thai biogas, though an additional US\$200 million would be required to fully develop the identified potential in the sector. Considerable growth appears very likely due to probable subsidies under the government program to reach its 8% renewable energy target.

The importance of the Clean Development Mechanism as an additional revenue stream for projects is being demonstrated by a number of current developments. CDM potential is also attracting investors to this market as they seek sources of carbon credits.

Biofuels

The development of biofuels is more advanced than in other ASEAN countries. In 2003, the Cabinet approved the Gasohol Utilization Strategic Plan—covering a gasoline-bioethanol blend. In 2005, it approved the Strategic Plan on Biodiesel Development, aiming to bring production based on palm oil to 8.5 million litres per day—displacing about 10 per cent of petroleum-based diesel by 2012.

Thailand has established a significant ethanol industry producing some 1.3 million litres per day (see following article). This growth has been supported by financial incentives together with the provision of information to investors and consumers. The consumption of gasohol (E10) more than doubled in 2007. With the introduction of E20 in 2008, daily demand for ethanol should reach two million litres by 2011 when new cars capable of using E85 should be on sale.

However, due to the inability of old cars to use E85, it may take 15 years for E85 to account for 50% of gasoline sales. Mandating that all diesel oil be B2 by February 2008, coupled with pricing incentives for biodiesel, have pushed the daily demand for biodiesel (B100) from 6,000 litres in 2006 to more than one million litres at present. It is hoped that the expansion of palm oil plantations will enable mandatory B5 usage in 2011.

Media Extract 3: Poonpirom wants to make Thailand world-class 'green energy' hub

February 28, 2008 (Bangkok Post) - Thailand is developing a master plan to build the country into the world's second largest green energy producer after Brazil. Energy Minister Poonpirom Liptapanlop said she wanted to see the country become a net exporter of green energy to tap strong global demand.

To achieve the goal, authorities plan to develop a 15-year Renewable Energy Development Plan to cover the full range of alternative energy businesses including gasohol, biodiesel, biomass, wind and solar power, she said yesterday.

"The plan will set a strategy to ensure the development of the whole industry, such as the quality of products and supply volume," she added.

Lt Gen Poonpirom said the government and producers specialising in green energy needed to co-operate more effectively under the plan.

Financial support for investors would be provided through the ministry's incentive programme including tax breaks and tariff-free machinery imports.

Ethanol, for which Thailand is achieving economies of scale, would be the first target for export.

Thailand produces 1.3 million litres a day of ethanol from nine plants, far above domestic consumption of 700,000 litres a day.

The government forecasts additional output of one million litres a day from seven to 10 new ethanol producers, which could add 2.3 million litres of output by the end of this year.

"We can turn this surplus into an opportunity by looking for a chance to ship [the ethanol] to other countries," Lt Gen Poonpirom said.

Biodiesel, however, would take five or six years to expand as new palm plantations are necessary. Crude palm oil is at risk of shortage because most is used in the food industry.

The Bank for Agriculture and Agricultural Co-operatives (BAAC) has extended assistance to palm planters to help them expand production.

Gasohol consumption is expected to reach 12 million litres a day by the end of this year from the current seven million litres. Gasohol is a mixture of ethanol and gasoline. B2, a mixture of 2% biofuel with diesel, made its debut this year and replaced all high-speed diesel. The government also plans to launch B10, a mix of 10% biofuel mixed with 90% diesel, within this year.

Indonesia

Current Energy Status

Primary energy demand is projected to grow at an annual rate of 2.7 percent to reach 359 Mtoe in 2030.

- Indonesia is currently a net energy exporter. However, Indonesia is at the turning point of becoming a net energy importer and the net energy import ratio will increase from minus 55 percent in 2002 to 0 percent in 2030.
- To secure energy supply Indonesia needs to address both demand and supply-side issues. On the demand side improving efficiency and public infrastructure through economics incentives, mandatory standards, and optimal pricing and on the supply side investment to increase the reserves of natural gas, oil and coal.

Indonesia has a wide variety of abundant energy resources, including fossil and non-fossil resources, as reflected by its being a net energy exporter for many years. The primary energy source fuelling Indonesia's economy continues to be oil, although decreasing domestic production, increasing domestic consumption, and global price hikes over the past few years have reduced oil consumption and prompted efforts to develop other domestic energy resources.

Coal will be the primary domestic energy resource, particularly to fuel new power generation capacities. The second most important fuel source for Indonesia's population is biomass, although most of its use occurs in the informal economy. Meanwhile, biofuels have been identified as the primary energy resource to diversify transport fuels.

Energy Regulatory Framework

The energy sector in Indonesia is covered by four key policies and objectives:

- **Diversification:** A key objective of the Government of Indonesia is to reduce dependence on oil by expanding the use of coal, gas, and renewable energy resources.
- **Rational Energy Pricing:** The Government of Indonesia recognizes that it can no longer sustain uniform pricing for electricity and petroleum products across the country, and it has begun to eliminate subsidies.
- **Energy Sector Reform:** The combination of decentralization of government decision-making to give greater involvement to regional authorities, and the need to attract capital investment in the energy sector call for energy sector reform that introduces greater transparency to planning and decision-making. This is now a critical priority for the government.
- **Rural Electrification:** The Government of Indonesia wants to bring electricity to 90 percent of the population by 2020.

Many of the problems the country faces have resulted from the policy of subsidizing petroleum products, which had been adopted and maintained by the government over the past few decades. Prices had been set lower than market prices to enable all strata of society to easily procure oil fuels. The policy has led to an approximately 75 percent reliance on oil in Indonesia's primary energy mix.

The oil price subsidy policy also put other energy options at a financial disadvantage, and hampered programs for energy conservation and energy diversification. Rural electrification programs were developed based on diesel generators rather than on lower-cost renewable energy options. As domestic oil production declined and international oil prices increased, the economic and financial cost of rural electricity service jumped dramatically.

The basis for renewable energy development in Indonesia is Presidential Regulation No. 5/2006 on National Energy Policy (Kebijakan Energi Nasional). It sets national targets for an optimal energy mix in 2025:

- (i) less than 20 percent from oil;
- (ii) more than 30 percent from gas;
- (iii) more than 33 percent from coal;
- (iv) more than 5 percent from biofuel;
- (v) more than 5 percent from geothermal;
- (vi) more than 5 percent from other renewables, especially biomass, nuclear, micro-hydro, solar and wind; and
- (vii) more than 2 percent from liquefied coal.

The decree also includes a program to replace the general subsidies of the past with more targeted incentive programs that achieve social objectives and encourage diversification. It also includes road maps for solar, geothermal, and nuclear energy, and suggests provisions for introduction of a carbon tax.

Early in 2007 a Presidential Instruction was issued on the Supply and Use of Biofuel. The road map for biofuel aims to develop pro-growth, pro-poor, and pro-job biofuel projects in Indonesia. The government seeks to use investment in biofuel projects to provide a sustainable source of energy supply, while helping to alleviate poverty and support national development. The Presidential Instruction underscores the need for a multi-sectoral approach and specifies the roles of eleven ministries in biofuel development.

Electricity Law

PLN's financial viability was severely damaged by the 1997 economic crisis. Efforts to restructure the electricity sector were initiated in 1998. The restructuring aimed to separate the commercial, social, and regulatory functions of PLN. Electricity Law No. 20 was passed in 2002 to facilitate the liberalization and privatization of the sector by introducing a "multi-sellers, multi-buyer" system in which private investors could sell power to PLN, which would retain control of the transmission and distribution systems. However, the Constitutional Court challenged a number of the aspects of the new laws effectively returning the electricity sector to a monopoly and centralized control. With the liberalization of the energy sector, the Government of Indonesia did however give the Ministry of Environment and Mineral Resources (MEMR) more responsibility to oversee market activities, especially for oil and electricity. In addition, greater emphasis on transparency and decentralization followed the decision to give regional governments more control over managing their energy resources. The effectiveness of these changes is however still to become fully evident.

Energy Efficiency

The movement away from subsidies heightens the attractiveness of investments in energy efficiency. Higher prices for electricity and fuels naturally drive consumers in the industrial, transport, commercial, and residential sectors toward more efficient energy use. Because past policies did not encourage efficient energy use, initial investments in energy savings can yield large benefits. In particular, demand side impacts can be achieved quickly, and support for minimum standards and labelling can avoid confusion in the marketplace. Nonetheless, energy-efficiency opportunities have received relatively little attention from government planners. The target to reduce energy intensity by 1 percent per year is modest. There is continuing concern that the government, under considerable pressure from interest groups, is still attracted to maintaining fuel subsidies for certain industry and business sectors.

Renewable Energy

In contrast to energy efficiency, renewable energy projects have received considerable attention from policy-makers in Indonesia. The electricity regulations for small and medium-scale power generation from renewable energy resources specifically seek to increase the use of renewable energy. However, despite efforts to clarify procedures and terms of sale, negotiation of power purchase agreements with PLN to achieve acceptable rates of return on investment in renewable energy projects remains challenging, even in locations where the renewable option is significantly cheaper than the conventional diesel generators used by PLN. Those looking to develop private power projects complain that although there are existing Presidential decrees covering the rate that they should be paid by PLN (effectively a percentage of their avoided cost) PLN's pricing structure is not transparent. There are however some indications from recent power purchase agreements that PLN will agree rates that are close to those that are acceptable to the private market.

Much of the focus on renewables in the near term is around the provision of basic energy to rural communities with a stated target of 95% electrification by 2025 – the current level of electrification is 59% (2006) or 33.1 million households. Given these targets the current level of installations and those currently planned (by public agencies) can only be seen as modest. The recorded (rural) installations are shown as

- Solar PV 12 MW
- Micro hydro 207 MW
- Wind 1 MW
- Biomass 150 kW

With projected additions for 2008 of:

- Solar PV 1.8 MW (35,000 units @ 50Wp 4 units @ 10 kW)
- Micro hydro 20 – 500 kW
- Wind 7.5 MW (150 units at 50kW)

These efforts parallel an underlying “self sufficient energy villages” strategy being promoted under which villages are encouraged to develop bio-fuel (Jatropha Curcas, Coconut, Palm, Cassava or Sugar Cane) and non bio-fuel based (Micro-hydro, Wind Turbine, Solar Energy, Biogas or Biomass) energy services for their own needs. The plan is that 100 villages will be self sufficient by 2007 rising to 1000 by 2009.

| Type Of Energy | Resources | Potential | Utilization | Installed Capacity |
|------------------|-----------------|------------------------------|-------------|--------------------|
| Large Hydro | 845 million BOE | 75,67 GW | 6.851 GWh | 4.200 MW |
| Geothermal | 219 million BOE | 27 GW | 2.593,5 GWh | 807 MW |
| Mini/Micro-hydro | 500 MW | 500 MW | | 207 MW |
| Biomass | | 49,81 GW | | 445 MW |
| Solar | | 4,80 kWh/m ² /day | | 12 MW *) |
| Wind | | 3-6 m/second | | 1 MW *) |

Table 7: Potential for various renewable energy technologies in Indonesia⁶

⁶ Maritje Hutapea; Directorate General for Electricity and Energy Utilization, Ministry of Energy and Mineral Resources Indonesia - Singapore, 17-18 March 2008

Table 8 below suggests a development schedule for the resource types summarized in Table 7. Experience in Indonesia has shown that the pace of new development is often considerably slower than official projections may suggest.

| Type | Unit | 2010 | 2015 | 2020 | 2025 |
|---------------|-----------------|-----------|-----------|------------|-----------|
| Bio-diesel | Kilo liter | 1.160.000 | 3.000.000 | 11.800.000 | 4.160.000 |
| Bio-ethanol | Barrels per day | 42.860 | 48.110 | 55.340 | 60.320 |
| Bio oil | Kilo liter | 244.000 | 257.000 | 627.000 | 4.863.000 |
| Biomass Waste | MW | 30 | 60 | 120 | 200 |
| Geothermal | MW | 1.320 | 4.340 | 5.090 | 5.270 |
| Wind Power | MW | 10 | 40 | 80 | 160 |
| Solar Energy | MW | 80 | 100 | 120 | 580 |
| Micro-hydro | MW | 450 | 740 | 950 | 950 |

Table 8: Development schedule for renewable energy resources ⁷

Sustainable Energy Technologies in Indonesia

Hydroelectricity

Recent announcements (August 2007) note the planned development of two hydroelectric plants, Genyem in Papua and Poigar in North Sulawesi, which have a combined capacity of over 50 MW, and three mini-hydroelectric projects with a combined capacity of 4.2 MW, located in West Kalimantan, North Sulawesi and Gorontalo. With an agreement also covering an West Java 60MW geothermal development, Ecosecurities has entered into an Emission Reduction Purchase Agreement (ERPA) with PLN, Indonesia's national electricity supplier, to develop and purchase the Certified Emission Reductions (CERs) generated by these projects.

Geothermal

At present, although various estimates have suggested that Indonesia has a geothermal potential of some 27,000 MW (reputedly the world's largest potential), only 970 MW of capacity are installed. It is estimated that within the existing development areas there is a potential for 1,000 MW of additional generation under private control and a further 3,000 MW under the management of state entities. There are also claimed to be some 50 fields that have been identified and are ready for detailed exploration and drilling. The key restraints to further development are seen to include many that have been influencing geothermal prospects in Indonesia for many years:

- Economics:
 - High initial costs to develop geothermal energy
 - Remote areas, limited infrastructure

⁷ Maritje Hutapea; Directorate General for Electricity and Energy Utilization, Ministry of Energy and Mineral Resources Indonesia - Singapore, 17-18 March 2008

- Drilling deep wells
 - Subsidized prices of fossil-based energy (petroleum fuels, and electricity mostly generated from fossil energy)
 - Environmental benefits are not included in cost calculation
- Regulations:
 - Alignment of upstream and downstream regulations
 - Required set of implementation regulation for Law 27/2003
 - Alignment with Forestry regulation (national parks, boundary of various forest categories, overlap uses)
 - Role of local government in geothermal undertakings
 - Procedure for tender & licensing
 - Incentive for research & development, improve capacity of local contents
 - Road map & master plan on energy mix is not binding

According to Gawell and Greenberg (Geothermal Energy Association 2007 Interim Report Update on World Geothermal Development) the Indonesian energy plan envisions both expanded production from existing fields and new field development, with several new projects reported in the past two years. In 2006 Indonesia was reported to be seeking Arab investors in several geothermal projects include the Kamojang, Lumut Balai, Lahendong and Ulu Belu fields. A 60 MW construction contract was awarded for Kamojang to the Shaw Group, and development of a 110 MW geothermal power plant at Darajat, Near Garut, West Java was recently announced.

Indonesia's state-owned oil and gas company, Pertamina, announced it will build three geothermal power plants with Para Group involving investment of \$1.5 billion. The plants would have a total capacity of 1,060 megawatts, but no timeline for development was made public.

Also in 2006 a consortium consisting of its wholly owned subsidiary, Ormat International, Inc., a unit of Medco Energi Internasional Tbk (Indonesia's largest private oil and gas company), and Itochu Corp. of Japan, has been declared the winner of a tender issued by the Indonesian state-owned utility PT PLN (Persero) for the development of the Sarulla, North Sumatra, Indonesia geothermal power project on an independent power producer basis. The Sarulla project is to be constructed over the next five years in 3 phases of 110 to 120 MW each, with the first power generating unit to be operational within 30 months and the last within 48 months from the financial closing.

In 2007, Indonesian officials announced plans to tender seven additional geothermal areas that would generate around 575 megawatts of electricity.

Media Extract 4:: CHEVRON Darajat III Commercial Production

August 13, 2007 – (The Associated Press) JAKARTA, Indonesia: Chevron Corp., the only foreign business currently developing geothermal energy in Indonesia, is expanding operations at one of its power plants on Java island to bring electricity to an additional 700,000 homes, the company said Tuesday.

The U.S. energy company, which has operated two geothermal fields on the seismically charged island since the 1980s, said in a statement it has started commercial production at its 110-megawatt (MW) Darajat III plant in Garut, West Java province.

The renewable energy produced there will bring the number of homes receiving electricity from Chevron's geothermal projects in Indonesia to 3.9 million up from 3.2 million at present, said John Watson, president of Chevron International Exploration and Production.

The sprawling archipelago sits on what is believed to be the world's largest geothermal resource base, with the potential to provide 21,000 megawatts — enough to supply all the energy needs for its 220 million people.

But existing plants have a combined capacity of just over 800 megawatts, or 4 percent of Indonesia's potential. Legal uncertainties, financial risks and government bureaucracy have kept international investors at bay.

Media Extract 5: Iceland is seeking opportunities to invest in geothermal development

Jakarta (ANTARA News) 23 October 2007

Iceland is seeking opportunities to invest in geothermal development in Indonesia, an Indonesian official said.

"They are offering cooperation to develop geothermal-based energy projects," Industry Minister Fahmi Idris said after accompanying President Susilo Bambang Yudhoyono in receiving Iceland's Minister of Industries Ossur Skarphedinsson here on Tuesday. Iceland had expertise in geothermal development, he said.

Iceland which was one of world's poor countries when the Second World War broke out now had a per capita income of US\$44,000 and become one of the rich countries because of its success in developing geothermal industries, he said. Fahmi said at the meeting with President Yudhoyono Minister Skarphedinsson disclosed six companies in his country had expressed an interest in investing in Indonesia.

He said Iceland also expressed interest in processing bauxite ore imported from Australia in Indonesia using geothermal energy. "So far they ship the commodity to Iceland. That is too far. Now they are thinking of processing it in Indonesia. The strategic location for it is naturally in the eastern region which is close to Australia," he said.

Fahmi said there had not been any further discussion about it but he still had to receive Minister Skarphedinsson at his office on Wednesday.

In the Indonesia-Iceland Geothermal Forum in Reykjavik on September 12-13, the two countries wished they would have had concrete cooperation in the field of geothermal development in Indonesia at the time when they commemorated the 25th anniversary of their diplomatic relations.

The two countries will make geothermal development one of the priorities for cooperation because of their large geothermal potentials. While 72 percent of electricity need in Iceland is supplied by geothermal energy the use of the energy in Indonesia is still only around three percent of the country's potential which is the largest in the world, namely around 40 percent.

Oct 24, 2007 - AsiaPulse

Jakarta - Reykjavik Energy Invest (REI) will team up with Indonesian state oil and gas company PT Pertamina to build a 500-megawatt geothermal power plant with an investment of US\$2 billion in Indonesia.

The 500-MW plant will be part of the first phase of a longer term investment plan by REI in Indonesia, its chief executive office Gudmundur Throddsson said.

Iceland Industry and Energy Minister Ossur Skarphedinsson said his country could build several geothermal power plants with total capacity of up to thousands of MW in the country.

REI is financially powerful and it is interested in cooperating with Indonesian companies to build more geothermal power plants, he said.

Pertamina President Ari H. Soemarno said REI is expected to start construction of its first geothermal power project in the country in the next several months.

Pertamina has a geothermal concession area with a power generating potential of up to 9,000 MW and until now operating plants only have a total capacity of 240 MW.

Solar PV

As noted in the background information, Indonesia's experience with solar PV has been directed at rural electrification opportunities where some 12 MW of solar home systems have been installed. A lack of financing has hindered the growth under private sector schemes and a major programme to address this with GEF support floundered when the Asian financial crisis hit Indonesia. The underlying problem is that Indonesia banks and

credit providers seek very high levels of collateral to cover lending slowing the market growth.

Biomass

Biomass provides part of the informal energy delivery as in many countries within the region. It is not however reported on widely.

Municipal Waste

The municipal waste opportunities have received limited attention in the past. Though a number of international and domestic groups have investigated the market in some detail, the poor, uncontrolled quality of most landfills has meant that landfill gas operations are not easy to implement. A major project is being implemented in Bali and several city landfill sites are being developed to allow gas flaring. In the latter cases the flaring is being considered because to date it has been difficult to negotiate an acceptable power price with PLN for the sale of electricity. This situation is reportedly improving and if this is the case then additional landfill gas operations are likely. Those that are occurring are being funded in large by providing access to carbon credits. The World Bank Prototype Carbon Fund is active with one of the main development groups in this field providing advance payment against the credits to finance the installation of flaring facilities (which are locally manufactured). A number of additional sites are contracted for development but are stalled until financing can be secured.

Biofuels

Over the period 2005-2010, the Government is seeking a 2 per cent cut in diesel consumption through the use of biodiesel based on palm oil and *Jatropha Curcas*. Other raw materials, such as coconut, will also be used and it is anticipated that over the period 2016-2025, biodiesels will account for 5 per cent of diesel consumption. For bioethanol, the Government plans to introduce a 10 per cent blend with gasoline using molasses and starch. It is expected that gasoline consumption will be reduced by 3 per cent by 2011-2015 and by 5 per cent by 2016-2025.

Over the last year there have been extensive discussions and press coverage on the development of the biofuel industry in Indonesia. Ethanol production has been in place for a number of years but the recent focus has been directed at biofuels using *Jatropha* and non-food crops. This is all part of a very large country-wide scheme that the government is promoting as a road to reducing poverty by providing enormous employment opportunities. Various groups have public statements about their privileged access to extensive tracts of (uncultivated) land, particularly in eastern Indonesia. Based on the concept of small plot holders providing the harvested fuel source to centralised processing operations the approach as not won immediate support form the investment community.

The article below highlights some of the current issues

Media Extract 6: Biofuels in Indonesia

JAKARTA, April 29 2008 (Reuters)

Indonesia state oil firm Pertamina has cut the biofuel blend in diesel fuel to 1 percent from 2.5 percent as rising palm oil prices and lack of incentives have cut margins, a company official said on Tuesday. Since the company introduced Biosolar in May 2006, it has gradually cut its biodiesel content from an initial 5 percent to 2.5 percent in 2007 for the same reason.

The government subsidises biodiesel at the same level as fossil fuels, leaving Pertamina to cover the difference when biodiesel production costs exceed fossil fuel costs. Pertamina has cut the biodiesel blend to 1 percent since April 11, Djaelani Sutomo, the firm's vice-president of marketing and trading, told Reuters by phone. "Soaring palm oil prices have propelled prices of biodiesel, making them not feasible for the firm," Sutomo said.

Crude palm oil prices have jumped more than 45 percent since the beginning of this year. The cost of biodiesel has surged to 8,900 rupiah a litre in April 2008 from around 6,750 rupiah a litre in June last year. But Pertamina sells the biodiesel in gas stations in Jakarta, Surabaya and Denpasar at the same price as subsidised diesel oil at 4,300 rupiah. Indonesia, the world's biggest palm oil producer, has been pushing the use of biofuels made from various resources such as palm oil, sugar cane and cassava to cut the use of costly petroleum products.

Palm oil futures have tumbled around 25 percent from a record high of 4,486 ringgit a tonne last month on a bearish concoction of Jakarta export tax moves and dismal Asian demand. But prices are nearly 10 percent higher since.

Rising palm oil feedstock and low domestic prices have prompted many biodiesel producers and countries to delay introduction of the green fuel in the local market.

(\$1 = 9,220 rupiah) (Reporting by Mita Valina Liem, editing by Sugita Katyal)

Sinopec reportedly to invest \$5 billion in biofuels in Indonesia

January 29, 2008 (Biopact) - Sinopec, China's top oil company, reportedly will cooperate with an Indonesian enterprise to set up biofuel plants and to grow energy crops in Indonesia, with a major investment of US\$5 billion. Indonesia's national news agency Antara reported about the project, which would become Sinopec's second large overseas biofuel investment.

The plants and plantations are set to be located in Indonesia's Papua and East Kalimantan regions, and will be used for extracting biodiesel from crude palm oil and jatropha curcas oil. Sinopec will cooperate with PT Puri Usaha Kencana to build the plants as well as to crop oil palm and Jatropha curcas. According to Al Hilal Hamdi, chairman of Indonesia's National Biofuels Task Force, the project is likely to begin this year.

Over the past years, China's state-owned oil company has hinted often at this possible mega-investment. But as oil prices temporarily declined, the issue went off the agenda. Now, with persistent high prices and the oil crisis being felt by ordinary Chinese, it is back.

In January 2007, another oil major, the China National Offshore Oil Corporation (CNOOC) signed a Memorandum of Understanding with the Indonesian government under which it intends to invest \$5.5 billion in the development of the biofuel sector in Indonesia, announcing the establishment of 3 biodiesel processing plants in Kalimantan.

For China, biofuels produced overseas are not so much seen as a way to reduce its transport sector's greenhouse gas emissions, but more as a matter of sheer energy security and access to affordable liquid fuel sources, crucial for its economy. Besides Sinopec and CNOOC, several other Chinese state-owned and private enterprises have announced large biofuels investments in, amongst other countries, the Philippines, Malaysia, Indonesia, Mozambique and Congo. Most of these investments have gone unnoticed because China is quite discreet about them.

Sinopec is becoming a large player on the world's energy stage and is building its presence in Indonesia. In 2007, it was the successful bidder for the Indonesian National Petroleum Corp's residue hydrotreating catalyst project. The residue hydrotreating catalyst technology is used for the utilization and deep processing of low-grade or heavy crude oil.

Since 2006, Sinopec has speeded up its overseas investment. In 2006, it acquired six international refinery projects worth of US\$3.08 billion. In December 2007, Sinopec signed agreement with the Brazilian government for the US\$6.5 billion GASCAC gas pipeline project, which will be completed in five years. It is the largest overseas engineering service project of Sinopec Group by the end of 2007.

Other investments

Meanwhile, also in Indonesia, Bronzeoak from Britain plans to invest US\$270 million to produce ethanol from sweet sorghum. Bronzeoak will cooperate with the Satria Group to build a factory and plantation in the regency of Belu and Central Timor in East Nusatenggara.

The Sampoerna Group for its part reportedly plans to break the ground to mark the construction of an ethanol plant in Wonogiri, Central Java, before the end of the first quarter of this year. Sampoerno is a leading tobacco producer.

Sustainability problems

Sinopec's plan could accentuate an increasingly heated issue in the biofuels debate, namely that of the 'displacement effect': a country like Indonesia would produce biofuels for exports to Europe, from existing plantations, which are seen as yielding climate friendly fuels under the new EU sustainability rules. While at the same time it would be producing fuels and food products from new plantations for export to non-EU countries, like China. If the latter plantations are based on deforestation, the EU's sustainability rules would have resulted in this displacement effect and would prove to fuel environmental damages.

It is too early to tell whether the effect will play out in this case, because details about Sinopec's plantation plans are unavailable. However, discussions about this theoretical problem will grow larger as more biofuel projects come on line in forest-rich tropical countries.

MALAYSIA

Current Energy Status

- Malaysia's primary energy demand is projected to grow at 3.5 percent per year from 147 Mtoe in 2030; mainly due to the increase in demand for coal, oil and gas; with coal demand accounting for the highest growth rate at 9.7 percent per year through 2030.
- Indigenous oil reserves are projected to be depleted by 2030, thus shifting the economy to a net energy importer. Net import dependency will reach 32 percent in 2030 from a net export position of 57 percent in 2002.
- Ensuring security of energy supply will be central to Malaysia's National Energy Policy.
- To strengthen energy security through regional cooperation, Malaysia is expected to extend full support to inter- and intraregional trade and bi/multilateral-agreements, in all aspects of the energy supply chain, including among others cross border interconnection efforts like the Trans-ASEAN Gas Pipeline (TAGP) and the ASEAN Power Grid.

Sustainable Energy in Malaysia

According to the 9th Malaysia Plan period, the country's peak electricity demand is expected to increase at 7.8% per annum to slightly above 20,000 megawatt (MW) by the year 2010. From that capacity, 350 megawatt (MW) is expected to come from Renewable Energy (RE). However, the RE target is lower than the 500 megawatt (MW) target in the 8th Malaysia Plan due to various reasons. As Renewable Energy generally is still a relatively new development to the country, it is now putting in place the appropriate measures and implementation plan to ensure that this new target is achieved.

The Malaysian government sets out to intensify the development of renewable energy, particularly biomass, as the 'fifth fuel' resource under the country's Fuel Diversification Policy. The policy, which was set out in 2001, had a target of renewable energy providing 5% of electricity generation by 2005, equal to between 500 and 600 MW of installed capacity. The policy has been reinforced by fiscal incentives such as investment tax allowances and the Small Renewable Energy Program (SREP), which encourages the connection of small renewable power generation plants to the national grid.

The Small Renewable Energy Program allows renewable projects with up to 10 MW of capacity to sell their electricity output to the state-owned electricity utility, Tenaga Nasional Bhd (TNB) under 21-year license agreements. In 2005 it was reported that fifty applications for the program have been received, mainly involving biomass, and of these over half were for palm oil waste. The 28 approved biomass projects involved the installation of 194 MW of grid-connected capacity. There were also four approved landfill gas-based projects, with 9 MW of capacity, and 18 mini-hydroelectric projects offering 69.9 MW of total capacity. There were no wind or solar projects approved.

Despite these encouraging first reports, by mid 2007 the situation was that:

- 19 developers had concluded negotiations for a REPPA with TNB
- 9 had signed REPPA's with TNB (44.8MW total capacity) from landfill (2), mini-hydro (8.8), municipal solid waste (5) and biomass (29), with 2 due to sign in the near term
- Only 2 plants, the 2 MW landfill and a 10MW biomass installation have been commissioned.

To encourage energy generation using biomass, hydropower and solar power, the Government offers several incentives to those that qualify:

- Pioneer status with tax exemption of 70% will be increased to 100% of statutory income and the incentive period is extended from 5 years to 10 years.
- Investment tax allowance of 60% is to be increased to 100% on qualifying capital expenditures incurred within a 5-year period, with the allowance to be set off against 100% of statutory income for each year of assessment
- The incentive package of pioneer status, investment tax allowance, and import duty and sales tax exemptions will be extended until 31 December 2010.

The 2006 Budget set forth a National Biofuel Policy initiative to encourage production and utilisation of biofuel from palm oil as an environmentally friendly alternative energy resource. The programme starts with a biofuel mix of 5% of processed palm oil and 95% diesel and three palm oil biodiesel commercial plants, with a total capacity of 180,000 tons for export, are to be built.

Malaysia ratifying the Kyoto Protocol in September 2003 opened the way for Malaysian renewable energy project developers to seek financing under the Clean Development Mechanism.

Energy Efficiency

Another opportunity is emerging because Malaysia has one of the fastest growing building industries in the world, from which a corresponding increase in energy demand can be expected in the coming years. Though this presents a potential environmental hazard, it also provides opportunities for sustainable energy technology. Newly available building spaces combined with untapped solar energy resources in Malaysia point clearly towards the implementation of Building Integrated Photovoltaic (BIPV) technology in Malaysia. Considering the synergies and benefits of BIPV application, the technology has the potential to have an important and sustainable impact on the building market and is able to displace a considerable part of the conventional fossil-fired electricity required by the new buildings.

The climate for business opportunities in the field of PV and other high tech renewables and support systems is encouraging. Malaysia is currently promoting the continued diversification of its industrial base towards high-end manufacturing and the development of the value-added services sector. This is all part of a push towards a knowledge-based economy.

Media Extract 7: Malaysian Government Provides Incentives for Energy Efficiency

September 17, 2007 (Bernama) — Construction group Putrajaya Perdana Bhd (PPB) sees more projects as building owners take advantage of the Budget 2008 tax incentives for “green” investments. It said the tax allowances unveiled in the budget would further attract building owners to move towards “green” buildings, representing more projects for the group. To encourage companies to invest in greenhouse gases (GHG) emission reduction projects, income derived from trading certified emission reductions (CERs) certificates will have tax exemption, effective from assessment year 2008 until 2010 under Budget 2008. In a statement today, PPB said the group has the potential to enjoy increased revenue and earnings from the construction of energy-efficient buildings (EEBs), which helped consumers save on energy costs. EEBs or “green” buildings are efficient in their use of energy, water and materials, reducing the impact of the building on human health and the environment. This is made possible due to their design, construction, operation, maintenance and removal. “Green” buildings save energy costs to mitigate the effect of escalating energy prices, such as oil and gas and electricity.

For example, total energy consumption of each Low Energy Office (LEO) averages about 2,218MWh p.a. (RM0.44m p.a.) as compared to more conventional building which consumes an average of 5,290MWh p.a. (RM1.04m p.a.) translating into energy cost saving of about RM0.6m p.a.

“This lowers the operating costs of the building and realise real, economic savings for owners of these buildings,” PPB said.

PPB is the market leader in the construction of EEBs in Malaysia. Among its notable completed EEBs are the Energy, Water and Communication Ministry building worth RM115 million and the Zero Energy Office (ZEO) for Pusat Tenaga Malaysia worth RM16.1 million.

These projects helped to position PPB as a leader in the growing sector of “green” buildings, the group said.

It added that the tax breaks would benefit PPB as energy conservation projects involved capital expenditure.

Under the budget, the government also announced that that companies providing energy conservation services will get an additional 10-year pioneer status.

Others are: The investment tax allowance will be increased to 100 percent of qualifying capital expenditure incurred within five years. The allowance will be set off against 100 percent of statutory income for each assessment; and

Companies which incur capital expenditure for energy conservation for own consumption will have their investment tax allowance increased to 100 percent of the qualifying capital expenditure incurred within five years. The allowance will be set off against 100 percent of statutory income for each year of assessment.

In addition to savings from lower operating costs, it said buildings accredited under the United Nations Framework Convention on Climate Change’s Clean Development Mechanism (CDM) programme for reducing emission of greenhouse gases will receive CERs which can be sold for additional income.

Sustainable Energy technologies in Malaysia

Solar Thermal

Generally, the solar thermal market has been slow to take off for commercial and industrial uses due to comparatively low electricity prices in Malaysia compared with other countries. Solar thermal opportunities do exist for certain industries that require processing of hot water or pre-heating of water ahead of other forms of thermal input.

Solar Hot Water

There have been significant installations of domestic solar water heaters in Malaysia, with an annual growth rate of 10–15%. Heaters installed are both locally manufactured and imported, with the majority of imports coming from Australia.

Solar Photovoltaic

The solar radiation in Malaysia is high by world standards. Subject to location, a typical PV installation in Malaysia would produce about 900–1400 kWh/kWp. Despite the abundant resource, solar PV applications in Malaysia are limited to mainly standalone PV systems, especially for rural electrification where the systems receive a significant subsidy. Other minor applications include telecommunication, street and garden lighting, and autonomous energy for parking ticket dispensing machines. This use of PV to date reflects the fact that there is a high level of traditional electrification throughout the Malay Peninsula.

While BP Solar had a small (2MWp) capacity production facility in Malaysia in the 1980s, in March 2008 it was announced that the German group Q-Cells will build the second major photovoltaic production facility in Malaysia, the first being that of the US-based thin-film module manufacturer, First Solar. Q-Cells was ranked as the No. 1 manufacturer of solar

cells in 2007 and it is understood that their Malaysian plant for which construction will start in the second quarter of this year, will have a final capacity of some 300 MWp. First Solar's production is expected to reach 100 MWp by the end of 2008.

Under a UNDP GEF programme there has been a focus on BIPV as outlined in the box below. In the report on this project to June 2007 it was indicated that the installation of building integrated PV systems was some 660kWp, and that the cost of such installations had been reduced by some 11% since the project inception.

Case Study 3: The Malaysia Building Integrated Photovoltaic Project

Technology Application Project, MBIPV, is intended to induce the long-term cost reduction of the non-emitting GHG technology (i.e. the photovoltaic or PV) via integration of the PV technology within building designs and envelopes. It is aimed at creating a sustainable BIPV market in Malaysia that will generate widespread BIPV applications. The MBIPV project will specifically focus on the market development for BIPV technology, and building the national capacities on three major areas: (a) policy and education; (b) technical skill and market implementation; (c) technology development support. The project will catalyze BIPV technology acceptance among the public, policy makers, financiers and building industry, which will lead towards a sustainable BIPV market beyond the completion of the project. The project objectives will be achieved via a multi-pronged approach:

- (1) BIPV information services, awareness and capacity building programs;
- (2) BIPV market enhancement and infrastructure development;
- (3) BIPV policies and financing mechanisms program;
- (4) BIPV industry development and technology localization program.

The programme helped the establishment of the Malaysian PV Industry Association (MPIA) (registered on 5th May 2006), and this currently has 31 members to promote solar PV industry development. Under the "Suria 1000" programme within the GEF project, private sector participants are invited to bid for subsidised (up to 50%) BIPV demonstration installation opportunities with a target of some 1,200 kWp, largely focused on residential developments.

It was announced in March 2008, Bandar Baru Pusat Tenaga Malaysia (PTM) has been recognized as the first organisation in ASEAN to achieve ISP Accreditation in the Training Course on Design and Installation of Grid-Connected Photovoltaic System. The course is carried out in partnership with Malaysian Photovoltaic Industry Association (MPIA) who will be jointly providing training on the design and installation of grid-connected PV system. The 10 day course is structured with compliance to the requirements of **Institute for Sustainable Power (ISP)** where the training will constitute theoretical and practical sessions ending with a competency examination. The objective of the training is to create a pool of competent PV service providers in designing and installing grid-connected PV systems

The PV market is still considered to be very small and at its infancy in Malaysia as at the current pace the country may reach the target of 2MW generated by PV by the year 2010. Advocates for PV suggest that the country should attempt to generate approximately 100 MW through PV by 2020.

Biomass

Malaysia has tremendous biomass and wood waste resources available for immediate exploitation. Much of this is readily available waste from the agricultural sector.

Perhaps the largest biomass sector in Malaysia is the palm oil industry, both for direct production of energy fuels and the use of wastes for biomass-generated electricity for sale to the local distribution grid. Some 88 million tonnes of fresh fruit bunches (FFB) are processed every year in 395 mills. Aside from the dried fruit bunches that result there is also some 57 million tonnes of palm oil manufacturing effluent (POME). A large number of projects have been proposed using either dried fruit bunches as a fuel or capturing methane from the bio-digestion of the POME. However limited developments have in fact been commissioned. This is however likely to change in the near future as the pressure from those seeking CDM opportunities increases. Recent evidence suggests that Asian and

European groups are working to secure projects, offering advance payments on credits as an inducement.

Media Extract 8: Carbon Capital to invest RM150m in biogas, biomass plants

March 3, 2008 (The Edge Daily) - Carbon Capital Corp Sdn Bhd will launch RM150 million worth of biogas and biomass projects in Sarawak next month as part of its long-term strategy for growth. "We will be launching four biogas projects and one 10 megawatt biomass power plant there, utilising empty fruit bunches (from oil palm). These are all projects which we will be investing in and developing 100%," Carbon Capital group managing director William Kho said.

The company also expected to launch more clean development mechanism (CDM) projects for the reduction of greenhouse gases in Sarawak in the future, and was currently working on two such projects in Negri Sembilan, Kho told The Edge Financial Daily.

Carbon Capital recently announced a RM2 billion investment to undertake renewable energy projects in Sarawak under the Sarawak Corridor of Renewable Energy initiative, with the products to be exported to Japan.

The projects, to be undertaken on a 51:49 basis with Japan Carbon Mercantile Co Ltd, comprises the development of a multi-feedstock biodiesel plant with bulking facilities, and a 100,000ha jatropha and oil palm plantation in the initial five-year phase.

"We didn't come to be involved in biodiesel overnight. This is part of our long-term strategy. We want to support a balance of sustainable development in Malaysia, and we believe biodiesel is the future," he said.

Kho said going forward, the company was looking at include landfill gas projects, animal farming to harness methane gas for rural electrification, and mini-hydroelectric projects.

It was also considering listing on AIM, the London Stock Exchange's international market for smaller growing companies, although it had no immediate plans to list on Bursa Malaysia, he said.

The company's businesses include investment in CDM and renewable energy, consulting services, the provision of biogas and biomass power plant technologies using wastewater, animal, municipal and plantation waste, among others, and carbon credit trading.

Waste for its biomass and biogas projects were currently gathered from other parties, he said.

Kho said the company has rendered its consultancy services to the Thai government, Asean and the World Bank for the development of sustainable energy frameworks, training curriculum for cleaner technology and the implementation of sustainable energy management systems in industries.

On carbon credit trading, he said the company currently worked with international trading houses and utility companies in Japan and other industrial countries which could purchase the carbon credits instead of undertaking expensive measures to reduce emissions.

He also said the company had a presence in Thailand, Japan and India, where its partner, Emergent Ventures India, had been consulted on more than 120 CDM projects.

According to Kho, Carbon Capital began as a joint venture between Thailand's EEC group and Australia's Energetics 13 years ago. "The knowledge and experience that we gathered from our consulting has allowed us to venture into other areas," he said. On Malaysia's renewable energy industry, he said it had huge potential, provided there were right incentives and awareness in place, adding that it was part of Carbon Capital's effort to promote such awareness. "We should not waste wastes. Create wealth from wastes. Ultimately, this is what we should all be doing," he said.

Municipal Solid Waste

It is estimated that some 30,000 tonnes / day of solid waste will be generated by 2020 and that some 45% of this will be organic waste. Of some 290 landfills throughout the country only 179 are operational and of these only 10 could be considered as sanitary. In August 2007 a solid waste act was gazetted and this is expected to lead to an integrated system for the collection, separation, storage and disposal of wastes through a special solid waste department. 16 existing landfills are to be closed and are expected to generate carbon credit income through the CDM process.

Media Extract 9: Malaysia invests \$400m in biofuel industrial park

December 3, 2007 (Biofuel Review)

A 200 acre Biofuel Integrated Environmental Park is to be built in the Malaysian State of Perak at a cost of \$400 million, it was announced last week. The project, a joint venture between the Perak State Government and Earth Biofuel (Asia) Sdn Bhd, will involve 900,000 carbon credit, a centralized treatment system for 4000 m³/hr industrial & biological waste water, methane gas recovery for 300,000 tonne/year landfill and R&D cum Training Centre generating about 30,000 jobs related to the project. According to a State Government source, "We have to look beyond our dependence on polluting fossil oil, especially in the area of power utility in our industrial sector, and the proposed biofuel industrial park, with its own self sufficient source of electricity and steam will not only achieve this, but will utilise our State based renewable energy source - biodiesel from our own crude palm oil, rice husk, waste woodchips, waste palm sludge and waste cooking oil.

"This facility will be a showpiece industrial park, with investors enjoying total self-sufficient renewable energy sources, arising from its own on-site based biofuel plants, such as its Biodiesel plant, Biomass Co-generation Steam & Electricity Plant, Waste Liquid and Semi-solid Waste Treatment Plant, Biogas Methane Power Plant from biodegradable wastes and will also house the country's first Biofuel Training Centre with Employment specializing in all related technologies & operations of the Park ."

This project is set to be launched simultaneously with two other similar projects in other Malaysian States of Pahang, and Terengganu. The projects are all slated to commence in 2008.

Hydroelectric Energy

Malaysia's technically feasible hydropower potential has been assessed as up to 123,000 GWh/year. Though this is dominated by large schemes such as the Bakun dam (which has still to be completed) there are also small hydro options. Eighteen mini-hydroelectric projects offering 69.9 MW of total capacity have been approved under the SREP. There are 43 generating units in 15 power stations in Peninsular Malaysia with a total installed capacity of 1,911 MW.

Media Extract 10: Synergy to buy 60% of Sarawak Hidro, 2,400 MW dam project

November 17, 2007 (The Star)

Sime Darby Bhd says Synergy Drive Bhd has obtained the Government's approval to acquire a 60% stake in Sarawak Hidro Sdn Bhd, owner of the 2,400-megawatt Bakun dam project.

"Synergy Drive will proceed to commence negotiations with the Government of Malaysia on the terms of the acquisition," the company said in a statement to Bursa Malaysia yesterday.

Trading in the shares in Sime Darby, the main contractor for the RM6bil hydro-electric dam project, is currently suspended to facilitate the listing of Synergy Drive on Nov 30.

Sime Darby, Golden Hope Plantations Bhd, Kumpulan Guthrie Bhd and their subsidiaries have agreed to combine their businesses under Synergy Drive to create a conglomerate that is estimated to have a market value of more than RM60bil.

It would be the biggest company listed on Bursa Malaysia, with five core operations: plantations, property, heavy equipment, motor and power and utilities.

"With the letter of intent (LOI), we can start work with all our vendors," Synergy Drive chief executive Datuk Seri Ahmad Zubir Murshid said at a press briefing yesterday.

He said Synergy Drive, with its healthy balance sheet post-listing, would have the financial muscle to undertake such massive projects.

It was reported earlier that Sime Darby had expressed its intention to the Government to take up a key interest in Sarawak Hidro. It also wanted to play a leading role in the proposed undersea power cable project. Analysts said the power and utilities business could emerge as a major contributor to Synergy Drive if it managed to secure both projects.

The 700km submarine cable is said to cost RM9bil. The project is likely to be undertaken by a consortium that may include Tenaga Nasional Bhd. The Government, however, has yet to formally decide on the project. Zubir said Synergy Drive hoped to bring electricity generated from Bakun to the peninsula beginning 2013, assuming the Government accepted its proposal.

Construction works on the Bakun dam were expected to be completed by 2009, Zubir said, with equipment testing and other works expected to take another year.

Sarawak Hidro was set up by the Finance Ministry to take over the Bakun dam project after it was temporarily shelved in 1997 due to the Asian economic crisis. The mega project was revived in 2000.

PHILIPPINES

Current Energy Status

- The Philippines' primary energy demand is projected to more than double to 111Mtoe in 2030, growing annually at 3.4 percent; buoyed mainly by high growth in the demand for petroleum products in the transport sector.
- Robust economic growth stimulated by increasing population and demographic changes will further expand the economy's energy demand.
- The economy will remain a net energy importer despite efforts to expand the energy resource supply base with renewable energy technologies and alternative fuels.
- Between US\$68-87 billion in new investment will be required to finance the economy's projected energy needs.

At June 2007, the country's total installed capacity stood at 15,852 MW, 12,092 MW in Luzon, 1,852 MW in Visayas and 1,908 MW in Mindanao. In terms of capacity mix, coal registered the biggest share at 26% followed by hydro (21%), natural gas (17%), gas turbine (6%), geothermal (13%) and oil based plants (17%). Solar and wind power made up less than 1 percent of the total capacity. However, the total dispatchable capacity considering actual availability of all power plants was 13,651 MW or 86.0 percent of total installed capacity.

Clean Energy Regulatory Framework

A variety of policy directives, overarching laws and sector or fuel-specific laws and regulatory orders make up the policy and regulatory framework for clean energy in the Philippines. These policy and regulatory instruments set the objectives, create the regulatory authorities and define their mandates, provide fiscal and other incentives, and establish technical, safety, and product standards.

The Philippine Energy Plan, updated in 2006, defines the overall energy sector policy framework in the Philippines. The update provides a two-point policy agenda: (i) Energy independence and savings, which aims to achieve a 60 percent self-sufficiency level by 2010; and (ii) Power sector reforms that aim to promote fair and reasonable energy prices in a competitive environment. The goals indicate a preference for clean and renewable energy sources and technologies in the government's energy program, particularly the following:

- Increase renewable energy-based capacity by 100 percent in 10 years
- All buses in Metro Manila to run on compressed natural gas (CNG) by 2010
- 2 percent coconut methyl ester (CME) blend with diesel fuel for vehicles by 2009
- 5 percent ethanol blend with gasoline for vehicles by 2007 and 10 percent by 2010
- Convert retired and operating oil-based power plants to natural gas by 2010
- 2.9 Mtoe average annual energy savings in 10 years through the National Energy Conservation Program
- Single-digit national average systems loss of distribution utilities by 2010

Energy Efficiency

There are no laws or regulations that directly mandate the implementation of demand side energy efficiency in the Philippines, except for some directives that apply only to government agencies. DOE initiates various energy efficiency (EE) and conservation programs through its National Energy Efficiency and Conservation Program, with the participation of target beneficiaries mostly on a voluntary basis. Conservation measures in government offices are mandatory. On the supply-side EE legislation has been introduced to institutionalize a system loss reduction program for distribution utilities.

Renewable Energy

The Renewable Energy Policy Framework embodies the overall objectives, policies and strategies of the Department of Energy (DOE) for promoting further development and utilization of renewable energy. By itself, the framework does not have the force of law, but there have been efforts to pass legislation to provide comprehensive and more drastic measures to accelerate the development and advancement of renewable energy resources.

A recent bill includes such measures as:

- A Renewable Portfolio Standard (RPS), i.e., the minimum percentage that generation companies are required to source from RE resources
- Establishment of a Renewable Energy Market as a sub-market under the Wholesale Electricity Spot Market
- A Green Energy Option program in which end-users with a monthly average of at least 100 kW may directly contract for renewable energy based energy
- Net-metering agreements between distribution utilities and qualified small distribution grid users.

There are laws and regulations providing the policy and regulatory framework for the development of specific renewable energy resources, such as the following:

- The Geothermal Act established the Service Contract System (the production sharing regime for domestic energy resources in the Philippines) for geothermal development and provides incentives to contractors, including recovery of expenses and exemption from all taxes except income tax.
- The Mini-Hydro Law aims to enhance the development of the country's domestic energy resources by providing various tax incentives to qualified private sector developers of small hydropower.
- Executive Orders provide the guidelines for private sector participation in ocean, solar, and wind energy development.

Sustainable Energy Technologies in the Philippines

Large Hydropower

The abundance of water resources makes hydropower an important part of the sector. However, the large up front investments, long construction periods and related environmental concerns have tarnished some of its attraction. Hence, the government approach of specifically promoting small hydro.

In 2006 hydropower contributed 18 percent of the country's electricity requirements, posting fuel oil displacement of 17.14 MMBFOE. In June 2007, the total installed capacity from hydropower stood at 3,257 MW. About 61 hydropower projects with a total potential capacity of 2,295.02 MW have been identified for development.

Small Hydropower

The Philippines has over 420 principal rivers and watershed areas ranging up to 25,000 square kilometres. The DOE estimates the potential for small hydro schemes is of the order of 1300 MW and so far only 90 MW has been installed.

There are 51 existing mini-hydropower facilities with a total installed capacity of 82 MW. These plants contribute around 200 GWh, which offsets the use of about 340,000 barrels of fuel oil equivalent every year. The total installed capacity of mini-hydro will soon increase to

89 MW with the completion of a 7 MW plant in Bukidnon. By 2009, aggregate mini-hydro capacity will reach 150 MW with the additional 12 mini-hydropower sites under development.

Small hydro projects are very suitable for the Philippine Department of Energy's Renewable Energy Power Program (REPP), which allocates US\$30 million as a financial facility for private sector participation in new renewable energy projects for capacities from 200 kW to 25 MW. However, the proposed interest rate of 12% for the funding source, with an additional 4–6% spread for the conduit bank, is not overly attractive.

To stimulate mini-hydro development, the Philippines government has enacted The Republic Act 7156, better known as the Mini-hydroelectric Power Incentive Act, which creates special incentives and privileges, such as tax and duty waivers, lower sales tax, a 10% VAT exemption, and a seven-year income tax holiday. Note that the law requires at least 60% Filipino ownership of corporations, partnerships, associations or companies engaged in mini-hydro industry.

Geothermal

The Philippines are the world's second largest user of geothermal energy for power generation. There is over 2060 MW of installed capacity, which generated a total of 13% of the country's total electricity requirements.

There were two companies involved in developing geothermal fields in the Philippines: The Philippine Geothermal, Inc. (PGI), which was a wholly owned subsidiary of the US company Union Oil of California (since purchased by Chevron); and the state-owned PNOC-Energy Development Corporation (PNOC-EDC). Both of these sold their steam to the state-owned National Power Corporation (NPC).

However, things changed with the passage of legislation which allowed private sector participation in power generation. The PNOC-EDC's later developments were tied to power plants (built by foreign companies) through the Build-Operate-Transfer scheme. The DOE conducts initial geo-scientific studies in less explored areas to update the reserves database and promote the identified locations to those parties interested in them for further exploration. Exclusive incentives exist for geothermal contractors under Decree 1442 otherwise known as the 'Act to Promote the Exploration and Development of Geothermal Resources'.

To support the country's bid to become the world leader in geothermal production, the government is promoting the development of 799.38 MW of additional capacity from 21 indicative geothermal power projects.

Media Extract 11: First Gen wins \$1.35 bln bid for geothermal stake

November 22, 2007 (Reuters) (Philippines)

Philippine power producer First Gen won an auction for the government's majority stake in geothermal firm PNOC-Energy Development Corp with a \$1.35 billion offer that taps into the energy potential of the Pacific Ring of Fire. Manila is selling its holding in PNOC-EDC, which generates power from volcanic hot springs, to help meet its 2007 budget deficit target of 63 billion pesos, or 0.9 percent of GDP.

A powerful joint congressional committee said on Thursday the sale was illegal because under Philippine law only the government can explore and develop domestic sources of energy, but a First Gen executive said the company was unperturbed.

Senator Miriam Defensor-Santiago, the co-chair of the Joint Congressional Power Commission, said its members would summon Finance Secretary Margarito Teves next week to explain the sale of a government "crown jewel" before they consider possibly asking the Supreme Court to suspend the sale.

“We are giving the Secretary of Finance an opportunity to air his side before the Powercom decides on more coercive measures to insist that PNOC-EDC should stay within government ownership and control,” Defensor-Santiago said.

Political interference and legal uncertainty have traditionally deterred foreign investment into the Philippines and helped stunt its economic development.

But with oil prices just shy of \$100 a barrel, alternative energy sources are viewed as potentially lucrative investments and First Gen’s chief financial officer told Reuters the company was unperturbed by the congressional committee’s moves.

“Things are moving as planned,” Giles Puno said in a mobile phone text message.

Manila spooked investors last year when President Gloria Macapagal Arroyo voided a deal allowing Malaysia’s Mitra Energy Ltd. to hold talks with the state-run PNOC Exploration Corp. about drilling oil from the Malampaya gas field.

First Gen and Iceland’s Reykjavik Energy Invest teamed up to bid for the state’s 60 percent holding. Their Red Vulcan joint venture beat three other groups with an offer that valued PNOC-EDC at 9.75 pesos (\$0.23) a share, 55 percent higher than Wednesday’s closing price.

The bid of 58.5 billion pesos was 30 percent above the government’s reserve price and 10 billion pesos higher than the next best bid from Filinvest Development Corp. and Britain’s International Power.

PNOC-EDC, which operates 9 steamfields with capacity of 1,145 MW, accounts for around 60 percent of the country’s geothermal capacity.

The Philippines, with 22 active volcanoes, is the world’s No.2 producer of geothermal energy after the United States due to its location on the seismically active Ring of Fire.

Chevron, the world’s largest producer of geothermal energy, is also active in the Philippines, running two steamfields that supply 7 percent of power demand on the main northern island of Luzon.

Despite its large alternative energy potential, including homegrown products such as the jatropha plant, the Philippines’ power sector has struggled to attract major investment.

Next month, Manila will try for a fifth time to sell a 25-year licence to run the national grid, valued at up to \$3 billion, but in urgent need of modernisation.

The PNOC-EDC purchase is First Gen’s first foray into geothermal power. The group relies on natural gas, diesel and hydropower to fuel its plants, which account for 12 percent of the Philippines’ current installed capacity.

First Gen’s stock finished flat at 58 pesos on Thursday, while PNOC-EDC gained 9.5 percent.

PNOC-EDC stock has risen 53 percent since it made its market debut last December, outperforming a 22 percent rise in the main stock market index.

Wind Energy

Despite minimal use of wind energy in the Philippines, potential is strong. A wind mapping survey estimated that the Philippines could potentially generate 70,000 MW, equivalent to seven times current electricity demand (EIA, 2004). The survey identified 47 provinces with the potential to generate at least 1000 MW. The wind resource is greatest in the north and northeast of the country, in the regions of the Batanes and Babuyan Islands north of Luzon; and the interior of Luzon, Mindoro, Samar, Leyte, Panay, Negros, Cebu, Palawan where land is higher. Areas that face east towards the coast from Luzon to Samar also represent good-to-excellent wind resources for utility-scale and excellent wind resources for village-scale applications. Less potential exists in the south and south-west of the archipelago.

The early use of wind generation included a number of small standalone. A 25 MW Wind Farm was inaugurated June 18, 2005 at Bangui Bay, Ilocos Norte. It was the first wind farm to be fully operational in the Philippines. The project was developed by the NorthWind Development Corporation consisting of 15 units of wind turbines arranged in a single row on the shores of Bangui Bay . These turbines are connected to the Luzon grid and deliver power to the Ilocos Norte Electric Cooperative. The NorthWind Project is also the first project in the Philippines to have an Emissions Reduction Purchase Agreement (ERPA) under the Clean Development Mechanism. The ERPA was signed by NorthWind and the International Bank for Reconstruction and Development through the World Bank Prototype Carbon Fund.

Some 345 MW of capacity from 16 additional wind power sites is expected to be added between 2008 and 2010, including the 40 MW Northern Luzon Wind Power Project of PNOC-EDC. Pre-commercialization contracts have also been awarded to various companies to further explore and develop potential wind power sites in the country, with a combined capacity of 140 MW.

Media Extract 12: NorthWind to complete plant expansion in August

Bangui Bay, Ilocos Norte

The Manila Standard May 3 2008. NorthWind Power Development Corp., owner of the country's first wind farm, will complete its expansion to 33 megawatts from 24 MW by August.

NorthWind chairman Ferdinand Dumlao said in a briefing that the company had completed the groundwork for the expansion and would be ready to install the wind turbines shortly. The wind turbines are set for shipment to Ilocos Norte. NorthWind plans to sell the additional capacity to be generated from the expansion to Ilocos Norte Electric Cooperative. Any excess would be sold to the wholesale electricity spot market, Dumlao said.

NorthWind supplies 40 percent of the province's power requirement while National Power Corp. provides the balance. Dumlao said the company would offer a 7-percent discount on its rates to the cooperative.

He said the company's expansion plans, including the possibility of setting up a wind farm in Cagayan Valley, had received support from Japanese, Danish and Spanish investors and creditors. "We hope we can tap more funds so we can expand more in this province," he said.

Dumlao said the passage of the Renewable Energy Bill would also help in enticing investors to pour in funds for these capital-intensive projects. "The provision in the RE bill that will allow investors to enjoy incentives will help promote wind energy development," he added.

Solar PV

In 2000 the Philippines had an installed PV capacity of 567 kW. The applications are various including telecommunications, battery charging stations, vaccine refrigerators, egg incubators, street lighting and PV-powered cinemas. Solar home systems have been installed through private companies, local and rural electric co-operatives. Whilst the technical potential is present, prohibitive costs and grid extension of conventional electricity hinders the commercial potential of solar home systems, which the DOE places at 500,000.

The Philippines has one of the longest histories with PV systems in Asia (outside Indonesia). The majority of its programs have been aid-driven, with mixed results. Many of the programs have added additional barriers to the implementation of renewable energy systems in the Philippines, such as the expectation that systems will be 'free' or that, if financed, no-one will turn up after a few months to collect the payments.

Solar energy has been strategically tapped for the electrification of remote areas in the countryside. In 2004, the first solar (grid connected) power project using photovoltaic (PV) solar system with a rated capacity of 0.95 MW was connected to the Mindanao grid by the Cagayan Electric Power and Light Company (CEPALCO).

The US\$300 million Sunpower Solar Wafer Fabrication plant in Sta. Rosa Laguna is expected to supply about 6 percent of the world market for PV cells – 20 percent of which shall be sold to the local market at a discount to encourage the establishment of a downstream solar industry in the country.

Biomass

With extensive agricultural, forestry and livestock industries the Philippines has an abundance of bio-energy fuel sources at its disposal. Potential fuel sources include

bagasse, coconut residues, wood, rice hulls and municipal solid waste. Fuel wood dominates as a household energy source in rural areas. Wood and wood charcoal are also utilised in bakeries, restaurants and other small-scale commercial operations.

In 1996 bagasse contributed 3.6% to the energy mix, with 39 operating sugar mills producing an estimated 4600 tons of cane daily. In the same year rice hull potential was estimated at 2.26 million metric tons. A 6 MW biomass combustor plant designed to operate using rice hulls is proposed for Panay Island. Traditionally rice hulls are disposed of along road sides, in rivers or by open-field burning, with detrimental environmental impacts. Previously rice hull projects have failed as a result of poor maintenance, supply considerations and management constraints.

Coconut residues including husks, shells and fronds are predominantly processed and exported as activated charcoal. Domestically shells are converted into charcoal and used for cooking, ironing and heating. Coco husks are used for industrial copra drying. Fronds may also be used for industrial drying or domestic cooking.

Media Extract 13: Biomass | Talisay City, Philippines

May 02, 2008 in Biomass

Negros Occidental, in partnership with Ventures Factors of the Philippines have signed a power supply agreement with the First Farmers Holding Corp. The electricity will be sourced from a new bagasse biomass co-generation power plant in Talisay City. The biomass power plant will be capable of generating up to 21MW of renewable source electricity and is expected to be brought on line by October 2008.

Bagasse is sugarcane waste and it will come from the surrounding area with the biomass sourced power helping to cushion the effects of the power shortage now being felt in the Visayas grid.

Even with the power purchase agreement with First Farmers Holding Corp, it will still be necessary to purchase 40 MW from Kepco-Salcon Power Corp., a coal-fired power plant in Cebu, to meet the increasing power needs of the area.

Rosendo Lopez, FFHC vice president, said his firm's bagasse biomass co-generation power plant could produce 21 MW.

"We will be producing cheap renewable energy from sugarcane waste so it will not affect food security since we will still be producing sugar," Lopez said.

The biomass power plant will be constructed at a cost of P500-million and is expected to be commissioned in September with commercial operations beginning by October 2008.

Under the signed agreement, FFHC will sell 5 MW of power to Ceneco for two years from 2008 to 2010. The power supply from FFHC will be delivered to Ceneco through its existing 69 KV transmission line in Talisay City.

The FFHC selling price would be one percent less than the cost of power supplied by the National Power Corp (Napocor).

At current rates, the FFHC power cost would be about three centavos less per kilowatt-hour than that of Napocor, Montelibano said.

The plant could be entitled to carbon credits from the World Bank because the plant would produce renewable energy, FHC corporate secretary Rafael Lizares said.

Biogas

Several hundred domestic biogas systems for generation from animal wastes are installed in the Philippines with the technology having been used since the 1970s. Such plants are equally attractive for their pollution mitigation abilities as they are for their energy production. In the last 10 years there has been increasing activity in the treatment of waste water and animal waste effluent streams with biogas processes. There are a growing number of local manufacturers and suppliers of biogas technology in the Philippines. The major players in this field offer full development services, project finance and carbon advisory services.

There has been an increased impetus for development through the opportunities generated by the CDM process. 37 projects have been registered with host country approval – of

these 24 are biogas (waste water 8, animal waste 16) and 16 of these have been registered with UNFCCC. Again 11 of these are biogas projects - waste water 2, animal waste 9.

Municipal solid waste disposal is a growing problem in the Philippines, highlighted by the 2000 Payatas dump site collapse. This led to a Presidential Task Force on Solid Waste Management to consider landfill gas generation and incineration options. Progress has been slow, hindered by the significant social issues that improved waste management and recycling can generate for those whose livelihood depends on the ad hoc scavenging at the major city dump sites. The articles below outline some recent agreements to try and address these issues:

Media Extract 14: Firm proposes biogas project at Iloilo dumpsite

Cebu Daily News 12/17/2007 Iloilo City, Philippines

A private firm specializing in biogas projects wants to put up a plant at the Iloilo City dumpsite. PhilBio Sciences Company sent a proposal to the Iloilo City Solid Water Management Board (ICSWMB) last week seeking to use part of the 23-hectare Calajunan dumpsite for a plant that would use garbage to produce biogas or methane gas. The gas will be used to generate electricity. But there's another benefit — it would reduce the volume of garbage in the landfill, the proposal said.

PhilBio also proposed to convert a section of the dumpsite into a park, upgrade its waste disposal system with the installation of cell-type modular residual landfills to extend its economic life, improve the Leachate Collection System for re-circulation and increase recovery of biogas for energy applications.

Ricky Beltran, PhilBio consultant, suggested in the proposal that the project be taken on a Build, Operate, Transfer (BOT) scheme, which would mean that the city would not spend for the project but would eventually own the facility.

PhilBio manager John Cesar Santos said the project would entail a 25-year land use agreement and 25-year waste supply agreement with the city government.

The project proposes the conversion of some 50 metric tons of pure organic garbage to generate one megawatt of power supply. PhilBio also promised a discounted electricity rate for the city government.

Mayor Jerry Treñas said that while PhilBio's proposal sounded promising and beneficial to the local government since no money from the local government would be required, the proposal should be assessed further by the ICSWMB and reviewed by the city council.

Treñas said he was interested in the proposal since the use of natural waste as energy would help the city in its clean and green campaign. /Inquirer

Media Extract 15: QC, energy firm to convert Payatas biogas to electricity

August 2007

The Quezon City government, with the help of the Pangea Green Energy S.r.l. and the Pangea Green Energy Philippines Inc., a renewable energy company that invests in biogas projects worldwide, will soon start a project that will convert electricity the methane that is produced by the Payatas dumpsite.

The Department of Environment and Natural Resources (DENR) approved the project recently. Under an agreement signed last February 14, Pangea will extract, collect, flare and convert energy the biogas that will be collected from the Payatas dumpsite.

Biogas is produced during the fermentation of organic matter such as sludge, municipal solid waste or biodegradable waste. It is mainly composed of methane and carbon dioxide. It can be used for heating or cooking and likewise be used for generating electricity.

Located in Area 2 of Barangay Payatas in Quezon City, the project aims to assist the local government in managing the biogas produced by the Payatas dumps to mitigate its environmental impact.

The project involves the extraction, collection, processing and conversion of biogas emissions from its 22-hectare Payatas-controlled disposal facility.

Methane from the collected bio-gas will be converted to electricity and the rest burned in a high temperature enclosed flare.

Environment and Natural Resources Secretary Angelo T. Reyes signed recently a letter of national approval for what is named Quezon City Controlled Disposal Facility Biogas Emission Reduction Project, one of the several Clean Development Mechanism (CDM) projects that are expected to reduce greenhouse emissions around the country.

According to Reyes, "the Quezon City government is aware of the adverse impacts of biogas on the health of its people and on the environment as a whole. By effectively extracting and converting biogas emissions to energy, it helped reduce greenhouse gas emissions, thus, addressing global and regional impacts of climate change."

The DENR is the designated national authority (DNA) for CDM projects, started under the Kyoto Protocol where developed countries pledged to reduce their emissions of carbon dioxide and five other greenhouse gases.

The signatories had likewise committed to engage in emissions trading or "carbon trading" if they maintain or increase emissions of their greenhouse gases. Under the carbon trading scheme, developed countries can either undertake to cut domestic emissions of carbon dioxide and five other greenhouse gases themselves or "buy" the equivalent amount of reduction by financing emissions-reducing projects in developing countries like the Philippines.

The Philippines expects to cut to an estimated 116,339 tons of its carbon dioxide emissions in the next few years. As the DNA in the Philippines, the DENR evaluates whether a project contributes to sustainable development and whether the Philippine-based project participants have the legal capacity to participate in the proposed project. To date, the DENR has received a total of 39 applications for registration in the CDM, with a total estimated reduction of 1.74 million tons of carbon dioxide per year. Of these, 17 were already issued with country approval by the DENR, 10 of which are now registered with the CDM executive board in Bonn, Germany, with an estimated reduction of 346,170 tons of carbon dioxide per year.

The NorthWind Bagui project, a 33-megawatt wind turbine power plant located on the foreshores of Bangui bay in Ilocos Norte, is the country's first CDM project registered in Bonn, Germany.

Biofuels

On January 12, 2007, Republic Act No. 9367 was passed by the Philippine Congress directing the use of Biofuels and launched the Philippines' Biofuels Program. Enshrined in the law is the State's policy to "reduce dependence on imported fuels." Within two years, gasoline shall be blended with bioethanol to the extent of 5% of its volume with the percentage increased to 10% in four year's time. The law also mandates a 1% biodiesel blend for all diesel engine fuels within three months from with the blend increasing to 2% in two years time. The Specific Tax on local or imported biofuels "component" was rated at "0" with the sale of raw material used in the production of said fuels exempt from the value-added tax.

The Department of Agriculture has reported a total of 16 bioethanol projects being constructed. When completed, the rated capacity of these projects, representing half a billion US dollars in investments, is placed at 567 million litres annually. This is on-stream to meet the Philippines 2014 requirement of about 537 million litres of bioethanol.

Media Extract 16: Madrid-based firm investing \$200M to develop 100,000 hectares of land for Jatropha plantations in the Philippines

December 2, 2007 (Inquirer)

A MADRID-BASED biodiesel firm is planning to invest \$200 million in the Philippines to develop at least 100,000 hectares of land into jatropha plantations, the Department of Agriculture said.

The jatropha will be used as feedstock for biofuel facilities in the country.

According to Agriculture Secretary Arthur C. Yap, Bionor Transformacion S.A., a global multi-feedstock firm, disclosed last month its plans to invest in the Philippines' biofuel sector through the memorandum of agreement signed between AME Bioenergy Corp. and Philippine Agricultural Development and Commercial Corp.

Under the agreement, AME is the "key integrator for Bionor in the country" and has been tasked to "identify suitable jatropha plantation sites, consolidate lands, organize and train farm labor and organize local support to install plantation infrastructure."

AME is likewise expected to study the cost structure for production to determine and recommend to Bionor whether its planned jatropha development project is economically viable and internationally competitive.

Meanwhile, PADCC will assist AME and mobilize the resources of the DA's agencies and bureaus, as well as financial institutions, to help realize Bionor's investment plans.

"Bionor's main thrust is to develop feedstock plantations worldwide using raw materials that do not compete with the food sector and do not lead to deforestation," Yap said.

For this reason, Bionor is tapping jatropha, a non-food crop, to support the requirements of its refineries, he added.

Bionor is currently operating two biodiesel plants in Spain and Italy with a combined output of 125,000 metric tons.

It is constructing an additional five plants in Spain and Brazil, which will add 900,000 MT of capacity in 2008.

By the first quarter of 2009, Bionor is expected to have a combined capacity of more than a million tons of methyl ester.

Last January, President Gloria Macapagal-Arroyo signed into law RA 9367 or the Biofuels Law, which aims to ease the country's dependence on imported, dollar-draining and pollution-generating energy sources.

The law has made the blending of ethanol and coco biodiesel in petroleum products mandatory.

Media Extract 17: Waste Recovery, Inc. Acquires & Merges With Alternative Green Technology and Energy Company

CAGAYN DE ORO, PHILIPPINES--(Marketwire - April 11, 2008)

Waste Recovery, Inc. (PINKSHEETS: WRII), a Texas Corporation, will File its 8K for a Name Change to GreenGold Ray Energies, Inc. and its Acquisition/Disposition of Assets.

Waste Recovery (WRII) entered into an agreement on April 8, 2008 to acquire 100% of GreenGold Ray Energies, Inc. (GGRE) in exchange for 9,500,000 super voting preferred shares and 1,000,000 post reverse split shares of Waste Recovery, Inc. Waste Recovery will reorganize so that every shareholder holding 10,000 common shares of WRII will receive 1 new unrestricted and 10 new restricted GGRE common shares in exchange thereof. GGRE currently controls through joint venture agreements, approximately 3,000 hectares of land in Mindanao Island and 300 hectares in Batan Island of which Jatropha seedlings have been planted. GGRE is now preparing the 3,000 hectares of land as GGRE's Jatropha Plantation. Another 10,000 hectares are in the process for acquisition in Bukidnon, Mindanao Island. As a part of the Agreement, Waste Recovery will change its name to GreenGold Ray Energies, Inc. (GGRE) and has appointed new officers and directors effective April 8, 2008.

The GreenGold Ray Energies, Inc. (GGRE) Company is a growing international green technology and environmental energy company that is working to fully utilise both agricultural oil-based mineral resources and alternative energy sources produced from sugarcane, coconut, Jatropha, sweet Sorghum and other crops. GGRE is considered as a development-stage company and will remain in this status until revenues are generated from the first Jatropha productions begin: estimated production is during the Fall of 2008.

GreenGold Ray Energies, Inc. (GGRE) shall be one of the foremost biodiesel, biofuels, and biogas companies in the Philippines, seeking an equilibrium between the current oil-based technologies biodiesel, biofuels, biogas, and utilizing long-term partnerships by harnessing the involvement of private groups, local governments and host communities, achieving consistent profitability, and making its contribution to the delight of its shareholders, customers, employees, and the environment.

BIODIESEL PRODUCTION

Company Field Director Rey Oliva managed the planting of the first Jatropha seedlings in the 300 hectares of land of the Island of Batan. Additional 3,000 hectares of land are being prepared for Jatropha plantation. There are another 10,000 hectares being offered for acquisitions in the Island of Mindanao to become a third Jatropha Plantation. Batan Island is a rich island with feedstocks include copra (dried coconut kernel), available in plentiful supply in that area, and the plentiful berries of the easily propagated Jatropha plant, known to be similar to fossil fuel in their chemical composition and requiring a short cycle from planting to harvest (approximately 7 months). GGRE is cooperating with the Philippines Department of Science & Technology (DOST) toward a design of the proposed biodiesel fuel production plant, and the company's engineers and environmental consultants will conduct an investigation into the environmental effects of cultivating the Jatropha plant on a commercial scale.

GreenGold Ray Energies, Inc.'s (GGRE) mission and vision is to partner with the Philippine government and local host communities to acquire land for manufacturing/distribution facilities of alternative energy products. In addition, GGRE is involved in providing products and services targeting the resource-rich yet fiscally poor host communities in order to create orderly and sustainable jobs, with manufacturing of bio-fuels, biodiesel and biogas that promote the growth of this high-potential energy industry in the Philippines, and the design and construction of wind energy power plants to supply electricity to remote areas throughout the Philippines.

The recent enactment in January 2007 of Republic Act No. 9367, otherwise known as "An Act to Direct the Use of Biofuels, Establishing for this purpose the Biofuel Program...", has sparked interest in the Alternative or Renewable Energy Sector in the Philippines. This has resulted in some foreign companies setting up biofuel production facilities in areas with vast sugarcane fields (raw material for bioethanol), coconut plantations (raw material for biodiesel), and Jatropha (raw material for biodiesel).

A Memorandum of Agreement (MOA) with the 300 hectares lot owners in Batan Island, Albay and with the KAHIB indigenous people association of Binasan, Iligan City, Mindanao, Philippines with a land area of 3,000 hectares had been designated to be developed as Jatropha Plantations, providing raw materials for the production of biofuel.

Vietnam

Current Energy Status

- Vietnam's primary energy demand is projected to grow annually at 4.4 percent to 142 Mtoe in 2030, as a result of industrialisation of the economy.
- Vietnam is expected to become a net energy importing economy beyond 2020; with the energy import dependency projected to reach 15 percent in 2030.
- The total investment requirements are estimated to be between US\$136-172 billion; of which four-fifths of the investment will be required for electricity generation and transmission.

Energy has been a key component of Vietnam's solid and strong growth during the last decade and will remain so if high growth continues through 2010. However, like many countries of similar demographics, Vietnam is facing the difficult challenge of maintaining this growth in a sustainable manner, with no or minimal adverse impacts on society and the environment. Vietnam will increasingly become dependent on fossil fuels. It is estimated that the share of fossil fuels – coal, oil, and natural gas – in the total primary energy supply will rise to 69 percent in 2030. However, it is expected that domestic energy production will meet most if not all the projected requirements as Vietnam has large oil, natural gas, and coal reserves. Vietnam has been a net energy exporter and is expected to remain so in the foreseeable future.

Biomass, mainly wood residues, which now accounts for the bulk of renewable supply, will decline in importance, both in relative and absolute terms, as modern energy becomes universally accessible and available, incomes rise, and urbanization spreads. The combined contribution of renewables, including large hydro and geothermal plants, in the total primary energy supply will fall to around 22 percent in 2030. Despite this, energy supply from renewables other than biomass (wind, solar PV, geothermal, waste-to-energy, and hydropower) is expected to increase. Hydropower production, in particular, is projected to grow by 4.9 percent per annum to 2030. Moreover, it is also likely that nuclear power will have a certain share by 2030.

Regulatory Status

The recently agreed National Energy strategy contains the following key elements:

- Developing energy infrastructure and ensuring adequate, stable and long-term energy supplies for development;
- Developing energy, taking into account environmental considerations and sustainable development;
- Encouraging the economical and efficient use of energy by:
 - taking steps to replace low efficiency equipment and facilities,
 - encouraging domestic manufacture of end-use equipment and facilities that meet energy efficiency standards,
 - carrying out measures to improve energy conservation in large buildings
 - applying the principles of demand side and energy supply management
- Developing new and renewable energy resources, such as small hydro, wind power, solar energy, and geothermal
- Promoting rural energy policy by ensuring adequate energy supply for the sustainable development of remote populations, achieving rural access for all by 2010;
- Enhancing international cooperation in energy
- Improving legal frameworks and market-oriented reforms, especially in the power sector

Energy Efficiency

The existing National Strategic Program on Energy Saving and Effective Use laid out a plan for achieving very ambitious energy saving targets in the Vietnamese economy, including saving from 3 percent to 5 percent in total energy consumption in 2006-2010 and from 5 percent to 8 percent in 2011-2015, against the existing forecast on energy development and socio-economic development.

A new Law on Energy Conservation and Efficiency is being drafted. This Law will help clarify the roles and responsibilities of agencies and ministries in carrying-out the several decrees and policies now in place. The draft was to be submitted to the National Assembly in December 2007. It is expected to take effect in 2009.

Besides the above-mentioned regulations that focus on demand-side energy efficiency, the Power Sector Development Master Plan targets supply-side efficiency improvement. It calls for a shift towards higher-efficiency coal-fired base load units.

Renewable Energy

The major renewable energy policy document remains the Renewable Energy Action Plan (REAP) promulgated by Ministry of Industry (MOI) in 2001 with support from the World Bank and Electricity of Vietnam (EVN). REAP is grounded in various Government documents, including the 2001-2010 Master Plan of Power Development. REAP focuses on rural electrification of remote areas as a near-term opportunity to scale-up renewable energy technologies, including micro-hydro, wind, biomass, and solar PV. It establishes goals for renewable energy-based electrification for the hundreds of thousand of households not covered by EVN's grid expansion planning. REAP comprises five components:

- individual renewable energy systems for households and institutions
- off-grid village hydro schemes
- grid-based renewable energy schemes
- policy and institutional capacity building
- technology improvement and resource assessment.

It is a two phase, 10-year programme with a Phase 1 target of adding 25-50 MW of renewable energy capacity, providing access to more than 35,000 households. Other than REAP, the only other mention of special encouragement for renewable energy is in the Electricity Law, which states that:

- investment incentives, preferential pricing, and preferential taxes are to be provided through MOF for development of new and renewable energy resources
- individuals and organisations are encouraged to utilise renewable energy when providing electricity access to rural and mountainous areas.

There is also an effort to develop a Master Plan for Renewable Energy Development that would seek to increase the amount of renewable energy developed according to certain long-term targets. MOI and the Institute of Energy were working on the background analysis with an eye towards floating a draft decree in 2007 (Institute of Energy, 2006). MOI is also developing a Law on Renewable Energy, for which a draft was expected in 2007 as well.

Sustainable Energy in Vietnam

Over 50% of Vietnamese people live without electric power and only some can be expected to be electrified via the national grid. There exists, therefore, a considerable potential role for hydroelectricity, biomass and solar power. This includes both grid-connection of the larger renewable energy systems, and a considerable market for renewable systems for the many communities and houses that are likely to remain off-grid.

The major renewables implemented in the country so far are biogas digesters, windmills for water pumping, solar water heaters and mini-hydropower plants.

Solar Photovoltaic

Vietnam has a relatively good solar resource which makes solar energy an ideal source to meet the off-grid needs especially in the more diffuse population areas where mini-grids are not feasible.

The major organisations active in implementing solar energy systems are the Solar Laboratory of Vietnam Science Institute (Solarlab) based in Ho Chi Minh City, the Institute of Energy in Hanoi (which is a part of EVN within the Ministry of Industry) and the Renewable Energy Centre of the Hanoi University of Technology. There was an early major SELCO project, in cooperation with the Vietnamese Women Union, which installed over 600 systems in operation.

There are three types of systems that define the Vietnamese PV market:

- individual home systems
- village facilities (common lighting, audio, television)
- energy centres for recharging batteries

PV modules are generally imported while some balance-of-system components are locally manufactured. The national telecommunication company and EVN own subsidiaries for the design and installation of solar electric systems for their own internal needs.

There appears to be no central solar PV plan but a number of bilateral programmes as the following examples indicate:

Under a solar power cooperation program the 'Vietnamese-French Friendship Solar Station' was established in Ho Chi Minh City to provide a program of solar electricity provision in the provinces of Gia Lai, Quang Nam and Bin Phuoc (EIA, 2005). Over the last five years, some 1,270 household PV systems have been installed in provinces of the southern region. In addition, a number of systems, ranging in capacity from 500 Wp to 1,500 Wp, have been installed in hospitals, schools and village communities.

In April 2008 it was reported that Southern Tra Vinh province will operate its first solar electrical energy project, worth US\$36,000 to be financed by the Czech Republic, in an islet five kilometres from the coast. The project will supply a total of 1,100 kWh for 10 local households and a primary school. It will also provide electricity indirectly to nearly 110 households in Cau Ke district.

Recent announcements on domestic manufacturing suggest that the annual demand for solar PV is of the order of 1.2MWp (around 24,000 SHS per year).

Media Extract 18: Construction of Vietnam's first solar panel, cell plant launches

Thursday, March 20, 2008.

Work on Vietnam's first solar panel and cell manufacturing factory will kick off tomorrow at Hoa Duc Plastics Industrial Park located in the southern Long An Province. Ho Chi Minh City Energy Conservation Center (ECC), in cooperation with the Red Sun Energy Joint-Stock Company, will invest US\$10 million into the factory, with France-based Sunwatt Group acting as the primary technical consultant.

The plant will assemble solar panels from solar cells imported from France and German at a production capacity of 3MWp per year in the first stage. In the second stage, the factory will be able to manufacture solar cells with an annual output of 5MWp.

Forty percent of the factory's products will serve local demands, while the remainder will be exported. The products are guaranteed for five years and have a life expectancy of 20 years. The plant is expected to begin operating after construction finishes in six months time.

Biomass

Biomass, including wood fuel and agricultural residues (rice husk, rice straw, coffee husk, bagasse etc.), is widely used for energy production in Vietnam. Biomass fuels sources that can also be developed include forest wood, rubber wood, logging residues, saw mill residues, sugar cane residues, rice residues and coconut residues.

Currently biomass is generally treated as a non-commercial energy source, and collected and used locally. The use of biomass for producing energy in a commercial sense has not received the attention of energy planners in the same way as sources such as solar power and hydroelectricity.

Biogas

Biogas is another widely available resource for Vietnam. What is captured is generally used for cooking in households and a small amount is used for electrical generation in sugar mills (approximately 150 MW).

Different domestic biogas digester programmes have been implemented in Vietnam over the past 50 years, but it has been suggested that none have aimed at large scale dissemination or long-term operational success. This is despite the fact that conditions in Vietnam are favourable for biogas and that people are interested in the technology because of the obvious benefits that biogas can provide. A programme by Vacvina (a national agro-based NGO with over 250,000 members) actively promoted the use of simple systems that utilised a plastic containment unit. This was later developed into a concrete structure. In both cases these units operate at low pressure removing the need for skilled artisans to build the units commonly seen in operation in Nepal, India and China. Under a programme between the Vietnamese and Netherlands Governments a domestic biogas dissemination project began in January 2003 using the more traditional unit structures. The first phase was successfully completed in January 2006 with the accomplishment of completing 18,000 plants. In 2006, the programme expanded from 12 to 20 provinces and increased the number of installations with another 9,000. The planning up to 2011 is to reach about 35 provinces and install a total of 150,000 plants, which will provide 800,000 people with improved energy services.

Municipal Solid waste

A number of municipal waste to energy projects are under development utilising municipal solid waste, in general concentrating on the treatment of organic / liquid effluents from landfills to capture methane for small scale power generation. As with many similar projects in the region the challenges include the ability to secure an acceptable tipping fee that can be enforced and the generally poor quality of the landfill installations.

Hydropower

In 2003 hydroelectric power in Vietnam provided 50% of the nation's total electrical capacity of 6000 MW. Of this, grid-connected mini-hydro systems were generating about 60 MW of power, from 48 distinct systems ranging from 100 kW to more than 7.5 MW. Vietnam currently has five hydro developments underway, financed by the government or international assistance programmes.

- The Son La project. Construction began in 2005. Intended to be generating 2400 MW by 2012, which will make it the largest hydro project in Vietnam.

- The Ban Ve hydropower plant. Construction began in September 2004 and commissioning is due in 2008.
- The Dong Nai 3 and Dong Nai 4. These are EVN projects in the Central Highlands with a combined capacity of 500 MW.
- The EVN's Se San 4 hydropower plant in the provinces of Gia Lao and Kon Tum.
- Construction began in December 2004. The plant will be 330 MW and generate 1.4 billion kWh per year. Vietnam also plans to build three additional plants in the same region before 2010

In addition to grid-connected hydro, there are more than 300 independent hydro-grids with a collective capacity of 70 MW. Individually these systems range in capacity from 5 to 200 kW. A key problem has been reliability and it is estimated that only a third are currently operational.

Even smaller 'household scale' micro-hydro systems are proving important in isolated rural communities located far from the grid but close to suitable water courses. Vietnam has one of the world's largest markets for such small hydro systems in which up to 150,000 generation kits have been sold. Such systems provide between 100 and 1000 watts. This market is driven by the fact that poor quality systems account for around 90% of sales because they are cheap and affordable to poorer rural buyers. These low cost units do not provide a constant voltage with varying water flows and in safety standards are less than adequate. Historically there has been a preference for lower cost units imported from China rather than units produced within Vietnam.

Vietnam has a significant internal manufacturing capacity in the hydro sector manufacturing its own mini- and micro-hydro components for systems up to 2 MW capacity. The Vietnamese energy master plan recommends the establishment of a Small Hydropower Development Authority (SHPDA) to re-start investment in the sector, which has been depressed for some years. A key objective of the SHPDA would be to stimulate a pipeline of 'bankable' on- and off-grid small hydro projects by building local human capacity. It is estimated that investments in this least-cost remote power source could reach US\$20 million over a five-year period.

3. The Kyoto Protocol and its Flexible Mechanisms

International Context

The 1992 **United Nations Framework Convention on Climate Change (UNFCCC)** is an international convention, agreed to by 192 countries, which has the objective of, stabilising levels of greenhouse gasses (GHGs)⁸ in the atmosphere at a level that prevents dangerous interference with the climate system. The UNFCCC was developed in response to the growing concern that average global temperatures were increasing as a result of increased concentrations of GHG in the atmosphere. However, even in adopting the UNFCCC, the global community recognised that far greater emission reductions would be needed to achieve the stabilisation of GHG concentrations. In 1997, the **Kyoto Protocol** to the UNFCCC was adopted, which aims to reduce overall industrialised country emissions by an *average of 5% below 1990 emission levels*. The Protocol came into force in February 2005.

Under the Protocol, 38 Annex 1 countries have now committed to individual GHG reduction or limitation targets relative to their national emissions of GHGs in 1990. For example, the European Union has agreed to reduce the emissions of 15 of its member states collectively by 8% and Canada has a target of reducing its emissions by 6%. Australia, which ratified the Protocol on 11 March 2008, has a target of limiting emissions growth to 108% above 1990 levels. These targets are to be achieved between 2008-2012, which is known as the Protocol's 'first commitment period'.

The Kyoto Protocol allows industrialized countries with targets to meet part of their commitments through three so-called 'flexible mechanisms':

1. **Emissions trading** with other industrialised Parties with targets;
2. **Joint implementation (JI)** of emission reduction projects with other industrialised Parties with targets; and
3. **Clean development mechanism (CDM)⁹ projects**, which are emission reduction projects undertaken in developing countries that have ratified the Kyoto Protocol.

The Clean Development Mechanism

The CDM enables developing countries to attract investment for projects involving clean energy and other measures that reduce or sequester greenhouse gas emissions. These projects are also intended to contribute to the sustainable development of the host developing country by promoting the transfer of less carbon-intensive technologies and encouraging international investment.¹⁰ Under the CDM, valid reductions in emissions generated from projects in developing countries can yield credits known in this framework as certified emission reductions or CERs. Those credits can then be sold to or otherwise used by Annex 1 (developed) countries to count towards meeting their Kyoto Protocol targets at the least overall cost.¹¹ The rationale for this is that emissions reductions anywhere on the planet provide an equivalent benefit in mitigating climate change. Further,

⁸ Carbon dioxide (CO₂), methane (CH₄), nitrous oxide (NO_x), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆).

⁹ Article 12 of the Kyoto Protocol to the United Nations Framework Convention on Climate Change, 37 ILM 22 (1998) hereinafter the Kyoto Protocol

¹⁰ The Kyoto Protocol does not provide guidance on the meaning of 'sustainable development'. Therefore, it is a matter for the host country to determine whether or not a project will assist in meeting its sustainable development objectives as determined by national policies and plans. However, criteria that have been used by other countries include whether the project:

- provides a net environmental benefit;
- delivers a net contribution to economic development; and
- contributes to the improvement of social conditions. See: UNDP *The Clean Development Mechanism: An Assessment of Progress* (November 2006) hereinafter UNDP (2006) at p.124

¹¹ Article 12(2) Kyoto Protocol

it is often more cost effective to reduce emissions in developing rather than developed countries.

In order to achieve approval, CDM project activities must meet three other requirements in addition to promoting sustainable development in the host country. These requirements, which have been agreed at the international level, are:

- Projects must yield real, measurable and long-term emission reductions.¹²
- Reductions that result from CDM projects must be '**additional**' to any reductions that would have taken place anyway, in the project's absence.¹³ The method of determining a project's additionality will vary from project to project but essentially involves a comparison of baseline emissions (business as usual emissions), with emissions that can be anticipated after the project's implementation.
- Projects should not result in the diversion of existing Official Development Assistance (ODA).¹⁴ This requirement has been interpreted to mean that whilst ODA can be used to assist in building the capacity of a host country to participate in the CDM, it should not be used to invest in actual project infrastructure or to pay for CERs.¹⁵

In addition to the objectives set out in the Kyoto Protocol, there is also a qualification that the use of the flexible mechanisms must be **supplemental to domestic actions** taken by Annex 1 countries to meet their greenhouse gas emission reduction commitments.¹⁶ Domestic action is required to constitute a significant effort in Annex 1 countries, thus mechanisms assist, but do not displace, emission reduction activities in Annex 1 countries. As an example, the EU-15, which has a collective target to reduce emissions to 8% below 1990 levels anticipates that use of the flexible mechanisms will amount to 2.5% of that target or roughly 30% of its effort.¹⁷

It is anticipated that during the first commitment period over 2.5 billion CERs will be issued for more than 3000 CDM projects.¹⁸ This suggests that the CDM is an effective tool to mobilize large quantities of private and public investment for developing countries, to promote the transfer of low carbon technologies and to enable them to shift to a less carbon intensive economy.

How the CDM works – key players, project types and project cycle

At an international level, the legal framework for the operation of the CDM is derived from the UNFCCC, Article 12 of the Kyoto Protocol, the Marrakesh Accords, decisions made by the Conference of the Parties serving as the meeting of the parties to the Kyoto Protocol (COP/MOP), and rules developed by the Executive Board (EB) of the CDM.

Participation in the CDM is voluntary, so it is a matter for each country to determine whether or not to participate based on its assessment of the likely benefits of a project. The types of entities that may be involved in projects include governments, private companies, NGOs and international organisations.

¹² Article 12.5(b) Kyoto Protocol

¹³ Decision 3/CMP.1 'Modalities and Procedures for a clean development mechanism as defined in Article 12 of the Kyoto Protocol' Annex para 43-44 - set out in document FCCC/KP/CMP/2005/8.add.1

¹⁴ Decision 17/CP.7 preamble & Decision 3/CMP.1 Appendix B para 2(f)

¹⁵ OECD (2004) 'ODA Eligibility Issues for Expenditure under the Clean Development Mechanism: Proposal by the Chair' DAC/Chair (2004)4/Final 30 April 2004

¹⁶ Decision 2/CMP.1 'Principles, nature and scope of the mechanisms pursuant to Articles 6, 12 and 17 of the Kyoto Protocol' - set out in document FCCC/KP/CMP/2005/8.add.1

¹⁷ European Environment Agency (EEA) Report 5/2007 *Greenhouse gas emission trends and projections in Europe 2007. Tracking progress towards Kyoto targets* (Copenhagen, 2007) hereinafter EEA Report 2007

¹⁸ see UNEP RISOE CDM Pipeline at www.cd4cdm.org

Domestic implementation of the CDM requires certain enabling steps to be taken by the participating country to give effect to the international rules.

From a developing host country point of view, the only prerequisites for participation in the CDM are that:

- the country has ratified the Kyoto Protocol, and
- it has a designated national authority (DNA) for the CDM which has adopted a CDM approval process.¹⁹

Within the Asia Pacific region, 34 countries have established DNAs which are responsible for evaluating projects, based on approval processes related to national sustainable development criteria, and issuing letters of approval which are a prerequisite for a project to be registered by the EB.²⁰

Annex I countries that seek to participate in the CDM have additional requirements for participation which relate to inventories, reporting and compliance.²¹ These are addressed in more detail in relation to Australia below.

The CDM is supervised by the EB, which is elected by and responsible to the COP/MOP. The EB plays an important role in:

- reviewing modalities and procedures for CDM activities and making recommendation to the COP/MOP,
- approving new methodologies (e.g.: for establishing baselines, project boundaries and monitoring),
- accrediting designating operational entities (DOEs),
- maintaining the CDM project registry,
- reviewing project validation and verification reports prepared by DOEs, and
- issuing verified CERs.²²

A DOE is an entity accredited by the EB with sectoral expertise, to review the project design documentation (PDD) against CDM requirements for **validation** as a CDM project activity and to submit the PDD to the EB. The DOE also carries out the function of **verification** of emissions reductions of registered CDM project activities once the project has been implemented. DOEs are responsible for approving the technical and legal aspects of a proposed CDM project, such as the project's justification for additionality, the greenhouse gas emissions baseline and the monitoring plan.

At present, there are 19 accredited or provisionally designated operating entities and a further 30 applications are under consideration.²³ Most of these are companies based in Europe or Japan. In order to become an accredited DOE, the entity must meet criteria relating to its competence in a range of areas, including management, resource sufficiency and technical knowledge relevant to the sectoral scopes in which they operate.²⁴ The types of entities that have been accredited include management consultancies, certification, quality assurance and standards bodies.

¹⁹ Decision 3/CMP.1 Annex para 29-30 see FCCC/KP/CMP/2005/8 and Addendums 1-4 — these include the need to have appointed a designated national focal point for the CDM, calculated and recorded its assigned amount unit (AAU), established a national system for estimating its GHG emissions, put in place a national emission and transaction registry, submitted annually its most recent GHG inventory and developed an accounting system for the sale and purchase of AAUs.

²⁰ Contact details are available at <http://cdm.unfccc.int/DNA/Index.html> for the following Asian countries: Bangladesh, Bhutan, Cambodia, China, Fiji, India, Indonesia, Lao PDR, Malaysia, Maldives, Mongolia, Myanmar, Nepal, Pakistan, PNG, Philippines, Republic of Korea, Singapore, Sri Lanka, Thailand and Vietnam

²¹ Decision 2/CMP.1 para 5 & Decision 3/CMP.1 Annex para 31-32

²² Decision 3/CMP.1 Annex para 5

²³ <http://cdm.unfccc.int/DOE/list/index.html>

²⁴ UNFCCC 'List of Sectoral Scopes – Appendix A: Competence Criteria for an AE/DOE under CDM' CDM-ACCR-06 Version 4 p.2

To qualify for CDM approval and ultimately the issuance of CERs, projects have to successfully move through a step by step project cycle. This is outlined in the following diagram.

CDM project activity cycle

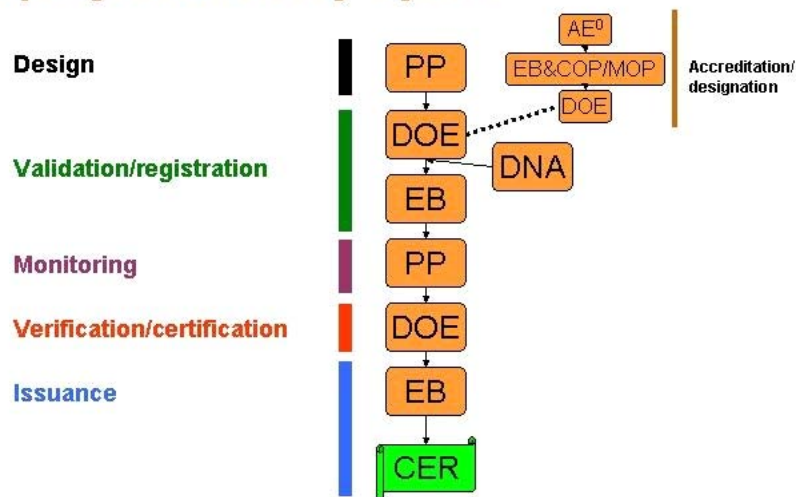


Figure 4: CDM Project Activity Cycle

What types of projects are eligible?

There is a wide range of project types that have been identified as being suitable for CDM project activities. Examples of some of the types of energy projects that are being carried out include:

- **Renewable energy:** solar home systems, wind battery chargers, wind or solar powered pumps, power fed into the grid from wind, wave, hydro, photovoltaic, geothermal and biomass.
- **Energy Efficiency:** upgrading voltage on transmission systems, improved efficiency in power stations, adoption of energy efficient equipment (lights, ballasts, appliances), efficient vehicles and fuel switching, methane recovery from mines, landfills and agro-industry.

A number of modalities and procedures have been developed for specific types of CDM activities.²⁵ In many instances adhering to the procedures is quite complex and costly. Therefore, simplified requirements have been developed for small-scale renewable energy and energy efficiency projects and other small scale activities to encourage their uptake.

In addition, rules have been established which enable **programmes of activities** (such as the administration of an appliance efficiency standard) that results in GHG emission mitigation²⁶ to be registered as CDM project activities.

²⁵ see www.cdm.unfccc.int

²⁶ IISD (2006) 'Making Development work in the CDM: Phase II of the Development Dividend Project' (October 2006) at p.22 hereinafter IISD (2006)

The Carbon Market

In the past few years, a number of international markets have developed to trade in carbon. Carbon transactions can be defined as purchase contracts whereby one party pays another party in return for GHG reductions or for the right to release a certain amount of GHG emissions so that the purchaser can meet objectives for climate change mitigation. Those objectives may be in response to a mandatory compliance regime or under voluntary arrangements linked to corporate citizenship.²⁷

There are two main categories of carbon transactions. First, those that are **allowance based**, in which the buyer purchases emissions allowances created and allocated by regulators under a cap and trade regime. Examples of these types of markets are international emissions trading under the Kyoto Protocol, the European Union Emissions Trading Scheme (EU-ETS), and the NSW Greenhouse Gas Abatement Scheme (GGAS). Second, **project based transactions** in which the buyer purchases emission credits from a project that can verifiably demonstrate GHG emission reductions compared with what would have happened otherwise.²⁸ This later category has enabled developing countries to become active participants and sellers in the carbon market, in particular through the CDM and the voluntary market.

Demand for carbon credits primarily comes from sovereign states that have commitments under the Kyoto Protocol and also from non-state entities that are involved in voluntary or national legislative schemes that involve commitments to reduce GHG emissions or that may be speculating in the market. Supply comes from countries and entities that do not need all their allocated allowances for compliance and from project developers who can generate GHG emission reductions under the project based mechanisms.

Value of CDM in the international carbon market

The value of the international carbon market was estimated to be approximately US\$64 billion in 2007, more than double its value in 2006.²⁹ This involved trading in over 2,983Mt CO₂e. Whilst the EU-ETS dominates the carbon market, project based activities such as CDM and JI represented approximately US\$13.4 billion in 2007 with the CDM representing over US\$12.8 billion of that amount. In terms of volume, in 2007 CDM transactions represented 791Mt CO₂e of emission reduction transactions, with 70% or 551Mt CO₂e from primary transactions.³⁰ Whilst there was only a small increase in the amount of primary transactions, the proportion of secondary transaction increased significantly from 2006, where less than 10% of transactions were secondary.

Pricing

The World Bank estimated that during 2007, the average price per tCO₂e for CERs was US\$13.60 (€9.90).³¹ Unlike prices in the EU-ETS, CER prices have remained relatively stable. This is for two reasons. The first is that China, which generated a significant proportion of CERs in 2007 maintains an informal pricing policy with a price floor of US\$10.40 – US\$11.70 (€8-9). Second, carbon funds view CERs as a relatively safe and stable investment compared to the more volatile EU allowances market.³²

In 2007, CER prices continued to trade at between Euro 8-14 (US\$10.40-18) in the primary

²⁷ The World Bank (May 2007) *State and Trends of the Carbon Market 2007* at p8 hereinafter World Bank 2007

²⁸ World Bank 2007 at p.8

²⁹ The World Bank (May 2008) *State and Trends of the Carbon Market 2008* at p1 hereinafter World Bank 2007

³⁰ World Bank 2008 at p.9

³¹ World Bank 2008 at p.31

³² World Bank 2007 at p.21

market and Euro 16-17 (US\$20-22) in the secondary market.³³ This range reflects price differentials that exist between CERs traded at different stages in the project cycle. The more advanced a project is in the CDM project cycle, the more secure its ability to deliver CERs, hence its ability to command a higher price. Similarly, projects with guaranteed delivery contracts have also traded at higher prices, often close to the prices for secondary CERs.

Supply and Demand of credits

During the Kyoto Protocol's first commitment period (2008-2012) there is likely to be significant demand for credits from project based mechanisms from Annex I/Annex B Parties. Additional demand may also be created by the growth of the voluntary market. At the end of March 2007 the World Bank predicted that, excluding Canada, which is approximately 1,300Mt CO₂e from its target, there was a residual demand for approximately 1,083Mt CO₂e from the Kyoto Protocol flexible mechanisms. This figure was revised up in the 2007 *State of the Carbon Market Report* to 2,435Mt CO₂e based largely on predicted increases in demand from the private sector operating in the EU-ETS market.³⁴

| Country or entity | Potential Demand 2008-2012 | | | |
|-------------------|--|--------------------------------------|--|--|
| | Distance to target (Mt CO ₂ e) | KMs Demand (Mt CO ₂ e) | CDM&JI contracted (Mt CO ₂ e) | Residual demand for KMs (Mt CO ₂ e) |
| EU-15 govts | 1,300 | 450 | 143 | 307 |
| EU ETS | 1,250 | 1,140 | 506 | 634 |
| | (900-1,500) | (900-1,400) | | |
| Japan | 500 | 359 | 266 | 84 |
| | | (100-500) | | |
| Rest of Eur & NZ | 200 | 60 | 2 | 58 |
| TOTAL | | 2,000 | 917 | 1,083 |
| Canada | 1,300 | ?? | 0 | ?? |

Source: World Bank 2007

Table 9: Potential demand for Kyoto Credits from 2008-12

Within the CDM pipeline, there is a potential supply of 1,500 Mt CO₂e.³⁵ JI is likely to supply 200Mt CO₂e and there is a potential supply of assigned amount units (AAUs) available for international emissions trading from countries such as the Russian Federation, the Ukraine and other economies in transition (EIT) of between 6,300 – 7,100 MT CO₂e.³⁶

Whilst the high level of AAUs raises the potential for oversupply which may impact upon demand for CERs, this is unlikely to be the case for four reasons. First, the EU-ETS does not allow regulated entities to surrender AAUs to meet their compliance obligations. Second, the Russian Federation and Ukraine have not yet met the eligibility requirements under the Kyoto Protocol to trade in AAUs. However, the Russian Federation may be in a position to do so by mid-2008. Third, there are reputational issues for buyers of AAUs as these may be perceived of having no environmental additionality. Fourth, EITs are likely to bank a significant portion of excess AAUs for compliance with future commitments.³⁷ On this last point, Russia has indicated that it will cap sales of credits at 300 million units over the next 5 years.³⁸

³³ Point Carbon *CDM & JI Monitor* 9/01/08

³⁴ World Bank 2008 at p.51

³⁵ This may be higher, with the World Bank estimating that between 1.4 billion and 2.2 billion CERS may be required by 2008 – see World Bank 2008 at p.20

³⁶ World Bank 2007 at p.40

³⁷ World Bank 2007 at p.40-41

³⁸ Point Carbon *Carbon Market Europe* 14/03/08

Buyers

The main buyers for CERs have traditionally been from Europe and Japan. The top 20 CER buyers include a number of governments, carbon asset managers and funds including Ecosecurities, Carbon Asset Management Sweden, EDF Trading, IBRD, Mitsubishi, the Danish Ministry of Climate Change and Climate Change Capital.³⁹ Of the European buyers, private sector players, many of whom are based in the UK, bought approximately 80% of CDM assets in 2007.⁴⁰ It is likely that these participants will continue to generate strong demand for credits in the coming years.

By the end of 2007, EU governments had purchased approximately 178Mt CO₂e or roughly 33% of the assets identified for purchase through the flexible mechanisms.⁴¹ 12 of the EU-15 Member States regulated by the Kyoto Protocol have indicated that they will set aside Euro 2.9 billion to invest in the flexible mechanisms.⁴² Japanese entities had also purchased approximately 320Mt CO₂e, which accounts for more than half of its expected shortfall in meeting its Kyoto target.⁴³ According to Japan's Fourth National Communication to the UNFCCC it is likely to purchase at least 100 million CERs (or 100Mt CO₂e) during the first commitment period.⁴⁴ However, the World Bank recently suggested that this figure could be revised up by between 19-34Mt CO₂e per year.⁴⁵ Switzerland has said that it intends to purchase up to 1.6 million CERs per year during 2008-2012 to meet its anticipated shortfall of approximately 8Mt CO₂e per year.⁴⁶ Similarly, Norway is likely to have a shortfall of approximately 9Mt CO₂e per year and is considering whether to use Kyoto units to address that gap.⁴⁷

Other potential buyers of CERs include Canada,⁴⁸ New Zealand, Australia, Iceland, Monaco, Liechtenstein and private companies in industrialised countries that will allow them to use CERs to comply with national climate policy obligations, such as the regional and state trading schemes being developed in the US.⁴⁹

International demand beyond 2012

One of the looming questions for the carbon market is the manner and form it will operate in during the period beyond 2012. At an international level negotiations are taking place under the UNFCCC and Kyoto Protocol to address issues such as future commitments for Annex I Parties to the Kyoto Protocol and the possible introduction of commitments for large emitting developing countries and developed countries that have not ratified the Kyoto Protocol (i.e. the US). These negotiations are due to conclude by COP 15 and COP/MOP 5 in Copenhagen in December 2009. As part of these negotiations, parties are discussing the extent to which mechanisms such as the CDM and JI will continue and possible modifications to the rules that govern their use.

³⁹ see UNEP RISOE April 2008

⁴⁰ World Bank 2008 at p.20

⁴¹ World Bank 2008 at p.25

⁴² EEA Report 2007 at p.85

⁴³ World Bank 2008 at p.23

⁴⁴ World Bank 2007 at p.22

⁴⁵ World Bank 2008 at p.23

⁴⁶ German Federal Ministry for Environment, Nature Conservation and Nuclear Safety (BMU) *Renewable Energy and the Clean Development Mechanism – Potential, Barriers and Way Forward, A Guide for Policy Makers* (April 2007) at p.13 hereinafter BMU 2007

⁴⁷ EEA Report 2007 at p.86

⁴⁸ In April 2007 the government of Canada announced that it would put in place policies to improve carbon intensity, leading to a reduction of emissions of 20% below 2006 levels by 2020. This is assumed to be 150 MTCO₂e by the Canadian government. In order to meet this target, emissions trading will be developed and current indications are that early action, banking and use of CERs for up to 10% of the projected shortfall will be allowed. If this is the case, there may be some demand for CERs from Canada in the near future. See World Bank 2007

⁴⁹ See for example the Regional Greenhouse Gas Initiative for the north west US states and the Californian Climate Change Registry – more details on demand for credits in the USA and Canada can be found in World Bank 2008 at p.59-64

At the most recent meeting of the Ad Hoc Working group on Article 3.9 of the Kyoto Protocol (AWG) which is discussing future commitments for Annex I Parties, the AWG agreed that:

*'emissions trading and the project-based mechanisms under the Kyoto Protocol should continue to be available to Annex I Parties as means to meet their emission reduction targets and could be appropriately improved. In considering possible improvements to the mechanisms, due attention should be paid to promoting, inter alia, the environmental integrity of the Kyoto Protocol and the contribution of the mechanisms to sustainable development. It further noted that the use of such mechanisms should be supplemental to the implementation of domestic actions at the disposal of Annex I Parties'*⁵⁰

Although an agreement about the international framework beyond 2012 is still two years away, the international community is starting to send clear signals that the flexible mechanisms will continue to operate and have value in the future.

The potential size of the carbon market will ultimately be dependent upon the level of ambition agreed to by the international community to reduce GHG emissions. Within the AWG, which is only addressing Annex I emissions, a range of reductions of between 25%-40% below 1990 levels is being discussed. A second Ad-Hoc Working Group has also been set up to address long-term cooperative action under the UNFCCC, which will consider, amongst other things, nationally appropriate mitigation actions from developing countries.⁵¹

Signals from the EU-ETS

In January 2008 the European Commission announced a package of measures outlining how it proposed to achieve a reduction of Member State greenhouse gas emissions by the year 2020.⁵² The EC proposes to limit emissions from its now 27 Member States to 20% below 1990 levels by 2020. Within the trading sectors regulated by the EU-ETS, this will equate to a 21% reduction of emissions compared to 2005 levels. In the event that other developed countries commit themselves to comparable emission reductions and economically more advanced developing countries commit themselves to contributing adequately according to their responsibilities and capabilities, the EC will adopt a more stringent target of 30% below 1990 levels by 2020. In terms of the use of international credits in the non-trading sectors, if a 20% target is adopted, member states will be able to use foreign credits amounting to 3% of their 2005 emissions and up to 8% if the target is more stringent. Both targets equate to approximately 25% of estimated national reduction efforts up to 2020.⁵³ For the purposes of the EU-ETS, the current limits on the use of credits from CDM and JI, which amounts to an average of 13.4% of the EU wide cap (ranging from 7-20% for individual Member States),⁵⁴ will be maintained beyond 2013. If a tighter 30% emission reduction cap is adopted the use of foreign credits will be increased to cover and additional 50% of the effort required to meet that target.⁵⁵

With this package, the EC has indicated that credits generated during the 2008-2012 period will be able to be used for future compliance.⁵⁶

⁵⁰ FCCC/KP/AWG/2008/L.2 para 4

⁵¹ Decision 1/CP.13 contained in FCCC/CP/2007/6/Add.1 at p.3

⁵² European Community *Proposal for a decision of the European Parliament and of the Council on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020* (Brussels 23/01/08) hereinafter EC Com 2008/0017

⁵³ Point Carbon *CDM & JI Monitor* 9/01/08

⁵⁴ EEA Report 2007 at p.54 and Table 7.5

⁵⁵ European Community *20 20 by 2020 Europe's climate change opportunity* (Brussels 23/01/08) hereinafter EC Com 2008/0030 at p.5-6 and Point Carbon *Carbon Market Europe* 25/01/08

⁵⁶ EC Com 2008/0030 at p.5-6

CDM market experience to date

Trends in CDM projects

At the date of writing this report, there are 3188 projects in the CDM pipeline. 1026 projects have been registered or are at validation stage in the CDM pipeline, representing the generation of approximately 2,700,000,000 CERs by 2012, assuming that all the emission reductions from the projects in the pipeline are actually transacted, realised and delivered.⁵⁷

(%) of CDM projects in each category

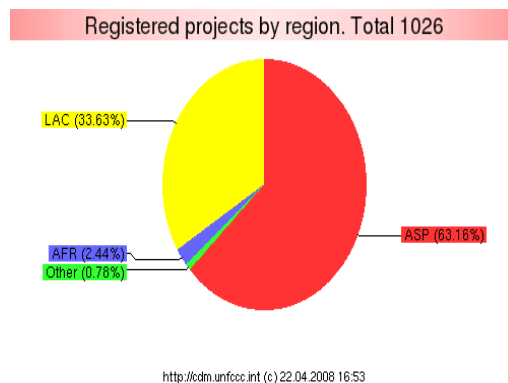
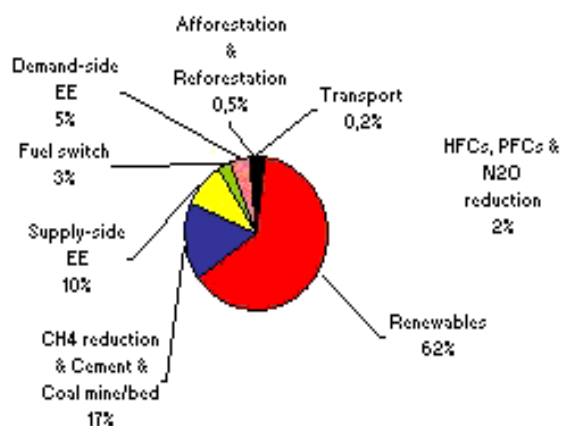


Figure 5: Breakdown of CDM projects by region and project type as at April 2008⁵⁸

From a regional perspective, Asia, and in particular China and India have dominated the CDM market on the supply side, followed by other larger developing countries in Latin America such as Brazil and Mexico.

Although renewable energy projects represent the vast number of projects, HCFC23 destruction projects have dominated the CDM market in the past few years, representing 67% of CERs in 2005 and 34% in 2006. Along with projects to destroy N2O, industrial gas destruction projects have accounted for approximately 50% of purchases since 2003 and represent 40% of expected deliveries by 2012.⁵⁹

⁵⁷ UNEP RISOE April 2008

⁵⁸ UNEP RISOE April 2008

⁵⁹ World Bank 2007 at p.27-28

| Type | number | | CERs/yr (000) | | 2012 CERs (000) | | CERs Issued (000) | |
|--|-------------|-------------|---------------|-------------|-----------------|-------------|-------------------|-------------|
| Hydro | 816 | 26% | 76838 | 17% | 363232 | 14% | 3984 | 3% |
| Biomass energy | 509 | 16% | 28915 | 6% | 168630 | 7% | 8736 | 7% |
| Wind | 409 | 13% | 33392 | 7% | 176562 | 7% | 3213 | 2% |
| EE own generation | 283 | 9% | 46668 | 10% | 242100 | 10% | 7391 | 6% |
| Landfill gas | 252 | 8% | 42671 | 9% | 245270 | 10% | 3232 | 2% |
| Biogas | 214 | 7% | 10312 | 2% | 52170 | 2% | 298 | 0% |
| Agriculture | 172 | 5% | 6571 | 1% | 43529 | 2% | 3100 | 2% |
| EE Industry | 139 | 4% | 5258 | 1% | 27911 | 1% | 568 | 0% |
| Fossil fuel switch | 107 | 3% | 36031 | 8% | 182130 | 7% | 1220 | 1% |
| N2O | 58 | 2% | 46558 | 10% | 255151 | 10% | 27124 | 20% |
| Coal bed/mine methane | 49 | 2% | 22381 | 5% | 120746 | 5% | 76 | 0% |
| Cement | 35 | 1% | 5216 | 1% | 34931 | 1% | 791 | 1% |
| EE Supply side | 31 | 1% | 6773 | 1% | 24299 | 1% | 30 | 0% |
| Fugitive | 24 | 1% | 9440 | 2% | 58534 | 2% | 5039 | 4% |
| HFCs | 19 | 1% | 81792 | 18% | 501209 | 20% | 67797 | 51% |
| Afforestation & Reforestation | 17 | 1% | 1166 | 0% | 6797 | 0% | 0 | 0% |
| Solar | 16 | 1% | 388 | 0% | 2122 | 0% | 0 | 0% |
| Geothermal | 12 | 0% | 2411 | 1% | 13560 | 1% | 125 | 0% |
| EE Households | 8 | 0% | 236 | 0% | 1226 | 0% | 0 | 0% |
| Transport | 6 | 0% | 592 | 0% | 3460 | 0% | 59 | 0% |
| EE Service | 5 | 0% | 49 | 0% | 263 | 0% | 0 | 0% |
| Energy distrib. | 4 | 0% | 129 | 0% | 1053 | 0% | 0 | 0% |
| PFCs | 2 | 0% | 166 | 0% | 944 | 0% | 0 | 0% |
| Tidal | 1 | 0% | 315 | 0% | 1104 | 0% | 0 | 0% |
| CO2 capture | 0 | 0% | 0 | 0% | 0 | 0% | 0 | 0% |
| Total | 3188 | 100% | 464267 | 100% | 2526930 | 100% | 132772 | 100% |
| HFCs, PFCs & N2O reduction | 79 | 2% | 128517 | 28% | 757303 | 30% | 94921 | 71% |
| Renewables | 1977 | 62% | 152571 | 33% | 777379 | 31% | 16356 | 12% |
| CH4 reduction & Cement & Coal mine/bed | 532 | 17% | 86278 | 19% | 503010 | 20% | 12228 | 9,2% |
| Supply-side EE | 318 | 10% | 53569 | 12% | 267452 | 11% | 7420 | 5,6% |
| Fuel switch | 107 | 3,4% | 36031 | 7,76% | 182130 | 7,2% | 1220 | 0,9% |
| Demand-side EE | 152 | 4,8% | 5543 | 1,19% | 29400 | 1,2% | 568 | 0,4% |
| Afforestation & Reforestation | 17 | 0,5% | 1166 | 0,3% | 6797 | 0,3% | 0 | 0,0% |
| Transport | 6 | 0,2% | 592 | 0,1% | 3460 | 0,1% | 59 | 0,0% |

Source: UNEP RISOE April 2008

Table 10: Number of Projects by type and CERs

Renewable Energy and Energy Efficiency CDM projects

Among the projects in the CDM pipeline, there are 2447 renewable energy (RE) and energy efficiency (EE) projects equalling almost 77% of the total project portfolio. At the date of writing, hydropower made up the largest share of CDM RE projects, representing 26% of the total CDM pipeline, followed by biomass projects 16% and wind energy at 13%. Despite the large share of projects by number, RE and EE projects generate a relatively small number of CERs. The current projects in the pipeline are expected to generate approximately 1.07 billion CERs or 43% of total 2012 CERs.

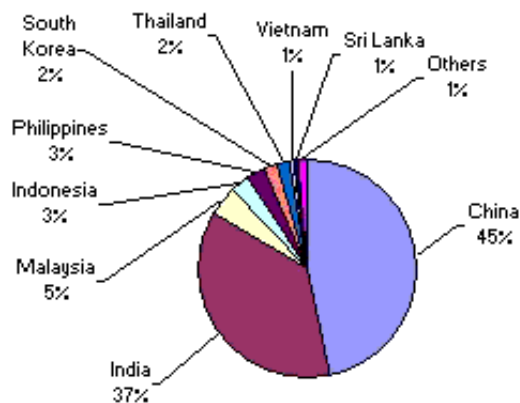
Between 2005 and 2006 CERs from renewable energy increased from 10% to 16% and transactions from energy efficiency and fuel switching projects grew from 1% to 9%. The growth in these project types is partly due to China's decision to prioritise these types of projects and develop policy frameworks to support them.⁶⁰

Experience with RE/EE CDM in Asia

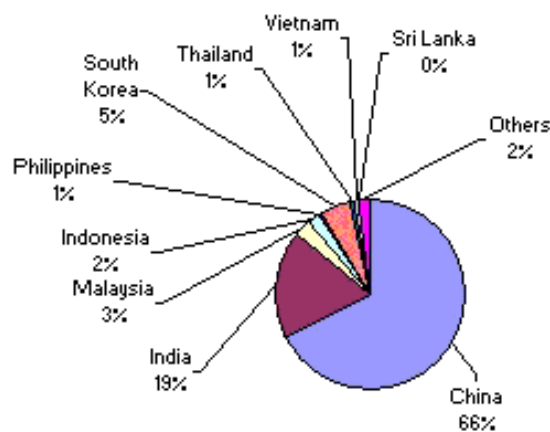
The following figures show the breakdown of CDM projects in the Asia Pacific Region. As has already been noted, China and India attract the largest share of CDM investments. However, other Asian countries are becoming more involved in projects, in particular the Republic of Korea, Indonesia, the Philippines, Malaysia, Vietnam and Thailand.

⁶⁰ World Bank 2007 at p.28

Percentage of CDM Projects



Volume of CERs generated by 2012



Source: UNEP/RISOE April 2008

Figure 6: CDM projects in the Asia Pacific region

CDM in China & India

China

China has historically been the largest player in the CDM market and as of April 2008 it represents 45% of the CDM pipeline by project number and 66% by volume of CERs generated. Initially a large number of the project activities in China related to the destruction of HCFCs. However, over time Chinese institutions have diversified the types of projects by identifying and supporting priority sectors such as renewable energy, energy efficiency in the industrial sector and methane recovery and utilisation. Of the 1150 projects approved by China's DNA, 54% of these are hydro projects, 15% wind energy, 3% biomass and 2% relate to energy efficiency.⁶¹

In addition, China has a very well organised DNA and clear processes for approval, operation and management of CDM projects.

Case Study 4: DNA for China⁶²

China has specified the National Development and Reform Committee of the People's Republic of China (NDRC) represented by the Director General of the Office to the National Climate Change Coordination Committee as its DNA. The NDRC's is established by, and its role is set out in, the *Interim Measures for Operation and Management of Clean Development Projects in China*, promulgated on 31 May 2004 and amended on 12 October 2005.

The Interim Measure sets out the procedures for granting host country approval of CDM project activities and approval criteria to guide administrative decision making. The Interim Measures also provide guidance on how to determine whether CDM activities will benefit the People's Republic of China.

Projects are reviewed against priority areas for CDM in China, such as energy efficiency

⁶¹ IGES *CDM Country Fact Sheet: China* (March 2008) p.5

⁶² This information summarises the discussion in C Streck & X Zhang 'Implementation of the Clean Development Mechanism in China: Sustainable Development, Benefit Sharing and Ownership of Certified Emissions Reductions' (2005) 16 *YBIEL* 259 at p.265-269

improvement, development and utilization of new and renewable energy and methane recovery and utilization.⁶³ CDM project are also required to promote technology transfer⁶⁴ and to comply with national law.⁶⁵

Whilst the Interim Measure does not define 'sustainable development' it refers to the need to conform to China's 'sustainable development strategies and policies'.⁶⁶ Further guidance is provided by requiring project participants to specify the contribution of the project to (i) the economy; (2) the environment; (3) employment; (4) education; and (5) poverty alleviation.

One of the main reasons for the success of RE and EE technologies in China has been the measures taken to promote renewable growth since the early 1990s, in particular the Law on Energy Conservation 1997 and the Renewable Energy Act 2005 which came into operation in 2006. China's renewable energy policies include a 20% renewable energy consumption target by 2020, generating a minimum of 30,000MW from wind, 80,000MW from hydro and 2,500MW from PV by 2020. Renewable energy enjoys strong government support and a high level of government recognition at both the national and provincial levels, with national measures including subsidies for RE production and favourable tax treatment for project developers and local support relating to facilitating planning and environmental approvals.

India

India represents approximately 19% of the CDM market by volume of CERs but represents 37% of the market by project number. India was one of the first country's to establish a National CDM Authority (NCA) in December 2003 and took proactive steps to carry out its National CDM Strategy in 2005. The first CDM project was approved by the NCA in 2005 and since then more than 600 projects have been approved. Of these projects, 302 have been registered by the CDM EB to date.

The sectoral distribution of CDM projects in India is heavily weighted towards renewable energy. As at February 2008, of the CDM projects registered, 34% were renewable biomass projects, 15% wind energy, 13% waste gas/heat generation, 13% energy efficiency, 12% hydro power, 8% industry, 3% fuels switching and 1% other renewables.⁶⁷ Similarly to China, strong government policy is part of the reason for this weighting. India is the only country to have a separate ministry for new and renewable energy sources and over time the government has provided a number of incentives to create a large and diversified renewable energy manufacturing base. State governments within India also support the federal policies, with 14 states introducing policies such as feed in tariffs, renewable energy purchase initiatives and tax incentives.⁶⁸

The majority of projects in India are developed on a relatively small scale, hence the number of CERs generated per project is often quite low. Nevertheless, there is the potential to scale up projects through the use of programmatic CDM, greater technology collaboration and diversifying projects for example, looking at energy efficiency and demand side management in the building sector.⁶⁹

Another important feature of the CDM in India is the fact that a large share of projects are developed unilaterally. In other words, the projects are developed by Indian stakeholders

⁶³ PRC CDM Interim Measures Art.4

⁶⁴ PRC CDM Interim Measures Art.10

⁶⁵ PRC CDM Interim Measures Art.6

⁶⁶ PRC CDM Interim Measures Art.4 - These include China's Agenda 21: White Paper on China's Population, Environment and Development in the 21st Century; Strategies and Policies for Sustainable Development Programme Areas and Suggestions of the Central Committee of the CPC on the 11th Five-year National Economic and Social Development Planning (2005).

⁶⁷ IGES *CDM Country Fact Sheet: India* (March 2008) p.6

⁶⁸ BMU 2007 at p.16

⁶⁹ Nitu Goel, TERI, presentation to the Asia-Pacific Consultations for the Gleneagles Dialogue, 18-19 July 2007.

without the involvement of an Annex 1 host government or partner. This has had the effect of increasing the price of CERs from these projects, as the local project developers are taking on the initial costs and risk of the project.⁷⁰

CDM Opportunities in other Asia Pacific countries

A large number of Asian countries have established DNAs and are therefore eligible to participate in CDM projects. Although China and India dominate the CDM market, other countries such as Malaysia, the Republic of Korea, the Philippines, Indonesia and Thailand are actively involved in project approvals and development. By early 2008, the EB had registered 16 project activities in the Philippines, 16 projects activities in the Republic of Korea, 15 project activities in Malaysia, 11 project activities in Indonesia and 5 project activities in Thailand.⁷¹ Furthermore, a number of least developed countries such as Bhutan, Bangladesh, Cambodia and Nepal are becoming involved in the CDM and have developed one or two projects each. The vast majority of projects in 'other' Asian countries are in the renewable sector, in particular hydro (Bhutan, Fiji, Mongolia, Korea, Sri Lanka, Vietnam) biomass (Indonesia, Malaysia, Thailand) and biogas (Nepal, Bangladesh, Philippines, Korea).

To date, only 2 DNAs have been fully established in Pacific Island countries (PICs) and only 2 projects have been registered. These are the Lihir Geothermal Power Project in Papua New Guinea which accesses and utilises geothermal steam to generate power and the Vaturu and Wainikasou Hydro Projects in Fiji, which are small-scale run-of-river hydro-electricity generating operations. As both of these projects involved Australian companies, they are used in the case studies below.

In terms of CDM potential in 'other' Asian countries and PICs, one of the key issues is whether there is a well functioning DNA and national approval process for CDM projects. The other key issue relates to the potential for and barriers to the dissemination of RE and EE technologies, which is discussed in more detail below.

The DNAs for the Philippines, the Republic of Korea, Malaysia, Indonesia and Thailand are all performing strongly with reasonable numbers of projects in their domestic pipelines. Information about each DNA and its approval process can be found at:

- The Philippines: <http://www.cdmdna.emb.gov.ph/public/cdm-home.php?main=home>
- Indonesia: <http://dna-cdm.menlh.go.id/en/>
- Thailand: <http://www.onep.go.th/cdm>
- Korea: contact dna.korea@opc.go.kr
- Malaysia: <http://cdm.eib.org.my>

The Institute for Global Environmental Strategies (IGES) has also recently produced informative fact sheets which summarise the key features of the DNA structure, approval process and project pipelines for some of these countries. See www.iges.org

At present there are no registered DOEs based in Australia. However, within the Asian region, DOEs operate in both Japan and Korea and may provide regional services.

⁷⁰ IGES CDM Country Fact Sheet: India (March 2008) p.7

⁷¹ See UNFCCC CDM project statistics and IGES Country Studies for Indonesia, Thailand, The Philippines,

Case Study 5: CDM Projects in PICs

The **Vaturu and Wainikasou small-scale hydro project**⁷² involves the bundling of two small scale hydro projects into one overall CDM project activity⁷³. The Vaturu and Wainikasou projects are small-scale run-of-river hydro projects in Fiji implemented by Sustainable Energy Limited (SEL), a joint venture between the Fijian Electricity Authority (FEA) and a hydro project developer, Pacific Hydro Limited (PHL). The total installed capacity of the Vaturu and Wainikasou projects are 3MW and 6.5MW, respectively.

Both projects are grid-connected and located in the largest of the main islands – Viti Levu. The Wainikasou project commenced operations in May 2004, and the Vaturu project started in 2005. The CDM component was an integral part of the financial package from the early stages of both projects.

Prior to the project total grid electricity generated in 2003 was made up of 44% diesel and 55% hydro. Additions to the grid for the last 20 years have been exclusively diesel, at an average 85% increase over the last 9 years.

The project is helping Fiji fulfil its goals of promoting sustainable development. Specifically, the project:

- Increases employment opportunities to local people both during construction and operation in the area where the project is located, where permanent and reliable sources of employment are scarce;
- Improves roads maintenance and repairs as the project obtains economical stability;
- Diversifies the sources of electricity generation;
- Helps Fijian Government achieve its commitment to environmentally clean and environmentally friendly production.

The project displaces existing and future generation facilities in Fijian national electricity grid. Under the business as usual scenario there would be continuing growth in diesel based electricity generation capacity.

Total emission reductions from the electricity generated by the bundle of the projects are estimated as 523,488 tCO₂e over 21 years, which means an average annual emission reduction of 24,928 tCO₂e.

The **Lihir Geothermal Power Project**⁷⁴ involves the construction of a Geothermal Power Plant (LGPP) on Lihir Island, Papua New Guinea (PNG). This project is to take place at the Lihir Gold Mine, which is owned by Lihir Gold Limited.⁷⁵

Like many of the island nations within the Pacific, PNG is subject to substantial volcanic and seismic activity which provides an abundance of geothermal energy resources which can be used as an alternate source of energy. It is within context that a 6 MW pilot geothermal installation was trialed in 2003. Following on from the success of this trial, the full scale LGPP will have an ultimate nominal capacity of 55MW (52.8MW net capacity),

By utilising the existing geothermal resources of Lihir Island to generate electricity, this project expects to displace most of the existing diesel generation on the island driven by the combustion of carbon-intensive heavy fuel oil (HFO). The geothermal energy source will offset diesel generation utilised by both the Lihir Gold Mine which comprises an open pit gold mine and carbon-in-leach processing facility, and the local village communities based on Lihir Island. This project is expected to displace an average of 411 GWh of HFO generated power per year assuming a total net capacity of 52.8MW.

⁷² This section is sourced from the Project Design Document for the Vaturu and Wainikasou Hydro Projects <http://cdm.unfccc.int/Projects/DB/TUEV-SUED1124483924.62/view.html>

⁷³ CDM methodology used: Type/Category ID (Renewable Energy Projects / Renewable electricity generation for a grid).

⁷⁴ This section is a summary of the Project Design Document for the Lihir Geothermal Power Plant found at <http://cdm.unfccc.int/Projects/DB/DNV-CUK1143246000.13/view.html>

⁷⁵ CDM methodology used: ACM0002, “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”

The LGPP makes a number of contributions to the sustainable development of Lihir Island specifically, and PNG more generally. Apart from its benefits on the global environment, further environmental benefits will be achieved through the reduction of air-based pollutants, such as oxides of nitrogen, oxides of sulphur, carbon monoxide and fine particles, being emitted into the atmosphere due to the reduced combustion of fossil fuels. The power plant is intended to be environmentally sustainable by using a currently wasted resource, steam, which is released from the ground during the course of mining operations.

It is expected that the LGPP will result in 2,789,037 tonnes of CO₂ emissions reductions over a 10 year period.

Overview of issues associated with RE/EE CDM

The limited emission reductions achieved by RE projects to date are not due to lack of potential. In many Asian countries there is significant potential for the use of hydro, wind, biomass, biogas and other renewable and energy efficiency measures. Rather, a range of market and policy barriers operate to impede the dissemination of renewable energy technologies (RET) in many countries.

Some of the factors that will be relevant to the viability of projects are country specific, such as the carbon intensity of a country's energy mix, whereas others are more generic, relating to the project type and the upfront costs of disseminating the RE technology. As an example, high carbon intensity developing countries such as China (916kg CO₂/MWh) and India (896 kg CO₂/MWh) will benefit substantially more than lower intensity countries such as Thailand (500kg CO₂/MWh) for each kWh substituted by renewable energy.⁷⁶

Recent studies have found that most RE and EE CDM projects are small scale, yield low numbers of CERs and have low internal rates of return compared to projects involving other greenhouse gases.⁷⁷ One of the main reasons for the low number of CERs is that most RE and EE projects involve reductions in emissions of CO₂ which has a global warming potential (GWP) of 1. In contrast, hydrofluorocarbons (HFCs) have a GWP of 11,700, and nitrous oxide (N₂O) has a GWP of 310. To put this in context, 41 of the over 3000 projects in the CDM pipeline that reduce HCF, PFC and N₂O account for over 40% of the CERs expected.

A further obstacle to the dissemination of RET through the CDM is the fact that RE projects get a disproportionately low financial benefit out of the mechanism. Brouns et al note that on the current price of CERs the additional revenue from the CDM has only a limited impact on the profitability of a project and is unable to counter the fundamental distortions in national energy markets.⁷⁸ Using Thailand as an example, electricity tariffs in 2006 were approximately 2.5 Baht per kWh and the costs for wind and PV were 5-6 Baht and over 10 Baht per kWh respectively.⁷⁹ CERs generated from a CDM project would be valued at 0.235 Baht per kWh, which does not come close to closing the price differential.

Notwithstanding the relatively small financial benefits that flow from RE CDM projects, the sale of CERs may still be sufficient to lift projects above the threshold that makes them financially viable. This is particularly the case for projects that reduce gases that have a higher GWP than CO₂ which may be more profitable than traditional RE and EE projects. In this regard, biogas projects that avoid methane (CH₄) emissions are yielding high

⁷⁶ BMU 2007 at p.14

⁷⁷ Brouns et al 'Promoting Renewable Energy Technologies in Developing Countries through the Clean Development Mechanism' Climate Change Report 15/07 for the German Federal Environment Agency(BMU) p.xv-xvi hereinafter Brouns et al 2007

⁷⁸ Brouns et al 2007 at p.xvii

⁷⁹ Brouns et al 2007 at p.109-110

numbers of CERs and may have a decisive comparative advantage in the CDM sector.⁸⁰ Also, the benefits that accrue from RE and EE projects in terms of contributing to sustainable development objectives and energy security cannot be overlooked.

Removing barriers and providing support

In order to address some of the barriers to RET, it is important for developing country governments to level the playing field and remove distortions that discriminate against RET, such as subsidies to fossil fuels and limiting grid access to independent operators. In addition, effective policies that create enabling frameworks and promote the development and dissemination of RET can assist in bringing down the costs of RETs. As noted above, such approaches have proved successful in China and India.

In terms of improving the use of the CDM to promote RE projects a number of steps can be taken. For example:

- Raising awareness about renewable energy technologies, enhancing technical capacity and putting in place policies in developing countries to promote RE CDM projects will help stimulate investment.
- Developing countries could also attract more CDM investment if their national approval processes were more streamlined, transparent and better coordinated with national energy policies.
- Both developed and developing country governments could give a clear preference to RE CDM projects. Some Annex I countries have already indicated that they will buy CERs from high quality Gold Standard projects.
- Using 'programmatic CDM' to consolidate dispersed small scale renewable energy activities so that collectively they may be commercially viable (e.g. installing solar water heaters or energy efficient lighting across a whole district) could also be promoted.⁸¹

Australian Engagement in Flexible Mechanisms

Who can participate in CDM activities?

In order to participate in the Kyoto Protocol flexible mechanisms, the government of the Annex 1 Party must:

- Be a Party to the Kyoto Protocol.
- Have calculated and recorded its assigned amount units.
- Put in place a national system for the estimation of anthropogenic emission by sources and removals by sinks.
- Establish a national registry to record and track the creation and movement of Kyoto credits.
- Submit a report to the UNFCCC secretariat detailing the country's emissions inventory and any supplementary information required.⁸²
- Maintain enough Kyoto credits in its national registry to ensure its Commitment Period Reserve is maintained. This equates to 90% of the assigned amount.

A party will be considered to meet the eligibility requirements after 16 months, unless the UNFCCC Compliance Committee finds that the Party doesn't meet the requirements, or at

⁸⁰ Brouns et al 2007 at p.113-4 there is currently one small scale CDM biogas project in the pipeline from Thailand which plans to produce electricity from pig farm liquid waste.

⁸¹ BMU 2007 at p.19-20

⁸² Decision 3/CMP.1 para 31

an earlier date, if the Compliance Committee decides that no questions of implementation arise relating to those requirements.⁸³

Australia's Eligibility to participate in the CDM

By ratifying the Kyoto Protocol, Australia is now under a legally binding obligation to meet its emission limitation target of 108% during the first commitment period. Australia may be able to meet that target wholly by domestic means, for example through implementing domestic emission reduction programmes. However, if it is likely to exceed its Kyoto target, it may take advantage of the flexible mechanisms and purchase credits from other countries.

As noted above, a number of steps must be taken before an Annex I country is eligible to participate in the CDM. The Federal government has commenced this process. On 11 March 2008, the government submitted its national inventory report⁸⁴ to the UNFCCC Secretariat.

Each year Australia will be required to report on annual emissions. The National Carbon Accounting System (NCAS), administered by the Department of Climate Change, provides a national system for estimating emissions and removals of greenhouse gases. NCAS has been developed in accordance with the Kyoto Protocol rules for GHG accounting and can therefore be used for accounting and reporting under the Protocol. A national registry to track and record the movement of Kyoto units will need to be established. The design of this registry is currently underway.⁸⁵

Australia will also need to establish a DNA and develop its own rules for granting approval to participate in CDM project activities. These rules may include rules on the types of projects that will be supported and also what, if any, limits may be placed on the surrender of CERs to meet domestic obligations.

As noted above, the EU expects to meet its Kyoto target with the use of flexible mechanisms accounting for approximately 30% of its Member States cumulative effort. This level may provide a guide as to what is considered significant domestic effort by an Annex I Party. So far there has been no indication of how the Australian government will treat the issue of supplementarity.

In terms of rules governing the types of projects that will be allowed, the EU-ETS, which is the main avenue for EU wide compliance with its Kyoto target, prohibits the importation of credits from afforestation and reforestation CDM projects. Credits from hydropower are permitted. However, if a project is greater than 20MW it must demonstrate compliance with the World Commission on Dams guidelines for large dams. Australia will no doubt review these and other potential limitations on the sources of project based credits closely.

Ratification also means that Australia will be eligible to participate in JI projects either as a project host or by authorising companies to participate in JI projects. However, it remains to be seen whether the government will be willing to establish the necessary frameworks to approve JI projects given the short period of time before the end of the first commitment period.⁸⁶ In this regard, other Annex I Parties have not actively pursued JI. New Zealand has placed national JI implementation on hold and Japan has not taken any steps to participate in projects.⁸⁷

⁸³ Decision 3/CMP.1 para 32

⁸⁴ Department of Climate Change *The Australian Government's Initial Report under the Kyoto Protocol 2007* available at www.climatechange.gov.au

⁸⁵ Kyoto Protocol factsheet available at www.greenhouse.gov.au/international/publications/FS-kyoto.html

⁸⁶ Baker & McKenzie *Client Alert: Climate Change and Renewable Energy: A new era for Australia* (November 2007) hereinafter Baker & McKenzie 2007

⁸⁷ Baker & McKenzie 2007 at p.3

If the review of Australia's inventory report by the UNFCCC Compliance Committee does not raise any questions of implementation, and the other steps mentioned above are taken promptly, Australia will be eligible to participate in the flexible mechanisms by **mid 2009**.

In the interim, Australian companies are able to participate in the CDM by gaining the approval of another Annex I Party. In the past this has been done by obtaining approval from governments such as the UK, the Netherlands or Sweden to participate under their authority.

Participation in the CDM by Australian Companies pre 2008

Although Australia did not formally become a Party to the Kyoto Protocol until March 2008, a small number of Australian companies have been participating in CDM projects and purchasing CERs.

Pacific Hydro is one of the best known Australian renewable energy companies. Founded in 1992, its core business includes developing, owning and operating hydro and wind energy projects in Australia and internationally. At present Pacific Hydro has 300MW operational capacity and 1200 MW under development. The company's core markets are Australia, and South America (Chile and Brazil) but it has identified significant growth potential in Asia (800MW).⁸⁸ Pacific Hydro is involved in two CDM projects - the Vaturu and Wainikasou hydro plants in Fiji and also the La Higuera hydro project in Chile. Both of these projects have been done as joint ventures with local companies in order to comply with the rules for CDM project development. In the case of the Fijian projects, Pacific Hydro had to obtain approval to participate from the UK and the CERs generated from the project are being sold to a UK buyer who will surrender them as part of their compliance with the EU-ETS. For the Chilean project, the Netherlands provided host country approval. Michael Wilson, the Executive Manager, Commercial of Pacific Hydro has expressed the view that the CDM is an emerging market where there will continue to be opportunities for Australian companies.⁸⁹ Pacific Hydro is expecting to invest between A\$1.5-2billion in clean power in international markets in the next 5-7 years.⁹⁰

Roaring 40s was launched in 2005 as a joint venture between Hydro Tasmania and the China Light and Power Group (CLP). The company operates as a business vehicle to enable global investment and partnerships in renewable energy projects. Roaring 40s has over sixty 50MW wind farms commissioned in China and plans to have a portfolio of 1000MW of wind assets in China by 2011/2012.⁹¹ During 2007 the company invested over A\$600 million in new wind assets in Australia, China and India and expects to increase investment fourfold over the next three years.⁹² Of the projects being developed by Roaring 40s, there are at least 8 wind farms in China and one in India that have been or are in the process of being registered as CDM projects. One example is the Jilin Shuagliao 49.3MW wind farm in in China which is being developed with CLP, and a Chinese energy producer Datang. The project is expected to generate over 646,800 CERs. (see text box above)

Another Australian company which has a longstanding connection with renewable energy and CDM projects in the Asia-Pacific region is the engineering and development consultancy **SMEC** (the Snowy Mountains Engineering Corporation). SMEC has assisted in the preparation of documentation for a number of CDM projects, including the Lihir gold

⁸⁸ Michael Wilson, Executive Manager, Commercial, presentation to the REGA Forum, April 2007

⁸⁹ Michael Wilson, Executive Manager, Commercial, presentation to the REGA Forum, April 2007

⁹⁰ Brisbane Times 'Kyoto Turnaround Worth Billions' 10/12/07

⁹¹ Mark Kelleher, Managing Director, presentation to REGA Forum April 2007

⁹² Brisbane Times 'Kyoto Turnaround Worth Billions' 10/12/07

mine geothermal project in Papua New Guinea and a hydro-power project in Nepal which is intended to sell power to India. SMEC provides carbon services that cover the full spectrum of project identification, structuring, documentation, registration, monitoring and verification and overseeing CER issuance and registry account management.⁹³

Recently, SMEC and Pacific Hydro established a joint venture called **Perenia Carbon**, which plans to focus on renewable energy, low emission generation, waste management, energy distribution and energy demand projects. Perenia will provide project development, origination, transaction and optimisation services for CDM, JI and voluntary emission reduction projects.⁹⁴

In addition to companies involved in project development, a number of other Australian based organisations, such as law firms, consulting firms and investment banks have been involved in providing professional services advice and finance for CDM projects.

Expectations for Australian demand 2008-2012 and Post-2012

In February 2008 the Australian Government's Department of Climate Change released a report entitled *2007 Tracking the Kyoto Target : Australia's Greenhouse Emission Trends 1990 -2008-2012 and 2020*. The Report states that current analysis projects Australia's GHG emissions at 108% of 1990 levels over the 2008-2012 period, or approximately 599 MtCO_{2e} annually. In other words, **Australia is set to meet its Kyoto target using domestic measures**. Looking forward to 2020, the Report projects that GHG emissions will be 120% of 1990 levels in the absence of additional measures being taken.

The Report takes into account the introduction of a renewable energy target of 20% by 2020 but does not analyse the impact of a domestic emissions trading scheme (ETS) which is currently being designed and is expected to commence operation by 2010. Australia has adopted an aspirational target of reducing emissions to 60% below 2000 levels by 2050 and is expected to decide upon an interim emission reduction target for 2020 in the near future. This interim target will be very significant as it will determine the level of ambition for domestic emissions reduction actions and the need to use international offsets to meet the target.

In July 2007 Professor Ross Garnaut was appointed to provide an independent review of the impacts and policy responses to climate change in Australia (the Garnaut Climate Change Review). In the Interim Report of the Garnaut Climate Change Review (Interim Report) a number of observations are made about the role that international credits play in achieving domestic and international GHG mitigation.

In relation to the establishment of an Australian ETS, the Interim Report notes that Australia would benefit from linking its market with others.⁹⁵ This is expanded upon in a discussion paper on emissions trading released in March 2008. In that paper the authors note that some commentators are somewhat sceptical of the use of international offsets such as the CDM, particularly when they are not backed by developing country commitments and may not demonstrate additionality.⁹⁶ Yet other commentators recognise that the CDM is 'the only game in town' and has induced significant mitigation effort in developing countries. With these views in mind, the authors recommend that Australia should seek international linkages for the ETS, but not in an indiscriminate and unlimited way.⁹⁷ The paper then provides the following comment in relation to the use of CDM offsets :

⁹³ see www.smec.com.au/carbonservices

⁹⁴ www.pereniacarbon.com

⁹⁵ Garnaut Climate Change Review *Interim Report to the Commonwealth, State and Territory Governments of Australia* (February 2008) at p.47 hereinafter Garnaut Interim Report 2008

⁹⁶ Garnaut Climate Change Review *Emissions Trading Scheme Discussion Paper* – March 2008 at p.65-66 hereinafter ETS Discussion Paper 2008

⁹⁷ ETS Discussion Paper 2008 at p.69

(i) CDM offsets

The first decision is whether to accept CDM offsets. If, due to the reservations about international offsets set out earlier, Australia were to decide not to link with the CDM, even indirectly, then Australia would not be able to link at all because every other emissions market (EU and all currently planned markets) allows or will allow CDM linkages. Despite legitimate reservations about the CDM, this would be too high a price to pay. However, direct links with the CDM should be limited. One option would be to allow CERs (CDM credits) directly into the Australian ETS only from countries that Australia would not yet expect to take on targets (e.g. least developed countries). Note this would still allow Australian businesses to develop CDM projects in any non-Annex B country, for sale into other ETS systems.

Decisions about the use of international offsets in the Australian ETS will be taken by the government later this year.

When looking to the period beyond 2012, the Interim Report considers the Kyoto Protocol to only be a starting point when considering the evolution of the global architecture beyond 2012. The report states that *'the agreement allows developed countries to achieve their targets in part through the purchase of clean development mechanism carbon credits generated by developing countries. However, in the absence of national targets one cannot be confident that CDM carbon credits in fact represent overall carbon emission savings'*.⁹⁸ The report also raises a concern about providing financing and generating credits through mechanisms such as the CDM in the absence of national emissions budgets for developing countries as part of the post-Kyoto international framework.⁹⁹

Notwithstanding the comments in the Interim Report, the Australian government appears to be supporting the continued use and improvement of the Kyoto Protocol flexible mechanisms beyond 2012. In its submission to the AWG on *Views and information on the means to achieve mitigation objectives of Annex I Parties* the government stated that *'the flexibility mechanisms of the Kyoto Protocol are an important additional way for Annex I Parties to meet their commitments.'* and that :

*The flexibility mechanisms should continue to tightly focus on the reduction of emissions. The scope of the existing mechanisms should also be broadened to facilitate mitigation in areas that were excluded or limited for project activity in the first commitment period, in particular with regard to sinks such as carbon sequestration and storage and afforestation and reforestation activities.*¹⁰⁰

In addition to these comments, the government recently stated in a fact sheet on the Kyoto Protocol that *'Australian innovation has an important role to play in global efforts to reduce emissions and the Government will be working to facilitate access by Australian companies to the emerging global market.'* These views indicate the government's general support for companies participating in the CDM.

⁹⁸ Garnaut Interim Report 2008 at p.35

⁹⁹ Garnaut Interim Report 2008 at p.37

¹⁰⁰ FCCC/KP/AWG/2008/MISC.1add.2

4. Voluntary Carbon Markets

Over the past 20 years a number of voluntary markets have emerged to facilitate the trade in emission reduction credits. These include the Chicago Climate Exchange (CCX), which was established in 2003 and the Greenhouse Friendly scheme established in Australia in 2001.

Although still relatively small compared to the EU-ETS and the Kyoto markets, the voluntary market has been growing rapidly over the past few years. In 2007 the value of transactions was approximately US\$66.4 million.¹⁰¹ Approximately 65Mt CO₂e was transacted with 22.9Mt CO₂e traded on the CCX and 42.1Mt CO₂e in over the counter (OTC) transactions.¹⁰² Since 2002, the voluntary market has grown over 200%, demonstrating a strong demand by businesses and individuals seeking to take some form of climate change action without direct regulation.

Not surprisingly, the greatest demand for credits from voluntary market sources is from North America (34%) and Europe (47%).¹⁰³ Whilst the USA and Europe were the major suppliers of credits in 2006, there was a major shift in project location in 2007 with Asia providing 39% of credits, North America 27%, Europe 13%, Latin America 7%, Australia and New Zealand 7%, Africa 2% and others 5%.¹⁰⁴ Forestry projects have traditionally represented the largest sector of project types making up approximately 36% of the OTC market in 2006. However, in 2007 renewable projects represented 31% or projects by type, energy efficiency projects and forestry both represented 18% and methane projects represented 17%.¹⁰⁵ Within the CCX, the vast majority of projects have been related to agriculture (soil) and methane recovery and avoidance.¹⁰⁶

The main buyers in the voluntary market are businesses that are seeking to fulfil obligations related to their corporate social responsibility (CSR) policies. In recent years a number of major companies, including Dell, Delta, Google, Nike, Yahoo and Sky, have declared that they will become 'carbon neutral' by certain dates.¹⁰⁷ In most cases, carbon offsets will be used to meet the shortfall between their corporate emissions and the carbon neutral target. A number of large banks are also setting up carbon funds to facilitate investment in new environmental products and services and are gearing up to engage in trading in these products.¹⁰⁸

One of the main features of the voluntary market is that it lacks the bureaucracy and high transaction costs of regulated markets. This has benefits, as it enables a certain level of experimentation with different market products and picks up sectors and projects that are otherwise unsuitable for the regulated markets. For example, the voluntary market currently provides the vast majority of carbon finance to forestry projects such as avoided deforestation. The market also has a significantly higher proportion of projects in Africa, and also more small-scale projects (less than 100,000t CO₂e) than the CDM.¹⁰⁹

The flip side of less regulation is that the price of credits in the voluntary market tend to be lower than in the regulated markets. In 2007 the average price for voluntary credits was US\$6.10 per tCO₂e and ranged from US\$1.80-US\$300. Native and plantation forestry

¹⁰¹ New Carbon Finance and The Ecosystem Marketplace *State of the Voluntary Carbon Market 2008* (8 May 2008) p.6 hereinafter *State of the Voluntary Carbon Market 2008*

¹⁰² *State of the Voluntary Carbon Market 2008* at p.5-6

¹⁰³ *State of the Voluntary Carbon Market 2008* at p.9

¹⁰⁴ *State of the Voluntary Carbon Market 2008* at p.7-8

¹⁰⁵ *State of the Voluntary Carbon Market 2008* at p.7-8

¹⁰⁶ *State of the Voluntary Carbon Market 2008* p.38

¹⁰⁷ *State of the Voluntary Carbon Market 2007*

¹⁰⁸ Wilder M & Miller M 'Carbon Trading markets: legal considerations' Chapter 5 in Bonyhady T and Christoff P (eds) *Climate Law in Australia* (2007, Federation Press) at p.76

¹⁰⁹ *State of the Voluntary Carbon Market 2007* p.7

credits were trading at approximately \$6.80 and \$8.20 respectively, renewable energy certificates at \$8.70 and industrial gas projects and geological sequestration projects prices were \$3.70 and \$2.50 respectively.¹¹⁰ On the CCX prices averaged US\$3.15.¹¹¹

There are currently no widely accepted standards and processes for certification and verification for voluntary credits and there are no requirements for listing credits in appropriate registries. However, a number of standards are being developed. Some of these address the quality of offsets, for example the Climate Group's Voluntary Carbon Standard, WWF's Gold Standard for Voluntary Emission Reductions, Plan Vivo and the Climate, Community and Biodiversity Standard. Others, such as DEFRA's Code of Best Practice for (UK) Consumers and Voluntary Code of Best Practice on Carbon Offsetting provide guidelines and certification to offset sellers. The Australian Greenhouse Friendly Initiative provides certification for offset projects through the "Greenhouse Friendly Abatement Provider" scheme and also certifies "carbon neutral" products and services developed by sellers. However, this scheme only applies to Australian projects.

In addition to the CCX, other registries have also started to emerge across the world. In 2007 the Asia Carbon Group started the Asia Carbon Registry for voluntary emission reductions. Also launched in 2007 was the Australian Climate Exchange (ACX) which provides an electronic trading platform and registry for a range of carbon products (see: www.climateexchange.com.au).

In 2007, the Global Sustainability team at RMIT undertook a review of voluntary offset providers in Australia. Their report, entitled *Carbon Offset Providers in 2007*, identifies the main Australian companies and organisations involved in providing voluntary carbon offsets and reviews the types of credits generated, certification standards used, prices and buyers. The following table, taken from the RMIT report gives a snapshot of the types of voluntary offset providers in the Australian market. Interestingly, the prices for credits in the Australian market have tended to be higher than those prices internationally, with biosequestration projects ranging from \$9-\$13 per t CO₂e and RE and EE projects trading at \$20-\$40 per t CO₂e.

¹¹⁰ *State of the Voluntary Carbon Market 2008* p.30

¹¹¹ *State of the Voluntary Carbon Market 2008* at p.40

| | Nature | Project types | Standards & accreditation | Price per tonne of CO2 | Carbon calculation | Links with NGOs | Major Clients |
|--|--------|-------------------|---|------------------------|-------------------------|-----------------|-----------------------|
| Offset Providers | | | | | | | |
| Australian Carbon Traders | Profit | BS& broker other | Greenhouse Friendly, NSW GGAS | NA | NCAT | NA | NA |
| Carbon Neutral | NFP | BS | Towards Greenhouse Friendly | \$13 | AGO, IPCC | Men of Trees | WA Govt, WaterCorp |
| Carbon Planet | Profit | BS & broker other | NSW GGAS | \$23 | GHG Protocol | NA | NA |
| Climate Friendly | Profit | RE | Gold Standard, GreenPower | \$22-\$34 | AGO, IPCC, GHG Protocol | WWF | Westpac, VicSuper |
| Climate Positive | NFP | RE & bonus BS | RECs under MRET | \$20, \$25, \$30 | AGO, IPCC | NA | Daimler Chrysler |
| Easy Being Green | Profit | EE | NSW GGAS, Greenhouse Friendly for wholesale | \$20 | AGO, GHG Protocol | NA | BHP Billiton, EPA Vic |
| Elementree | NFP | BS | Towards Greenhouse Friendly for wholesale | \$10 retail | AGO | NA | NA |
| Future Climate Australia | Profit | BS, GF | Greenhouse Friendly if requested | \$8.50 not certified | AGO | NA | NA |
| Greenfleet | NFP | BS | Towards Greenhouse Friendly | \$8.80 | AGO, IPCC, ABS | NA | CWW, Telstra |
| NECO | Profit | EE, RE | NSW GGAS, RECs under MRET | \$20, \$40 | NA | NA | NA |
| Treesmart | Profit | BS | Towards Greenhouse Friendly | \$12 | AGO, ABS | NA | Vic Govt |
| Electricity Retailers | | | | | | | |
| Origin Energy | Profit | RE, EE, BS | Origin CRS | \$16 | AGO, IPCC | NA | NAB, AIG, AFL |
| AGL | Profit | GF | Greenhouse Friendly | \$12/MWh | AGO | NA | NA |
| * RE = renewable energy, EE = energy efficiency, BS = biosequestration, GF = gas flaring NFP = not for profit, NA = not available | | | | | | | |

Source: RMIT 2007

Table 11: Offset Providers in Australia

Whilst most of the companies are involved in carbon sequestration through native and plantation tree planting, some, such as Climate Friendly, Climate Positive, Easy Being Green and NECO, are engaged in RE and EE projects. Of note, Climate Friendly is one of the few Australian companies that is involved in projects internationally.

Case Study 6: Climate Friendly

Climate Friendly was established in 2003. It invests in renewable energy projects in Australia and overseas that are 'genuine sustainable energy projects with undisputed climate benefits that build a long term solution to climate change'. All Climate friendly projects are independently verified and use either the Gold Standard or GreenPower accreditation. The company maintains a detailed register to record transactions and ensure accountability. Prices for offsets are between \$22 - \$34 per tonne CO₂. Clients include Greenpeace, the ACF, Westpac and the City of Sydney.

See: www.climatefriendly.com

In terms of the potential for project development in the Asia Pacific region, the main area of potential is in the forestry sector as avoided deforestation is currently not regulated under the Kyoto Protocol during the first commitment period. However, there is also considerable potential for renewable energy projects, in particular small-scale projects that promote the sustainable development of small communities.

5. Australia's Market Capacities and Opportunities for Export

The Clean Energy Council has produced a number of reports outlining Australia's clean energy industry capacities.

Australia's Renewable Energy Use, Technologies and Services

See http://www.bcse.org.au/docs/Publications_Reports/Renewables.pdf

This publication provides information on Australia's renewable energy use, technologies and expertise as well as information on the installed capacity, the policy drivers at a national and state level, and the companies and businesses which are operating within the renewable energy sector.

Australia has a strong and diverse renewable energy industry. This ranges from large scale baseload power supply (such as hydroelectricity) to small scale stand alone power systems for use in remote areas or site specific application, includes research and development into new technologies, and incorporates the development and implementation of training programs to support deployment and use of renewable energy technologies.

The industry has particular strengths in niche markets such as solar hot water, photovoltaics, biomass waste-to-energy conversion, small-scale wind turbines and stand-alone power systems. Australia has a leading edge in developing, manufacturing and deploying these technologies. Australia's consultancy services, project management and installation of renewable energy systems are increasingly being recognised world-wide.

In addition to developing and supplying renewable energy products and services, there are several Australian companies now operating internationally as renewable energy investors, financiers and developers. These firms facilitate and/or provide bulk generating solutions in a wide range of options. Furthermore, many Australian firms provide important components for renewable systems, and so play an intrinsic role in renewable energy systems around the world.

Australia has also developed considerable expertise in the development, implementation and accreditation of renewable energy training programs. Australian companies have successfully designed and implemented programs throughout the Asia-Pacific region for solar, wind, micro-hydro and hybrid systems. In addition Australia has facilities that provide independent high quality testing services to the renewable energy industry, and specialises in testing inverters, stand alone power supply systems, solar home systems and battery charge controllers for solar photovoltaic systems.

The report details that the renewable energy technologies¹¹² utilised in Australia include:

- Bioenergy
 - Bagasse
 - Cogeneration
 - Digesters
 - Pyrolysis
 - Landfill Gas
 - Municipal Solid Waste
 - Sewage Gas

¹¹² For the purposes of this report we have limited our focus to the definition of renewable energy included under the Australian Government's Renewable Energy Action Agenda and also the Mandatory Renewable Energy Target.

- Hydropower
- Power from the ocean
 - Tidal
 - Wave
- Photovoltaic and associated technologies
 - Flat plate modules
 - Concentrating systems
- Solar Water Heating
 - High temperature solar thermal (steam)
 - Low temperature for residential use
- Wind energy

Australia's Energy Efficiency Market and Industry Capability

See <http://www.bcse.org.au/docs/International/EEfficiency2.pdf>

Implementing energy efficiency strategies across the economy are the most cost-effective and immediate way to start reducing greenhouse gas emissions. This Guide looks at Australia's performance to date, the capability of the industry, and current government strategies and programs.

Energy efficiency measures aim to reduce energy consumption while at the same time maintaining or increasing the level of useful output or outcome delivered. Or put another way, "aimed at reducing the energy used by specific end-use devices and systems, typically without affecting the services provided. Such savings are generally achieved by substituting technically more advanced equipment to produce the same level of end-use services (eg lighting, heating, motor drive) with less electricity."

Thus the industries and companies covered in this Guide are those which reduce energy consumption, such as:

- insulation (wall, cavity, roof, floor),
- energy efficient lighting systems,
- double glazing,
- draught-proofing,
- lagging of pipes
- heating systems (from controls to boilers) and

The technical and economic potential for improving energy efficiency in all sectors of the Australian economy is very large. Global studies have repeatedly demonstrated the existence of 'no-regrets' opportunities for the implementation of energy efficiency measures, where investment approaches are highly profitable for individuals and organisations, even when the wider social benefits are ignored. This should make energy efficiency attractive to business, industry and households alike.

Pursuing Renewable Energy Business with China

http://www.bcse.org.au/docs/Publications_Reports/China.pdf

The *Doing Business in China* project, which began in late 2005, aims to improve market opportunities between the Australian renewable energy industry and energy efficiency sector and China, and to increase the capacity of Australian industry to take advantage of opportunities in the Chinese market, as well as the reverse situation.

The Guide to Pursuing Renewable Energy Business in China is intended as a practical tool for Australian firms seeking to develop renewable energy business opportunities in China and with Chinese partners. In part it is intended to 'debunk' some common misinterpretations about differences in our countries' business practices. It will also explain

where and why differences do exist so that Australian and Chinese firms can be better equipped to build strong, lasting mutually beneficial business relationships. It also disaggregates China, to identify variations and potential business opportunities at the provincial level, which might prove more manageable to Australian renewable energy firms, particularly those considering China for the first time.

6. Overview of Australian Government Activities

The new Federal Rudd Labor Government has made tackling climate change one of its main priorities and since coming into power it has introduced a number of measures to put Australia on a low emissions trajectory. The Government has set a target of a 60% reduction in greenhouse gas emissions on 2000 levels by 2050. Signing the Kyoto Protocol has allowed Australia to fully participate in the global effort to combat climate change, while domestically the National Emissions Trading Scheme, to commence in 2010, is designed to maximize the reduction of greenhouse gas emissions in an economically viable manner. The Government will also establish a national Renewable Energy Target Scheme which will build on the existing Mandatory Renewable Energy Target (MRET) and enable it to achieve its policy commitment of renewable energy sources supplying 20% of Australia's electricity by 2020.

There are a number of Government Departments and agencies directly tasked with implementing the Federal Governments commitment to a low emissions future including:

- the Department of the Environment, Water, Heritage and the Arts (DEWHA);
- the Department of Climate Change (DCC);
- the Department of Innovation, Industry, Science and Research (DIISR);
- the Department of Resources, Energy and Tourism (DRET);
- the Department of Foreign Affairs (DFAT);
- Austrade; and
- AusAID

These Departments oversee measures that range from clean energy education programs aimed at both Australian residential and business users; research and development grants to stimulate the development of clean energy technology; rebates and incentives to encourage the uptake of energy from clean energy sources; initiatives to attract private investment; and export and investment programs to assist the growth of the Australian clean energy industry and maximize opportunities for Australia in the global clean energy market. While many of these measures are domestically focused the research and development and implementation strategies involved contribute to the overall growth and expertise of the Australian clean energy industry and this flows through to an increase in the sophistication and competitiveness of the industry in the global market.

The relevant Government initiatives for the purposes of this report are as follows.

Advanced Electricity Storage Technology (AEST) [DRET]: a research and grant program designed to increase the commercial tractability on intermittent electricity generation sources such as wind and solar and improve their contribution to the power market. Support is given to projects demonstrating batteries, electro-mechanical and chemical storage technologies in either on-grid or off-grid situations that could lead to on grid usage. Priorities include on-grid megawatt-size storage for large wind farms, on-grid kilowatt-size storage for household photovoltaic electricity systems, and remote area power supplies and other renewable electricity applications. To run for 2004/5-2008/9 with a budget of \$20.4 million, the estimate of available resources for 2008/9 is \$8 million.

Asia Pacific Partnership on Clean Development and Climate (APP7)

The Asia-Pacific Partnership on Clean Development and Climate (APP) brings together Australia, Canada, China, India, Japan, Republic of Korea and the United States of America to address the challenges of climate change, energy security and air pollution in ways that encourages economic development and reduces poverty.

The APP members are large, fast growing economies that represent around half the world's emissions, energy use, GDP and population.

Its focus on the development, deployment and transfer of cleaner, more efficient technologies. Eight international government and business taskforces operate under the partnership (Cleaner Fossil Energy, Aluminium, Coal Mining, Steel, Cement, Buildings and Appliances, Power Generation and Transmission, and Renewable Energy and Distributed Generation.)

Asia Pacific Partnership 7-Renewable Energy and Distributed Generation Taskforce (AP6-REDGTF) [DRET]: a collaboration amongst partner countries to increase access to, and accelerate the uptake of, affordable and reliable renewable energy and distributed generation. The goals are to create measurable deployment outcomes over five years; close the gap between the cost of renewable energy generation and conventional generation; and identify market and policy barriers to deployment and implement mechanisms to overcome these. Measures include the support of cooperative projects to deploy renewable and distributed generation technologies to support rural and peri-urban economic development and poverty alleviation; the implementation of renewable technologies including renewable source identification, wind forecasting and energy storage technologies; and the identification of country development needs and opportunities and the enabling environments needed to support widespread deployment, including in rural, remote and peri-urban applications. There is \$25 million allocated to renewable energy and distributed generation from the \$100 million 2007-2011 Australian Government Asia Pacific Partnership fund.

Bilateral Climate Change Partnerships

Arrangements for bilateral cooperation are currently in place with the United States, China, New Zealand, the European Union, Japan and South Africa. These partnerships are aimed to Australia aims to:

- undertake practical actions that achieve or facilitate emission reductions
- build support for an effective global response to climate change
- improve scientific understanding of climate change
- build capacity to enable implementation of mitigation and adaptation programs
- facilitate market opportunities for greenhouse technologies, products and expertise from Australia and partner countries and thereby expand the capacity for climate change action
- foster direct involvement by industry, business, scientists and communities in bilateral projects to broaden participation in climate change action.

Clean Business Australia [DIISR]: a partnership with business and industry aimed at delivering energy and water efficient projects. This is split into 3 components:

Green Building Fund (\$90m)-grants for energy efficient retro-fitting of buildings and support for training initiatives of building operators

Re-tooling for Climate Change (\$75m)-grants to small and medium sized companies to improve energy efficiency, invest in energy efficient hardware, invest in small scale cogeneration and cut water wastage.

Climate Ready (\$75m) - \$50,000 to \$5 million grants will be provided on a dollar-for-dollar basis, matching company spending on research and development, proof-of-concept and pre-commercialisation activities to develop solutions to climate change challenges.

Projects supported could include:

- new technologies for water recycling, waster recovery or small-scale renewable energy
- development of green building materials to make homes more energy efficient and more comfortable

- innovations to reduce the energy used by appliances, cutting emissions and household power bills

Clean Energy Enterprise Connect Centre [DIISR]: funding of \$20m is available over a period of four years. The Centre connects small and medium businesses with new ideas and new technologies, especially in respect of improving energy and water efficiency. The aim is to assist businesses to upgrade their capabilities and become more productive and competitive. Services include providing advice, facilitating workshops, participating in innovation networking activities and supplying hands-on manufacturing support. Much of this support will be through the national network of Manufacturing Centres. Businesses will be able to benchmark themselves against best practice, find and adapt the latest research and technology, and access prototyping and testing facilities. They will also get help in identifying export markets and understanding relevant regulatory, cultural and market issues, receive support to become export ready and be advised on government sources of support for their innovation and export activities. Through the Centre, businesses will be able to gain quick access to services provided under Austrade's Clean Energy Export Strategy.

Clean Energy Export and Investment Programs [Austrade]: aimed at promoting clean energy capability and facilitating export and investment opportunities.. Austrade is appointing liaison officers to work with individual clean energy firms and specialist staff in clean energy growth markets, such as China and India, to facilitate opportunities. The programs are designed to target the trade development strategies of Australian businesses and will help by identifying export markets and investment opportunities; by accessing domestic government support; by taking advantage of overseas governments' climate change policies; and by building relationships with governments, industry groups and local businesses in the clean energy sector overseas. Austrade's extensive international network can assist clean energy companies in markets around the globe.

Energy Innovation Fund (EIF) [DRET]: objectives include: developing Australia's research and development capabilities and intellectual property in clean energy technologies; increasing collaboration within Australia and internationally on clean energy research and development; creating clean energy technology development, growth and export opportunities for Australian businesses; and placing Australia at the forefront of global research and development in solar energy. The Fund will provide \$150 million over five years divided into two initiatives:

Australian Solar Institute (\$100m): this will support solar thermal and solar photovoltaic research and development;

Clean Energy Program (\$50m): targeted at general clean energy research and development, including energy efficiency, energy storage technologies and hydrogen transport fuels.

Export Market Development Grants (EMDG) [Austrade]: this scheme provides partial reimbursement for expenditure made by Australian small and medium enterprises on eligible export promotion activities, as an incentive for businesses to enter into export and grow to become sustainable exporters. The target for 2008/9 is for a total number of grant recipients at a cost of \$150.4 million.

Green Car Innovation Fund [DIISR]: aim is to encourage research and development in the Australian automotive industry to develop and manufacture low emission cars. The \$500 million fund will run for a five year period starting in 2011/12 and industry will be asked to match Government contributions on a three-to-one basis.

Greenhouse Gas Abatement Program (GGAP) [DEWHA]: aims to improve environmental management practice in the motor trades sector, including reducing emissions to air, in order to deliver an abatement of five million tonnes of carbon dioxide equivalent per year

during the Kyoto period of 2008-2012. The Program had funding of \$400 million for period of 1999-2012 and no further funding rounds are available.

Low Emission Technology and Abatement Program (LETA) [DEWHA]: aims are to support the identification and implementation of cost effective abatement opportunities; to encourage the uptake of technologies that reduce energy demand and emission intensity across business, industry and local communities; to leverage private sector investment in emissions reduction technologies; and to complement other climate change initiatives. Funding of \$26.9 million, applied through capital grants, is spread across a number of sub-programme areas:

LETA-Renewables: which is designed to compliment other existing climate change measures by supporting broad industry development projects and national projects as set out in the Renewable Remote Power Generation Programme (RRPGP) Partnership Agreements;

Strategic Abatement-Identification of Opportunities: funds are available for industry on a sector wide basis to identify opportunities for emissions reductions;

Strategic Abatement-Local Government and Communities: the objective of this sub-programme is to achieve cost effective abatement at the community level;

Geosequestration-Pilot Project: funds will be provided to demonstrate enhanced monitoring and verification technologies for geosequestration in Australia.

Low Emission Technology Demonstration Fund (LETDF) [DRET]: the objective of the Fund is to demonstrate the commercial potential of new energy technologies or processes, or the application of overseas technologies or processes to Australian circumstances, in order to deliver long-term large-scale greenhouse gas emission reductions. LETDF aims to address the demonstration phase within the technology innovation chain. The Fund is of \$500m and has an expected Government to private sector \$ ratio of 1:2. It is designed to run over a long time frame, from 2005/6-2019/20, as assessing and contracting large scale technology demonstration projects is complex and takes time. Six projects have so far been approved accounting for \$410 million of the funds. One of these projects is a 154 megawatt solar power station, based in Victoria, which will use new solar concentrating technology.

National Clean Coal Fund [DRET]: this Fund will invest \$500 million over seven years from 2008/9-2015/16 to support the National Clean Coal Initiative. The aim of the Initiative is to support the development and deployment of clean coal technologies that Australia will need in order to achieve substantial reductions in greenhouse gas emissions from future coal use while guaranteeing the contribution that coal makes to the economy and energy security. The Fund will work in cooperation with other stakeholders including State Governments, the coal industry (including its Coal21 initiative) and other research and industry bodies, and these stakeholders are expected to contribute an additional \$1 billion in funding. Direct beneficiaries of funding provided under the National Clean Coal Fund will include the research community and technology developers, operators of demonstration projects and developers of CO₂ storage sites and associated infrastructure.

National Framework for Energy Efficiency (NFEE) [DRET]: a joint initiative of the Federal, State and Territory Governments the Framework aims to realize the potential associated with the increased uptake of energy efficient technologies and processes across the Australian economy, and to achieve a major enhancement of Australia's energy efficiency performance, reduce energy demand, and lower greenhouse gas emissions. The policy dimensions involve using incentives to increase minimum energy performance standards, support new innovative technology and demonstration projects, supply training and accreditation to build capacity, and provide education and disclosure to raise awareness of energy efficiency and make energy performance assessable and visible. Programs within NFEE include the Energy Efficiency Exchange(EEX), a one-stop information portal on energy efficiency, and Energy Efficiency Opportunities, which is a

regulatory measure requiring large energy using businesses to undertake energy assessment every five years.

Renewable Energy Fund (REF) [DRET]: the aim of the fund is to accelerate the development, commercialization and deployment of renewable energy technologies in Australia. Through capital grants the fund will provide the opportunity to develop and demonstrate new renewable technologies on a commercial scale in order to prove their technological and economic viability and to attract further private sector investment. The Fund will invest \$500 million over six years from 2009/10-2015/16 of which \$50 million will be for the Geothermal Drilling Program (to help overcome the barriers to proving that geothermal resources can provide baseload power) and \$15 million over three years for the Second Generation (Gen 2) Biofuels Research and Development Program (strategy to supplement existing fuel supplies in a sustainable manner by deriving biofuel from low cost, non-food materials).

Renewable Energy Equity Fund (REEF) [DEWHA]: this is designed to supply venture capital for small innovative renewable energy companies. The aims are to provide early-stage seed funding to encourage the commercialization of renewable technologies; to leverage private sector investment; and to develop fund managers with experience within the renewable industry. The Government contributed \$17.7 million and the private sector \$8.8 million to establish the \$26.5 million equity fund (CVC REEF Investment Managers), which makes independent investment decisions, and with the fund manager, other private investors and the Government sharing any profits. The fund is proposed to run from 2000-2010, with a possible extension to 2013, and so far there has been investment in thirteen companies supporting research and development and early stage commercialization of enabling technologies, wind, hot rocks, biomass, biofuels and marine energy. Eight fund managers have been trained and with the current unrealized internal rate of return in excess of ten percent, REEF is one of the most successful of the Commonwealth's venture capital funds.

Renewable Remote Power Generation Program (RRPGP) [DEWHA]: the aim of the Program is to increase the use of renewable energy generation technologies (including individual systems and community systems) in remote areas not serviced by the main grid and thus presently reliant on fossil fuel to generate electricity. The original funding of \$205 million was supplemented by an additional \$80.5 million in 2007 with the scheme scheduled to run from 2000/01-2011/2012. The funds from 2000 are delivered through State and Territory programs, while from 2007 the new funds will be delivered through the Commonwealth. A Residential and Medium-scale (RM) sub-program provides rebates of up to fifty percent of the capital cost of renewable generation and essential enabling equipment for households, communities, not-for-profit, business, government and other organisations, in those areas of Australia not close to a main grid (where existing RRPGP sub-programs are not available). The program has proved successful in providing an effective electricity supply to rural and remote area users, in stimulating the development of renewable energy (strengthened the skills base, helped retain manufacturing and research and development in Australia, and improved quality and standards), in promoting renewable energy to the media and public in remote areas, and in reducing reliance on diesel in remote off-grid areas.

Solar Cities Program [DEWHA]: the purpose of the program is to show how solar power, smart meters, energy efficiency and new approaches to electricity pricing can combine to provide a sustainable energy future. The objectives are to demonstrate the economic and environmental impacts of integrating cost reflective pricing with the concentrated uptake of solar, energy efficiency and smart metering technologies, and to identify and implement options for addressing barriers to distributed solar generation, energy efficiency and electricity demand management for grid-connected urban areas. Funding for five Solar Cities (Adelaide, Blacktown, Townsville, Alice Springs and Central Victoria) totalled \$75.3 million (\$12 million from RRPGP funds), with an additional \$18.8 million being provided to

expand the program to include Perth and Coburg. The program is to be implemented over a number of years up to 2013.

Solar Homes and Communities Plan [DEWHA]: this plan is designed to encourage the long-term use of photovoltaic technology to generate electricity. This was previously known as the Photovoltaic Rebate Program (PVRP) and its objectives are to support the design and installation of solar PV systems on residential and community buildings, to encourage more people to use low emission PV technology, to stimulate the solar industry and research and development community to improve effectiveness and decrease cost, and to support training and accreditation of solar designers and installers. Original funding of \$52 million in 2000 which was managed through States and Territories has been supplemented by an additional \$150 million in 2007/8 to run for five years until 2012 and to be managed through the Commonwealth. The residential rebates, which are up to a maximum of \$8000, are available to households with an annual taxable income of less than \$100,000, and the system must be installed at the principal place of residence that is connected to a main-grid or are very close to a main-grid

Solar Hot Water Rebate [DEWHA]: the aims of this program are to accelerate the domestic uptake of solar and heat pump hot water systems to achieve cost-effective greenhouse gas abatement, to promote and boost the Australian solar hot water industry, and to shield Australian homes against possible price rises due to emissions trading. This is a rebate scheme for residential use and the solar hot water system must replace an electric storage hot water system. The rebates, which are worth \$1000, are available to households with an annual taxable income of less than \$100,000, and the system must be installed at the principal place of residence. In addition, the system must be eligible for at least twenty Renewable Energy Certificates (RECS) at the time and place of installation. There is funding of \$252 million over the period of 2007-2012.

National Solar Schools Program [DEWHA]: this program will help Australian schools to take practical action to participate in Australia's response to climate change. It aims to make every school a solar school, installing up to \$50 000 (GST exclusive) worth of solar power generation technology, and energy and water efficiency improvements. Schools installing a minimum 2 kilowatts new solar power system, or a minimum 2 kilowatts extension to an existing system, will be eligible for a grant of up to \$50 000. Schools that prefer to install a smaller (ie. less than 2 kilowatts) or no solar power system can still apply for grants of up to \$30 000 to be spent on other eligible items such as rainwater tanks, and a range of energy and water efficiency measures There is funding of \$480 million over the period 2007-08 - 2014-15

As well as these environmental initiatives there are also a number of generic business programs that, while not specifically targeted at clean energy, could be utilised by businesses within the clean energy sector. These include:

Commercialising Emerging Technologies (COMET) [DIISR]: this is a merit based assistance program with the aim of increasing the commercialization of innovative products, processes and services by providing individuals and early stage companies with access to growth capital and the management, business and intellectual property skills to bring new ideas and products to market. Total program funding is \$170 million and the scheme that started in 1999 is due to run until 2011.

7. Financing Village-Level Energy Case Studies

A selection of case studies



Introduction

There is growing awareness of the potential for cleaner and more renewable energy to provide an environmentally sustainable and relatively cheap means of supplying off-grid access to energy for the poor, particularly in developing countries. An estimated 1.6 billion people in developing countries, 1 billion of whom are in the Asia-Pacific region, do not have access to modern energy services for basic cooking, heating and lighting.

Despite the absence of a specific Millennium Development Goal for energy, it is clear that the widespread lack of access to modern energy services among the poorest acts as a severe impediment to progress in achieving most of the poverty alleviation targets defined in the MDGs. Energy is often a critical factor in achieving significant improvements in infant and maternal healthcare and combating disease (refrigeration, lighting, sterilization, transport, etc), education (lighting, heating, telecommunications, information technology, etc) agriculture and the eradication of hunger (irrigation, transport, storage, processing, etc), and so on.

Furthermore, the chronic lack of access to cleaner and more sustainable energy supplies has major implications on economic growth by placing significant restraints on the productive capacity of micro-entrepreneurs and rural supply chains. It is also increasingly apparent that continued use of wood, kerosene and traditional biomass for cooking, heating and lighting is exacerbating the contribution of poorer communities to emissions of greenhouse gases.

The emerging picture clearly places sustainable energy provision, with all its strategic economic, social and environmental dimensions, at the heart of the sustainable development challenge

While the IFC, World Bank and other international financial institutions are structured to provide large-scale financing for multi-million dollar projects at favourable, long term rates, these have often been focused on the extension of electricity grids from large energy

generators, such as power stations and hydroelectricity dams, an approach that often still leaves large numbers of people, especially in rural areas far from transmission lines, without access to power.

The Philippines provides an instructive example: there is a pressing need for affordable energy in small isolated communities, and there is an even greater need to stimulate livelihood schemes. The Philippines has, on an affordability basis, the second highest priced electricity in the world (after Cambodia). It has a population of 91 million, a GDP per capita of US\$ 1,642.00, comprises over 7,000 islands with a rural population density of about 300 people/sq mile, and presents a clear challenge to a national grid supply of electricity for village use. The Government has for some years been pursuing a policy of village electrification, historically satisfied by diesel fuelled generators but now the emphasis is turning increasingly to renewable sources. Some success has been achieved in attracting both overseas and domestic investment to larger renewable energy schemes, e.g., the 25MW NorthWind project in northern Luzon. It is difficult to attract private sector investment into small renewable schemes typically producing 5 -50kW when the local people, often existing on less than US\$1.00/day can ill afford to pay anything for the power, let alone commercial rates.

The failure of governments to achieve significant rates of rural electrification in many countries has meant that off-grid energy sources such as solar lighting systems, biogas, micro-hydro, wind and LPG cook stoves, are increasing in importance and use. Despite the low operating costs of these energy sources, high initial costs have proven to be one of the main obstacles for the poor in accessing alternative energy.

At a recent workshop in Manila - Financing Village-Level Energy for Development in Asia-Pacific - Craig Wilson, Executive Director of the Australian-based Foundation for Development Cooperation, explained that efforts to expand the provision of clean/cleaner/more renewable energy at the village level in Asia and the Pacific now depend less on technology and more on improved financing models to make this energy accessible and affordable at the village level across the Asia-Pacific region.

The workshop showed that several innovative microfinance institutions (MFIs) – and other financial institutions – are taking up the challenge represented by this lack of access through making available microfinance loans specifically designed to fund alternative sources of energy. In some cases, MFIs have themselves provided in-house energy lending and have become energy suppliers as well as lenders. In other cases, MFIs have partnered with energy suppliers and retailers to develop energy and loan products that are tailored to the needs of the poor and micro-entrepreneurs.

Despite some success stories, many gains in the financing energy sector are small and have not been consolidated due to a lack of effective avenues for information sharing across the industry. This constrains the growth of the sector, the development of best practices, product development and supply, consumer awareness, and partnership formation.

While access to microfinance for energy loans is already occurring in several countries, much needs to be done to realise the potential of such loans on a larger scale. Increasing outreach and scale is related to the capacity of MFIs to attract investors as well as energy suppliers willing to back energy lending portfolios.

A need thus exists to find ways to enable the nascent energy lending sector to grow, develop and consolidate the array of success stories and stakeholder relationships occurring across the globe. This requires established and formal avenues for networking, information-sharing and advocacy, up-to-date product and stakeholder data, as well as ways of financing and recognising innovation in the energy lending sector:

- to reduce poverty through greater access to cheaper and more accessible energy;

- to improve health at the village level through greater access to cleaner energy; and,
- to mitigate climate change through creating opportunities to scale up technologies promoting the provision of off-grid renewable and cleaner energy.

Fewer obstacles now exist for communities to attract financing from various sources such as carbon or clean energy investment funds, which have the flexibility to fund reduced scale, decentralised and renewable energy projects. Despite the challenges faced by local communities in satisfying the great administrative burdens and high transaction costs involved in setting up complex carbon mitigation projects, there are growing opportunities for intermediaries and microfinance institutions that can mobilise and leverage carbon finance for energy lending in such communities.

The case studies profiled in this report were featured in presentations during the workshop on "Financing Village-Level Energy for Development in Asia-Pacific", held in Manila, The Philippines, from 9 to 11 April 2008, hosted by the Asian Development Bank (ADB) www.adb.org ; The Foundation for Development Cooperation (FDC) www.fdc.org.au and GVEP International www.gvep.org .

Special thanks to Jack Whelan, Head of Private Sector Engagement, The Foundation for Development Cooperation (FDC) for preparing the case studies. Jack can be contacted at jackwhelan@fdc.org.au

The above organizations and the editors accept no responsibility for the information or accuracy of any data provided in this report, which is extracted from the presentations provided by the project facilitators and microfinance institutions, and sourced from their web sites and other summary reports.. References and contact details are listed at the end of the report. Photos are reproduced with the permission of the respective project leaders.

Sri Lanka and Bangladesh

SEEDS (Guarantee) Ltd

SEEDS = Sarvodaya Economic Enterprise Development Services, and is the commercial arm of Sarvodaya (meaning “Awakening of all”) – a national microfinance institution. Founded in 1958 by Dr. A. T. Ariyaratne with the aim of envisioning people and communities in the country, the Lanka Jathika Sarvodaya Shramadana Sangamaya has today emerged as the largest and the oldest indigenous NGO in Sri Lanka with linkages at a global level.

The SEEDS energy lending project, “Lighting the village, Lighting for all”, is designed to cater to rural off-grid communities through three main programmes: [1] Solar Home Systems and [2] Grid power for very low income groups – both designed for rural households based on individual lending, and [3] Village Hydro, developed for a village-based, community lending, self-help service. The project operates with the aim of providing power connection to the remote village communities to provide bright light for safety, security, health, education, and the improvement of income.

The project is managed as a joint venture operated by the financier and the technical service provider, keeping the key service factor as customer convenience. To date it has provided lighting to over 80,000 customer homes with over US \$ 29.9million investment, which has resulted in 5.4million gallons of kerosene burning avoided, saving = US \$ 16.18m. A total of 2,900 k.w. power has been generated and 40-47 thousand tones of carbon dioxide emissions prevented.

Most of the loans are targeted at micro-entrepreneurs and small business owners, characterised as low income, under-served persons who are unable to invest capital to purchase lighting equipment/services.

These have typically included stone ornament craft workers, sewing machinists, computer operators, carpenters, mobile boutiques, food stalls, home grocery shops, metalworkers, weaving, spices processing, etc. Solar power is also used in villages threatened by elephants for electric fences to protect valuable agricultural crops.

The benefits for the various parties include:

For the borrower > Total service at the door step; warranties; risk assurance arrangements in unforeseen circumstances; credit at better terms; extended day light.

For the financier > Synergy; scaling up at least cost.

For the equipment / service supplier > More sales, expansion island-wide

Among the main future challenges identified is the ever increasing cost of equipment and services which represents a threat to affordability of the prospective customers. The project continues to expand the service to an average of 1,000 customers per month. Funding and capacity building at all levels is priority.

Khaula Karya Foundation - Financing Biogas Retail Services

Depot Energi Khaula (Denkha)

Seventy percent of the Indonesian population relies on agriculture activities, and many still face difficulties in accessing markets, modern infrastructure (including energy technology) and financing. Although electricity access at the village level is quite high (67%), there are still 70 million people have no access to electricity. As energy is the backbone of economic activities, limited access to it certainly places rural community at a disadvantage: limiting the growth and competitiveness of the communities' products.



To meet the needs of rural communities for better, cheaper and more sustainable energy solutions, Khaula is now developing Depot Energi Khaula (Denkha), which is a franchise-based rural energy service. Denkha's target consumers are, among others, community enterprises, households and commercial users (SMEs) in agriculture. Rural entrepreneurs, cooperatives or community development facilitators are the main actors to operate DENKHA shops.

Khaula provides technical supports and financing facilitation for eligible owners/operators of Denkha shops, which include business planning, start-up capital mobilisation, establishment, business operation guidelines, technology selection and supply management, as well as technical and business skills assistance.

To ensure a successful programme, Denkha involves several partners.

1. Market; approximately 120,000 dairy cow farmers in Indonesia. Most of them have not utilized their existing cow dung to provide fuel for their daily household activity and produce good quality manure.
2. Government; Indonesian government has 12.5 million Euro that can be utilized as loan guarantees channelled by banks to finance renewable energy and energy efficiency projects.
3. Financial institutions; by entering the renewable energy sector, which is crucial considering the recent oil price increases, it opens up larger markets for banks.
4. Private sector; there are currently only 2 commercial biogas manufacturers in Indonesia. By providing decentralized services points, Denkha is able to penetrate a larger market size, also stimulating more biogas manufactures.

There are obstacles in different aspects:

1. Market; the current market cannot afford to pay cash for digesters. Banks that have the capacity to deliver credit facilities are hesitant to enter this market due to their unfamiliarity with the product and targeted market
2. Technology; pre-fabricated modular biogas digesters made from fibreglass, endorsed by Denkha, need improvements in strength and standardized manufacturing techniques. Using a cast to mass produce digesters at a more economic scale should lower the cost and standardize the quality.
3. Accessibility; developing retail services will be costly if established from scratch. With existing centralised sales practices, problems will persist with dispersed and smaller number of unit purchases which increase transaction costs. Also, market distortions are created when government provides digesters as grants.
4. Management; risks of credit non payment by beneficiaries.

Opportunities:

Banks are willing to finance renewable energy and energy efficiency projects with loan guarantees of minimum 20% of total project value. The other 80% is from the government's fund from DNS (Debt for Nature Swap) programme. By involving cooperatives, which are used to deduct credit payments from the milk payment of farmer members, credit payments are guaranteed. This ensures revenue from each of the digesters sold to members and the provision of maintenance services.

| | |
|--|-------------------|
| Number of market (First year) | : 1000 farmers |
| Credit payment duration | : 5 years |
| Interest rate p.a | : 12% |
| End user price | : USD 380/unit |
| Down payment by farmers (15%) | : USD 57,000 |
| Loan guarantee from Denkha & cooperative (30%) | : USD 96,900 |
| Loan leveraged from Bank (70%) | : USD 226,100 |
| Kerosene saved | : 456 kL/year |
| CO ₂ -eq emission reduced annually | : 17,542 ton/year |
| Savings for end users | : USD 147/year |
| Cooperative income as reseller & maintenance | : USD 43,480 |

Planet Finance – RENDEV

RENDEV is a 3 year project exploring ways to link microfinance and access to renewable energy. The project, which runs from January 07 to December 09, aims at bringing a positive contribution in rural development and poverty alleviation in Bangladesh and Indonesia by increasing access to solar energy, the development of micro enterprises, and the provision of microfinance mechanisms tailored for low income people's needs. RENDEV is financed by the European Commission under its Intelligent Energy line.

While rural population expenditures for basic energy services are very high, the quality of services delivered is very poor and even endangering their health, the main danger being fumes of low-quality stove and kerosene lamps. Implementing Photovoltaic Solar Home Systems is an easy solution to provide modern energy services at a reasonable cost to populations living in remote areas. The main advantages of a Solar Home System SHS - (One small PV module + battery + regulator + a few lamps) are: an easy installation, little maintenance required and the main part of the system is guaranteed by international manufacturers for 15 to 20 years.

However, despite the development in the late 90's of SHS providers in different developing countries working under 100% commercial schemes and demonstrating a real demand from rural population, the market remains in an embryonic stage. The reason is the high cost of the system: between 500 and 1000 USD.

Furthermore, subsidized programmes led by donors and/or local governments have often harmed the existing commercial sector: nobody would want to pay any more for a service neighbours are receiving for free. At the same time the challenges of rural electrification remain huge for donors and governments, and most of the programmes reach only few beneficiaries compared to the enormous demand.

Providing credit at an affordable price, thereby reducing the down-payment, is an alternative solution helping reach a wider part of rural population. Two different cases in Asia demonstrate to what extent microfinance schemes can help in financing Renewable Energy Services.

The two largest experiences are in Sri Lanka and Bangladesh under RERDEP programmes. More than 150,000 SHS have been installed in each country since 2002, making these programmes a real success in the field.

In Bangladesh, the programme is implemented by a state-owned financial private company, IDCOL which invests in infrastructure and equipment. The programme joined hands with the vibrant and sizeable microfinance industry of Bangladesh. The two largest organisations, Grameen Bank and BRAC, have developed a dedicated sister organisation and are leading the market, while 13 other organisations joined the programme and met the criteria defined by IDCOL.

The main originality of the programme is the direct subsidy element is quite low (around 10%) while most of the support is provided through soft loans to the partner organisations. The extended

network of Partner Organisations (Grameen and BRAC have branches in all sub-districts in Bangladesh) allows the programme to reach the whole population of Bangladesh. The original target of 50,000 SHS was reached in less than 3 years against a forecast of 6 years.

While IDCOL is allowing loans and monitoring the project, Partner Organisations are in charge of marketing, purchasing and installing the systems, training the population, collecting the monthly fees and maintenance of the system throughout the duration of the loan to the end-customer. The success of this programme was awarded by different International awards including Ashden Awards and 2007 Right Livelihood Award.

EXAMPLE 1: A micro enterprise to recharge mobile phone batteries, Bangladesh

Not long ago, rural areas in Bangladesh still had very little communication equipment. Grameen Shakti provides loans that beneficiaries use to buy a solar home-system to recharge mobile phones. The total cost of the system is 250\$US. The financial deal with Grameen Shakti includes a 25% down payment (62.5 \$US) and an 8% interest rate loan for the remaining 75%. The loan is reimbursed over two years, with an 8.54 \$US monthly repayment. On average, after deducting the loan repayments, the micro entrepreneur earns 91\$US per month thanks to his/her mobile phone recharge business.

In Sri Lanka, the success is similar but the scheme is different. The main actor is a large microfinance institution SEEDS. SEEDS works with 11 different solar companies. The solar company is in charge of marketing, purchasing and installing the system and ensuring the maintenance and introducing SEEDS to clients who require a loan to afford their services. (see SEEDS (Guarantee) Ltd above).

EXAMPLE 2: Provision of biogas bio-digesters in rural areas

Chine Tongwei County in Gansu Province, Northwestern China, is one of the country's poorest areas where the 420,000+ population mainly subsists on agricultural activities. The region is notable for a lack of energy which restrains the local area's agrarian development and any chance of improving the income levels of the poor farmers. A government-sponsored programme has been launched to promote the use of biogas and this programme is paying part of the cost of biogas bio-digesters with a solar panel component. Demand for biogas installations is rising among farmers but many candidates do not have the means of financing the amount not subsidized by the local government. A local microfinance institution developed a microloan specially dedicated to Renewable Energy (RE) access. The loans are used to install biogas pits and solar panels and provide energy to the farmers.

Pacific

Barefoot Power

www.barefootpower.com

Barefoot Power is a company set up in 2005 to help provide 1 million people with electricity, to reduce dependency on kerosene lighting. The company is incorporated in Australia, and works with suppliers in China plus partners in multiple developing countries. As a for-profit social enterprise, the primary aim is to build up a profitable, scalable business model that attracts commercial investors and delivers commercial returns - mostly, these returns will be through an increase in company value and share price, not through dividend payments, and hence building revenue quickly is important. As with normal start-ups, seed financing was obtained from family and friends, and difficult-to-find "angel" level financing of \$50,000-\$500,000 has been sourced from the microfinance industry. Normal avenues of financing remain closed, due to the perception of high risk - selling renewable energy to the poor in Africa and Asia has not yet attracted funds from normal commercial sources, indicating extremely high investor target IRRs (>50%).

The initial objective is to displace kerosene lighting for 1 million people in 200,000 households by 2011, mostly via white LED lighting products from China. Field studies indicate households spend on average \$1/week on kerosene, with some countries like the Pacific islands showing higher expenditure than poorer Asian countries like Nepal. Households are willing to risk spend up to US\$30, but generally up to \$15, on an alternative to kerosene, about 4-6 months expenditure, indicating very consumer high discount rates (>100%). However, 1W rechargeable/solar desk lamps provide a cost-effective alternative in the kerosene cash market. More expensive 2.5W-10W multiple lamp products are also proving popular in market trials, but may require end consumer micro energy loans to be affordable to the mass population.

Given that the initial objective is to deliver \$15-30 solutions to 200,000 households, total revenue over 2005-2011 may be around \$3-6 million. Investors will look for an exit (to sell their shares) at this point, and one option will be a trade sale to a company interested in scaling up village energy solutions. There has been little interest to date, and therefore this is unlikely to be valued highly by the buyer. An alternative is a public offering of shares on the share market, which requires a minimum company size of \$10 million revenue. We expect the public to value the company more generously than buyers in the private equity market, therefore, this latter target is the secondary objective for the company.

Due to a lack of angel investors and venture capital interest in Australia, Barefoot Power has spent considerable time and energy to find financing in Europe and the USA, from entities specifically interested in social investment. This term is almost unknown in Australia, whereas the UK has set up the Office of the Third Sector in recognition of the valuable contributions social enterprises make to the economy. Social investment firms are responding well in Europe, and slowly in the USA. Some microfinance partners are being mobilized to assist our national importers to sell the products, but sales are primarily occurring through cash-and-carry sales. This proves the point that end consumer loans are no longer necessary to break the energy poverty cycle. With affordable white LED products and an approach to building up home lighting systems watt-by-watt, aimed at matching household cash flow, an estimated \$10 billion/year of kerosene and battery expenditure can be redirected towards lamps, solar panels and house wiring.

Barefoot Power aims to rapidly scale its market trials and generate millions of dollars of revenue, whilst keeping its operating costs and hence product costs low by employing social entrepreneurs at very low salaries. Interest is growing from our 2-3 pilot countries to 10-20 countries worldwide, and Barefoot Power will do all it can to service the needs of any country, via its consolidating warehouse and shipping hub in China. Barefoot Power uses modern technologies like Skype to help train local/regional/national level partners, and backs up this support with on-ground project managers and high quality business plans to help partners raise finance. These free business support services add extra support to our partners, and with 20-30 strong partners in developing countries, we are confident of meeting our company objectives and providing good returns to our shareholders.

Papua New Guinea

Appropriate Technology & Community Development Institute (ATCDI)

Papua New Guinea (PNG) is a developing country located in the South Pacific, with a population of 6.1 million people, of which 85% reside in the rural areas. The country has great renewable energy potential, primarily solar energy, hydro energy and biomass. There are many small fast flowing streams and rivers near villages and stations that have the potential to provide power requirements using micro hydro power technology. Their utilisation has been limited due to lack of know-how and funding to harness the renewable energy resources.

PNG has a total hydro power potential of about 25,000 MW and about 50% of this is considered as suitable for development. Currently there are 17 big hydro power systems producing a total of 163 MW. Eight of these are isolated systems producing power for government centres and other industries. Less than 10% of the rural population has access to electricity.

Small communities throughout PNG are heavily dependent on fossil fuels. For example, petroleum accounts for a large percentage of commercial energy production in the country. A number of

organisations and groups are actively working on renewable energy to provide energy services, combat global warming, and escape rising oil prices. In many places, renewable energy is the only practical option. Many diesel generating systems (gensets) installed many years ago at government and mission stations to serve their work force have broken down adversely affecting health services, schools and other government services. Those gensets in good condition have their operating hours reduced to few hours per day due to funding problems.

The Office of Energy Development (OED) is the Government institution responsible for implementing National Government policies in relation to rural electricity supplies. OED officers have assisted with funding a limited number of RE projects, but the number of engineers available to assist with site work is very limited. Currently there is no rural electrification policy and no renewable energy policy.

There are 19 provinces with a main commercial/administration centre in each. The power requirements of these centres are generated and distributed by PNG Power Ltd (PNGP) using diesel generators, gas turbines, and hydros in the megawatt range. PNGP has a Rural Electrification Programme, which connects grid power to villages that are in the vicinity of the towns or next to low voltage grid transmission lines. It is not economically viable to extend the grid to many of the rural communities as they are scattered and remote. Diesel systems have broken down or operate with rationed fuel, with rural communities denied access to important basic services.

In the 1980s the PNG Government introduced a diesel replacement programme by investigating the use of stand-alone power systems focusing on the use of mini/micro hydro power and solar technologies. However, there are many hundreds of local government centres and rural health centres and schools with isolated power generating systems and many more with no power supply at all.

Apart from PNGP there are a number of private organizations that use renewable energy resources to generate power to meet their demands and also assist other communities. These include mining enclaves (hydro schemes, gas turbines and geothermal plants at Ok Tedi Mining Ltd, Lihir Gold Mine, Porgera Gold Mine, Misima Mines Ltd, etc); Churches (micro hydro power schemes at Catholic Mission Station at Bundi in the Madang Province), tourism lodges (Ambua Lodge at Tari in the Southern Highlands Province), non-government organizations, etc.

Some examples of ongoing projects funded by donors in PNG:

- AusAID - solar PV and micro hydro power projects, such as solar PV project at the Gain Aidpost to power a vaccine fridge and some lights. Community Development Scheme (CDS) – a programme of AusAID - funded a pico hydro project (PAT system) at Paruparu village in Bougainville.
- New Zealand Aid (NZAID) - RE training workshops at ATCDI, including engaging a trainer from Powerflow Ltd in NZ, the installation of two solar PV projects as part of the training at the Arisisi Primary Health Care Centre, and a solar water-pumping project for the Nalogwam hamlet.
- PNG Sustainable Energy Ltd is a new company setup by PNG Sustainable Development Programme Ltd funded by Ok Tedi Mining Ltd to assist with development projects in PNG. The World Bank has provided a funding of US\$992,000 in April 2005 to support school teachers to purchase solar lighting kits through the TISA Savings and Loan Society on a five year project currently managed by PNG Sustainable Energy Ltd.
- Japanese Government funded some solar PV projects for Community Schools.
- Chinese Government has donated some wind generators for small loads like an Aidpost or a School office - installed at suitable sites in the Central Province.

In PNG there is no specific office setup to coordinate rural electrification projects. The Government's rural electrification policy is not yet in place. Many communities do not know where to go for assistance. Some communities approach ATCDI/Unitech and many others miss out altogether on sourcing information and getting projects for their communities.

The Philippines

Project ACCESS, Solar Electric Company

The Government of the Philippines through its Department of Energy (DOE) aims to achieve 100% barangay electrification by 2009 and 90% household electrification by 2017. The DOE is implementing the World Bank and Global Environment Facility-supported Rural Power Project (RPP) of which Project ACCESS (Accelerating Community Electricity Services Using Solar) is one component using the Sustainable Solar Market Packages (SSMP) approach:

www.rpp.com.ph/abouts-access_intro.htm

Structural reforms and innovative approaches aided by legislation have enabled the programme to make considerable headway in the last decade. It has more than doubled the rate of rural electrification from 500 to about 1,200 barangays per year and effectively reducing the number of unenergised barangays to the last 2,500.

The financing sources for Project Access are GEF Financial Incentives, Government Subsidies, Mirant Foundation Philippines, Iligan Light and Power Inc., AMORE 21 – USAID, and the microfinance partners involved are Progressive Bank, TSKI and Paglaum Micro-finance Coop.



The SSMP approach bundled several barangays into market packages to achieve sufficient scale to overcome the higher transaction costs of doing business in distant areas and manage risks. The successful SSMP contractor will have an obligation to install the PV systems for community facilities within six months and warrant their operation for a period of five years. The project has a strong focus on after-sales service and continued marketing. The contractor is also obligated to market and sell solar PV systems in a commercial basis

to benefit at least 25 percent of total potential households in each SSMP cluster within 18 months from signing of contract.

Public sector, private entities, and donor resources funded the PV community facilities while a government subsidy of P 4,000 or P 8,000 (about \$80 or \$160) per PV system and GEF financial incentives of \$1.50-2.50/Wp, depending on the size of the PV system is offered for commercial PV installations. A cost-shared \$10,000 Market Development Support Facility grant is provided to eligible participating companies. All of the 8 market packages covering 76 barangays with 436 communal installations worth P74,893, 438 with 70.82kWp and a target of at least 4,235 SHS was awarded to SOLARCO after a competitive bidding in 2006. The Incubator Programme was also implemented to introduce productive partnerships between the Participating PV Companies (PCs) and the Micro-Finance Institutions (MFIs). The Incubator Programme serves as a “warm up activity” for both the PC and the MFI partner in doing solar micro lending business.

Upon implementation of the SSMP, 20% of the target barangays were already electrified and changes on the target sites, budget and timelines are needed. Improvement on the Rapid Rural Appraisal methodology and verification process is needed for a reliable market assessment prior to tendering of market packages.

Deficiencies in the installations were rectified by the contractor after inspection of the DOE-PMO. A benchmark installation is recommended for approval prior to massive systems installations. Participating companies face financial and technical challenges to maintain the systems for five years and to achieve large scale SSMP expansions and intensified marketing over the next two years.

There is a need to strengthen the DOE-PMO in preparation of bid documents, handling of contractual transactions, write specifications and handle supply variations, do timely verification of installations, and market SSMP to attract more participating companies. A transaction advisor may be necessary to assist the DOE-PMO in handling the project.

The Loan Guarantee Fund is critical to support companies to achieve deep market penetration with consumer financing through MFIs. Refinement of the LGF by the LGUGC as the programme manager is necessary to tailor the PV loans into the MFIs' standard loan profiles.

The biggest challenge is the involvement of private companies engaged in solar PV installations who will set up the systems in remote barangays and the Microfinance Institutions (MFIs) who will provide the lending window for the system. The need to create a synergy between both sectors is critical to the success of the Rural Power Project, plus the need for client education for end-users and information dissemination and sharing.

The Department of Energy also plays a strong role in matching solar companies like SOLARCO with an MFI. For example, the RPP-PMO matched SOLARCO and Iloilo-based Progressive Bank for the installation of solar PV systems in off-grid areas in Iloilo. Solar and the Iligan Lights and Power, Inc. were matched to provide electricity to the last two barangays of Iligan which have remained without electricity. With SOLARCO doing its part of supplying, constructing and turn key while ILPI provides the monitoring, administration and facilitation, Iligan will be the first province to have 100% electrification.

Under the Rural Power Project, electrification is accompanied with infrastructure that will enable communities to engage in micro enterprises. This will empower rural communities to make electricity work for their benefit and transformation as well as help them sustain the solar PV system with a sense of ownership and value.

Several opportunities have been identified for the project, including: there are households in "electrified" areas that still do not have access to electricity; the infrastructure has developed to reach more households in remote areas; there is an improved and wider range of Decentralized Clean Energy (DCE) technologies (PV, Wind, Hydro, Biomass); and there is now greater experience in various approaches to micro-financing DCE systems.

The project has attempted to collect market survey data from an island community with two barangays and a total of 812 households. A diesel generator provides electricity for 6 hours nightly to 295 (36%) households.

The actual cost of energy is 14.13P/kWh from diesel genset but is cross-subsidized at 6.37P/kWh with the rest of the consumers in the mainland. The minimum household demand is 4kWh/month while 20Wp SHS can only produce 3kWh/month. The cost of financing a 20Wp SHS is P292/month equivalent to the monthly bill of 14.2% of the households with an energy demand of 48 kWh/month.

Project Access has identified the following challenges and opportunities:

1. The rural PV market is still large but sparse.
 - customer density is high only in selected areas, aggregation may not always work
 - scale of operation must be adjusted to the market size
 - tendency to cater to few but large customers
 - fierce competition with other electrification projects
2. Customers value energy in terms of service delivered rather than just kWh
 - A 20Wp SHS can deliver lighting service similar to an 8kWh/day grid connection
3. Select the appropriate system size and type to customer energy demand and financial capacity
 - Provide other rural energy services beyond basic lighting and entertainment to generate income and cost savings.

Alliance for Mindanao Off-Grid Renewable Energy (AMORE) Programme

The Alliance for Mindanao Off-grid Renewable Energy (AMORE) Programme is a rural electrification initiative whose objective is to complement the national government's effort to attain 100 percent

village electrification by 2009. Aptly called an *alliance*, the programme is funded by public and private entities, namely, the United States Agency for International Development USAID, the Philippine Department of Energy, Mirant Philippines Foundation, and SunPower Corporation, among others.



Faced with the development challenge of providing access to electricity to the remotest and poorest of the poor households in conflict-affected Autonomous Region of Muslim Mindanao, the programme chose to utilize stand-alone renewable energy technology such as solar and microhydro. But even then, and given the

programme design of providing solar home systems to an initial thirty households in each village, and lighting to communal facilities in others, over sixty thousand homes remain unenergised in AMORE's 400 villages. In the franchise areas of the electric cooperatives, the National Electrification Administration estimates about 3.4 million homes to be without electricity.

To address the gaps in household electrification, a micro-financing model was piloted in 21 villages of the AMORE programme. Using the framework introduced by the World Bank Rural Power Project, a lending programme with two features was introduced – the payment of household equity amounting to PhP5,000.00, and a monthly payment amounting to PhP500.00, totaling PhP12,000.00 for two years – in AMORE areas by a Mindanao-based micro-financing entity, and was offered after the communal facilities were completed and rendered operational in the community.

While it is too early to render an assessment of the financing programme as the household electrification component of the World Bank rural electrification programme – where the micro-financing model was introduced – only began in July 2007 following the completion of establishment of communal facilities in December 2006, it is significant to note that not one family has availed of the loan facility. Findings in AMORE villages reveal that the 18,000-peso solar home system offered by suppliers is simply unaffordable by the households who earn about USD2 a day.

To facilitate a more effective household electrification programme, it is recommended that the H(ousehold)20--G(overnment)40--F(under)40 formula for financing be implemented. The Department of Energy is encouraged to invite more photovoltaic (PV) suppliers to join the market, a move that will drive competition and push prices downwards. Suppliers are encouraged to broaden product offerings with the option to pay for the systems cost minus installation cost. The AMORE programme in cooperation with the Department of Energy, meanwhile, will continue to provide technical assistance in the development of a set of prioritization criteria for the selection of eligible villages for micro-financing.

YAMOG Renewable Energy Development Group



Established in 1994 in Mindanao, Philippines, YAMOG is a founding member of the Micro Hydro Energy Association of the Philippines (MEAPHIL), a member of the Philippine Network on Climate Change, and a founding member of the Mindanao Renewable Energy Network. YAMOG specialises in integrated renewable energy systems (micro hydro and solar power), water system distribution and watershed management, building sustainable livelihoods for rural communities.

The YAMOG project has installed micro-hydro turbines and solar powered water pumps to several local communities in the Mindanao region of the Philippines. The objectives of the project were to bring electricity to these communities, provide

them with readily available drinking water, and protect the local watershed through good management and reforestation. The installation of these sustainable technologies means children and adults are no longer restricted to working during daylight hours, and do not have to travel far to collect water for drinking, cooking, washing and irrigation. Electricity can also power agricultural processing facilities, which allows farmers to process their own produce, thus avoiding paying to have this done elsewhere and helping to strengthen the economy. Overall the project has been a big success, and can function as a model for further rural electrification and potable water systems.

The project provides electricity to 1,875 indigenous peoples in the villages of Dumalaguing and Tablo, Mindanao. The programme includes capacity-building elements towards operation of the projects and business support.

The financing scheme was supported by the UNDP GEF Small Grants Programme and GVEP International GAP Fund. The tariff structure agreed with the communities included a capital replacement fund; operations and maintenance fund; community development fund, and a watershed protection fund.

The Project has measured the following impacts:

- 375 indigenous households with access to quality lighting, and milling
- A change in energy use pattern from kerosene to electricity.
- Women become more productive at night and need not carry and walk to a distant corn mill.
- Enhanced weaving production at night
- Each farm family saves an average cost of US \$ 95 annually for corn milling and transportation
- School children quality study at night.

The success of the project can be attributed to the self-sustaining financial model with cash generating (usually day time) end uses to produce cash flow and increase the use of plant facilities (load factor) . Furthermore, the income generated helps community development projects, small enterprise development, technical assistance, social infrastructure, maintenance of the system, and in part for the watershed management.

Furthermore, local capacity to manage, operate and maintain micro hydro projects has been boosted, and community participation facilitates involvement in the design and generation of hydro power, and reduces costs.

The main challenge identified by the project is the process of building a broad sense of community ownership through community participation, from the project conceptualization to the project evaluation. The community played a key role in building the plant and the agricultural processing facilities, investing considerable amount of time, efforts and materials.

The next steps for the project are:

- to replicate and scale up the business model – using an energy coridoring strategy towards wider impact
- further developing community and multi stakeholder partnerships
- continue the integration of micro hydro power systems with productive end-uses, and enterprise development with micro financing
- facilitate a watershed management and rehabilitation programme as an adaptation strategy to climate change impacts.
- enhance capacity to manufacture local turbines and the control equipment (crossflow turbines and electronic load controller)
- develop a local network of renewable energy practitioners.

SIBAT - Sibol ng Agham at Teknolohiya

Sibol ng Agham at Teknolohiya, or ‘Wellspring of Science and Technology’, is a non-governmental organization engaged in the promotion and development of appropriate technology in the Philippines. SIBAT have been operating since 1984, and has projects in rural areas all over the Philippines. The two main fields of work are renewable energy and sustainable agriculture. SIBAT develops and installs Community-Based Renewable Energy Systems (CBRES), including micro-hydro systems, solar PV water pumps and wind turbines.

One project, completed in August 2007, is a feasibility study for the development of six community-based renewable power sites, prioritized for poverty reduction. The feasibility of the sites would be supported by production enterprises including: sustainable food production processes and micro-enterprises based on water. The feasibility study was funded through the GVEP International GAPFund, and the implementation partner is the Centre for Lumad Advocacy & Services Inc. (CLANS).

The overall objective of the project is to strengthen the Community-based Renewable Energy Systems (CBRES) as the appropriate mechanism for energy provision, and a responsive tool to combat poverty and hunger in the poorest off-grid sites of the country. The specific objectives were to produce 6 feasibility studies for CBRES development of a power enterprise, one in each of 6 selected sites in provinces with high poverty incidence and included in the priority list for the government’s poverty alleviation programme. The following elements of sustainability were incorporated: (a) a power enterprise; (b) financial sustainability modelling; (c) organizational modelling; (d) productivity, water and micro-enterprise development plan of the community.

The feasibility studies for the six proposed micro hydro project sites highlighted the potential of resolving a perennial post-harvest processing need and provide household lighting of the communities that would give them an economic advantage in the long run through access to a CBRES. Reviewing the context, the identified project communities are dominantly dependent on corn and upland rice production for food and income, along with secondary crops, forest products and livestock. Farming households in Mindanao sites have to travel long hours by horse (4-8 hours) to the nearest corn milling centre to mill their corn grains. A significant amount of time for farm production work is lost and most milling revenues and other corn by-products go to the mill owners and traders with the farmers getting no cash returns.

With CBRES energy, the community can put up their own corn milling centres in their villages which they themselves will manage and patronize. The immediate effect would be a large number of productive work hours saved and re-allocated to farm work rather than spending time to travel to distant milling centres of private traders. Likewise, the revenues derived will be spread out as patronage rebates among community members, loan repayments for the corn enterprises, allocations for sinking and revolving funds for systems operation and maintenance and for other community project endeavours.

Overall, the power enterprise model presented in these feasibility studies also generated strong interest from partners including donors noting the innovative approach of the project towards poverty alleviation. These projects are noteworthy in terms of potential contribution to the protection of the environment at the local level through protection of catchment areas and watersheds which supply water to the hydro systems.

Some of the lessons learned from the studies include:

- There should be adequate flow measurements and updated hydrologic references that could be utilized in assessing and analysing the hydrological profile of water resources in the areas;
- Climate change has already created adverse impacts as regards rainfall patterns and river flows. This poses some threat to the stability of the water resource in the near future that would affect harmonious seasonal cropping particularly of food crops;
- Some local government units, at least in areas visited, are not highly aware of renewable energy systems and technologies such that local development planning does not have concrete and adequate measures to harness and integrate these into their plans and strategies;
- One site has one water resource that is a spring that initially poses a difficult hydrological configuration compared to others with wider catchment areas and river tributaries to correlate.
- Most of the areas have rich potential agricultural resource for development. There is a dearth of government infrastructures particularly farm-to-market roads that are existing or are being planned except in one selected project site.
- The socio-economic conditions of poor communities bear tremendously on the structure of financials and potential financing of the project. The latter cannot be imposed without substantive data, hence rigorous socio-economic research needs to be done.

A continuing hydrology study will be conducted for three sites for the period prior to project implementation, to fine tune hydrology projections.

One significant unintended outcome was the revival of the trust of indigenous peoples to service delivery agencies. A long while, the communities weakened their trust particularly of the government who promised to provide basic services but where majority have not been fulfilled. The regular visits, consultations and attention given by NGO workers during the whole process of the study have restored their faith in partnership particularly to some local government units (LGUs) who have shown seriousness in supporting the projects with tangible expressions.

The feasibility studies conducted validated the 14 villages' expressed needs and technical viability of the proposed community-based micro hydro power enterprises. There are 505 households that will benefit from direct household connections while a conservative estimate of 1,299 households that will benefit from post-harvest facilities (i.e. corn/rice mills), and irrigation from tailrace water of the micro-hydro projects.

An extract from a SIBAT report illustrates some of the longer term implementation challenges:



“The barangay has a 7 year old 2.7kW solar water pumping system, funded by AusAID and installed by the local government. However, this has recently stopped working and requires maintenance. The barangay does not have the skills or the money to fix it. There was no tariff collection for water usage, and therefore no available money to replace the batteries or the pump. Technology breaking down and having no maintenance systems in place is a common problem with large aid agencies and government projects. SIBAT works closely with communities to work out ownership and tariff systems, monitor projects and carry out maintenance.”

The dysfunctional 2.7kW solar water pumping system in Matarinao

Peace and Equity Foundation - Renewable Energy Programme

Peace and Equity Foundation is an independent, private, non-stock foundation, established in November 2001. It administers an endowment fund (at present, worth \$40M), with the interest earnings used to finance opportunities for poor communities in 29 priority provinces.

The Renewable Energy Programme builds economic, social and technological opportunities and the Foundation promotes renewable energy nationwide. Started in October 2006, the programme's main partners include: GEF-UNDP-DOE through the CBRED Microfinance Fund project. The purpose is to provide loan funds to civil society organisations (CSO) to finance small-scale renewable energy projects in off-grid communities.

The project's main challenges are:

- lack of access to efficient small-scale technology
- inability of the poor to afford the high upfront cost of RE technology
- lack of locally relevant productive applications
- absence of service providers: after sales service, replacement of parts, etc.
- absence of interested and capable CSO partners

The provision of renewable energy technology will directly result in tangible and measurable reductions of poverty in poor communities on any scale.

The Solar Lantern Lending scheme has involved seven CSO Partners and served 800 Households. The project is planned to outreach to 10,000 households, with the following main impacts:

- Better, cleaner, safer and efficient lighting systems
- Affordable sources of Home Lighting through monthly amortization at existing spending levels
- Provision of Safe Lighting Environment to Rural Homes
- Positive impact on education of children
- Positive impact on family economy
- Positive Health Impact due to Switch from Kerosene based Wick Lamps

The Peace and Equity Foundation will pro-actively develop and fund other renewable energy projects that utilize pico-hydro systems, biogas digesters and cook stoves.

Nepal

Foundation for Sustainable Technologies (FoST),



The fuel crisis is becoming a burning issue all over the world, no matter if people live in mountains, hills or plains, they need fuel for cooking food for the family. The majority of rural communities in Nepal use fire wood and other biomass products. Commercial fuels such as kerosene, LPGas and electricity are not only unaffordable but also inaccessible to them. Finding firewood to cook food is becoming more difficult as forests are not conserved and protected. Trees are cut for household use well before maturity. Due to these environmentally-unfriendly behaviours, communities are facing hardship in managing fuel for the household use. Forests are being depleting everywhere

contributing significantly to global greenhouse gas emissions.

In Nepal, women typically spend a day to collect a bunch of firewood about 20-30 kg. There is no other alternative energy source for them to substitute firewood for cooking. This scenario is found in many developing countries. However, all communities generate a lot of wastes at the household level which can be renewed and reused in several ways, and can be recycled to produce an efficient alternative energy source to substitute all types of traditional and commercial fuels. The Foundation named it "fuel briquettes", a nature-friendly alternative fuel made from household wastes, agricultural and forest residues, without charcoaling and polluting the environment.



Applying alternative and renewable energy sources in daily life reduces greenhouse gas emissions, minimizes environmental pollution, both indoor and outdoor, protects forests, reduces waste/garbage, prevents smoke-borne and water-borne diseases, and creates micro-enterprises to give more and more employment opportunities in urban and rural areas by reusing and recycling wastes to producing an efficient energy

source.

Lao PDR

Sunlabob Renewable Energy Ltd



company, and a training company.

Sunlabob Renewable Energy Ltd is a Lao commercial company, licensed since 2001, which operates as a profitable, full-service energy-provider selling hardware and providing commercially viable energy services for remote areas where the public electricity grid does not yet reach. The headquarters and base are in Vientiane, the capital of the Lao People's Democratic Republic. Sunlabob is a hardware company, an energy service

Sunlabob trains small rural entrepreneurs so they can install and service the technologies and run their business as a franchise. This ensures fast and reliable follow-up services.

Sunlabob is also a rental company, renting out systems at affordable rates to off-grid areas, and it is a brand for equipment uniquely suited for long term use in remote areas and with rental operations. Sunlabob believes that responsible, long-term oriented entrepreneurship is the driving force for sustainable economic development and for providing the managerial, technical, and financial resources needed to meet social and environmental challenges. With this core principle, Sunlabob can generate a profit as well as provide a service to the developing country of Laos. To this end, we have been committed since our inception to providing our solutions at affordable and competitive rates and devoted to finding new ways of providing energy to all.

Sunlabob is aiming to become the largest regional provider for commercially viable renewable energy solutions and for field-tested reliable equipment, packages, and products. Sunlabob will continue to be at the global cutting edge of exploring new concepts, new operational procedures, new ventures, and new systems that will benefit off-grid rural people. Sunlabob expands its concepts and operations through franchising partnerships with any company anywhere on the planet.

Sunlabob's achievements to date include:

- Since 2000, over 5,600 systems have been installed in over 450 villages and locations all over Laos.
- Public Private Partnerships formed with development agencies such as GTZ, DEG, and IFC.
- Expansion into village grids with hybrid renewable energy sources and has launched R&D efforts for solar pumping and biofuels.
- A rental service for energy systems that allows households and villages to afford electricity.
- Teamed with other Lao agencies to launch the [Lao Institute for Renewable Energy](#) (LIRE), a non-profit organization dedicated to the research and testing of viable technology for the Lao people.
- Key player for carbon-reducing concepts and has successfully entered the carbon trade market.

Climate change has become one of the most important issues facing the world today. Energy production from fossil fuels makes a significant contribution to this problem. In order to help customers become greener, and save themselves money, Sunlabob has announced a new energy efficiency service. Sunlabob can provide an energy efficiency audit service to homes and businesses, where an assessment is made of current energy use practices and advice offered on how energy use can be reduced. Sunlabob can also provide a wide range of products to make energy efficiency easier.

Programme summaries:

Hybrid Village Grids for remote areas – an affordable alternative for rural electrification in Laos. Sunlabob provides energy systems that run on multiple renewable sources: sun, water, wind, and

biomass. Within the hybrid system, these resources are combined and fed into the same village grid. The HVG utilizes solar energy – which is always available during the day time – and generators as back-up systems when water flow levels are low at different points in the year. This combination helps to go beyond improving living conditions and moves toward increasing income.

Rental Systems. A large number of villages in the Lao PDR will not be hooked up to the grid for many years to come. Their only resource of electricity will be decentralized small systems, i.e. solar systems or micro-hydro, but these require high initial investments and continual servicing, which makes them not affordable to many villagers. Moreover, there is a lack of long-term credit available in Laos.

Sunlabob offers rental services for energy systems to overcome these problems, by buying equipment and installing it, renting out energy systems, and paying back the investment.

Solar Community Systems (SCS) can be for either public or private purposes.

Public purpose systems include, for instance, lighting for schoolrooms, healthposts, etc. They must be funded through public mechanisms of the community. Private purpose systems involve various persons sharing a system for their own private benefit, such as a farmers group using solar pumps for a drip-irrigation system or a processing group operating a sterilizer or cooler. The groups finance such systems collectively. Sunlabob has several years of experience in installing Solar Community Systems.

Solar Powered Water Pumps. The solar water pump system provides a reliable and long-lasting technique, which is more cost-efficient than normal diesel water pumps. As the solar-powered water pumps run on a renewable energy source, the future cost can be better calculated, as opposed to insecure standard fuel prices. In addition, they cause fewer problems with noise, dirt, and fumes, so emissions can be reduced and they contribute to ecological sustainability as well. Low maintenance and an easy-handling technique are further advantages of this energy solution, and make the solar water pumps an affordable replacement for fuel-burning engines, windmills and hand pumps.

Solar-rechargeable lamps. The households with the least income cannot afford to rent the Solar Home Systems. Nevertheless, they would very much prefer electric light to the petrol lamps and candles they generally use. Lower-income households have persistently requested cheaper solutions for basic lighting. After some research, the solution is battery-charging stations for rechargeable lamps, which local operators rent. This allows Sunlabob to expand the accessibility of solar lighting to the large number of lower-income households, while at the same time retaining all the proven advantages of a rental service for the villagers.

Two completed case studies:

Ban Sorg: Pilot village for home solar rental system. In Laos, nearly three quarters of the population live in the countryside in remote areas without access to public infrastructure, which means that access to roads is difficult and they are not connected to grid-electricity. Despite the fact that the villagers are very much aware of the importance of electricity for their livelihood, their only opportunity to access energy is via independent decentralized systems, i.e. solar panels. However, solar lighting has some problems for benefiting poor rural households: Initial costs are beyond the reach for most people, the servicing has to be assured over many years, and, in Laos, the lack of long term credit does not allow villagers to invest.

Nam Kha: Pilot for Hybrid village grids (HVGs) A large number of villages in Lao PDR will not be connected to the main grid for many years to come. Small village grids fed by decentralized local energy sources are an option to be explored and developed to overcome this lack of energy supply. In some places it is feasible to consider hydro-electric solutions. During the dry season, in most areas, stream flows are considerably reduced. Hence, a feasible small grid has to be boosted with solar energy or a diesel generator. (In the future, after the commercial viability of its use is proven, Sunlabob is planning to substitute the diesel with biofuel made from *Jatropha*. At the moment the partner LIRE is researching about the effectiveness of the *Jatropha*-seed-oil.) In view of the government's policy for decentralized energy production in remote areas, and in view of repeated requests by villages and district and provincial authorities, Sunlabob has looked into the possibilities of small hydro-power generation and the operation of village grids. With regard to the national grid, the village grids themselves may also act as "systems-fringe boosters", with their generators remaining operational in order to ensure voltage at the outer reaches of the grid.

Indonesia

PT Gikoko Kogyo



PT Gikoko Kogyo is working with UNDP Global Sustainable Business programme to develop an innovative biogas cooking, heating and water sanitisation service company using fossil fuel displacement methodology to claim Clean Development Mechanism (CDM) status. Implemented in a village in East Java with 7,000 residents and 14,000 cows, Gikoko proposes to establish an Energy Service Company Cooperative (ESCOC) with the local stakeholders to invest in a low cost bio-digester to harvest the methane gas from converting manure into renewable sources of energy for community use. The project developers have experience of developing commercial scale

CDM small scale cooking heat, clean water and later electricity generation projects.

Diary farmers and the poor community in East Java lack adequate animal manure waste management systems and access to clean water, vital for health and productivity of both people and the cows.

A private enterprise with experience in investment in Public Private Partnerships in Municipal Solid Waste management and methane abatement projects proposes to establish a special purpose renewable energy services company cooperation with local government and community stakeholders and the UN Development Programme to make the delivery of basic services happen and reduce risks of waterborne disease. The UNDP Millennium Development Goal fund or the Asian Development Bank's Asia Pacific Carbon Funds are the potential buyers.

The challenges are to ensure a financially viable business model that will generate an adequate return for the technology investment and CDM registration-related costs, while selling affordable cooking heat for the poor. A generally low financial Internal Rate of Return results due to relatively small carbon emission reduction potential and the geographically dispersed diary farms and the poor community.

The technologies required are ground water pumps and water sanitation systems utilizing flare heat, animal manure waste digestion and biogas generation systems, suitable low cost manure delivery systems that would provide much needed work for Greenhouse Gas Reduction flares and monitoring systems and post digestion compost delivery systems.

Opportunities exist for using CDM finance where carbon offset buyers may utilize the offset purchase agreement as collateral and international lending institutions may monetize the Emission Reduction Purchase Agreement to make interest free loans for technology investment and CDM registration related costs. Microfinance institutions may lend to the members of the Cooperatives to be equity owners of the ESCOP and individual for food making enterprise utilizing the cooking heat and water.

Animal waste problems exist in many rural areas of Indonesia and elsewhere in the region. The newly approved CDM Programme of Activity (PoA) enables many discrete projects to be identified and added on for projects of similar model and methodologies used. PoA should lead to benefits of scale and economy for replication of the proposed business models.

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TERI, India

Ms. Akanshya Chaurey - Associate Director, Distributed Generation & Rural Electrification, Energy Environment Technology Division. Lighting a Billion Lives Campaign

Pacific Islands Greenhouse Gas Abatement through Renewable Energy Project PIGGAREP).

The PIGGAREP project covers the Pacific Island Countries, which consists of the Cook Islands, Fiji, Kiribati, Nauru, Niue, Papua New Guinea, Samoa, Solomon Island, Tonga, Tuvalu and Vanuatu. This project is aimed at reducing the growth rate of GHG emissions from fossil fuel use in the Pacific Island Countries (PICs) through the widespread and cost effective use of their renewable energy (RE) resources. It consists of various activities whose outputs will contribute to the removal of the major barriers to the widespread utilization of RE technologies (RETs). The project is expected to bring about in the PICs: (1) Increased number of successful commercial RE applications; (2) Expanded market for RET applications; (3) Enhanced institutional capacity to design, implement and monitor RE projects; (4) Availability and accessibility of financing to existing and new RE projects; (5) Strengthened legal and regulatory structures in the energy and environmental sectors; and, (6) Increased awareness and knowledge on RE and RETs among key stakeholders. The PNG Sustainable Energy Ltd (PNGSEL) and ATCDI has submitted over 15 RE projects to PIGGAREP for co-financing. PIGGAREP will co-finance non-hardware components. ATCDI is currently sourcing funding to co-finance its 12 projects.

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| Weekly | Carbon Info Service | Reuters International | www.reutersinteractive.com | International |
| Weekly | Renewable Energy Info Service | Renewable Energy World | www.RenewableEnergyWorld.com | International |
| Weekly | Clean Tech News Service | CleanTech Group USA) | www.media.cleantech.com | International |
| Weekly | Clean Tech News Service | Clean Tech Forum | www.cleantechforum.com | India |
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9. Acronyms and Abbreviations

| ACRONYM | Full Name |
|-------------------|--|
| AAU | Assigned Amount Units |
| ADB | African Development Bank |
| ANZ | Australian and New Zealand Banking Group |
| AU | African Union |
| BAAC | Bank for Agriculture and Agricultural Co-operatives |
| BIPV | Building Integrated Photo Voltaics |
| CASBEE | Comprehensive Assessment System for Building Environment Efficiency |
| CDM | Clean Development Mechanism |
| CEPALCO | Cagayan Electric Power and Light Company |
| CER | Certified Emission Reductions |
| CII | Confederation of Indian Industry |
| CME | coconut methyl ester |
| CNAEC | China National Association of Engineering Consultants |
| CNG | compressed natural gas |
| CNOOC | China National Offshore Oil Corporation |
| CNY | Chinese Yuan |
| CO ₂ e | Equivalent carbon dioxide |
| COMET | Commercialising Emerging Technologies |
| DBSA | Development Bank of Southern Africa |
| DCC | Department of Climate Change |
| DEDE | Department of Alternative Energy Development and Efficiency (Thailand) |
| DEDP | Department of Energy Development and Promotion (Thailand) |
| DEG | Deutsche Investitions- und Entwicklungsgesellschaft |
| DENR | Department of Environment and Natural Resources (Philippines) |
| DEWHA | Department of the Environment, Water, Heritage and the Arts |
| DFAT | Department of Foreign Affairs |
| DIISR | Department of Innovation, Industry, Science and Research |
| DME | Department of Minerals and Energy (South Africa) |
| DNA | designated national authority |
| DOE | Department of Energy |
| DOE | designating operational entities (Kyoto Protocol) |
| DRET | Department of Resources, Energy and Tourism |
| EB | Executive Board |
| E+Co | Energy and enterprise |
| EC | European Commission |
| ECBC | Energy Conservation Building Code |
| ECC | Energy Conservation Center |
| EDC | Energy Development Corporation |
| EE | Energy Efficiency |
| EEB | Energy-Efficient Building |
| EEX | Energy Efficiency Exchange |
| EGAT | Electricity Generating Authority of Thailand |
| EIA | Energy Information Administration |
| EIT | economies in transition |
| EMDG | Export Market Development Grants |
| ENCON | Energy Conservation Promotion Fund |
| EPPO | Energy Policy and Planning Office (Thailand) |
| ERPA | Emission Reduction Purchase Agreement |
| EU-ETS | European Union Emissions Trading Scheme |
| EVN | Electricity of Vietnam |
| FDC | Foundation for Development Cooperation |
| FFB | fresh fruit bunches |
| FMO | Netherlands Development Finance Company |
| GDP | Gross Domestic Product |
| GEF | Global Environment Facility |
| GGAS | NSW Greenhouse Gas Abatement Scheme |
| GGRE | GreenGold Ray Energies |

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| GHG | Greenhouse Gasses |
| GOBAS | Green Olympic Building Assessment System |
| HCF | Hydrofluorocarbon |
| HSBC | Hongkong and Shanghai Banking Corporation |
| HVAC | Heating, Ventilation and Air Conditioning |
| IEA | International Energy Agency |
| IETA | International Emissions Trading Association |
| IGBC | Indian Green Building Council |
| IGES | Institute of Global Environment and Society |
| IISD | International Institute for Sustainable Development |
| IPP | Independent Power Producer |
| ISP | Institute for Sustainable Power |
| JBIC | Japan Bank for International Cooperation |
| JI | Joint implementation |
| KVA | Kilo Volt-Ampere |
| KfW | Kreditanstalt für Wiederaufbau, (<i>Reconstruction Credit Institute</i>) |
| kW | kilowatt |
| kWh | kilo Watt hour |
| kWp | kilo watt, peak |
| LEED | Leadership in Energy and Environmental Design |
| LEO | Low Energy Office |
| LETA | Low Emission Technology and Abatement |
| LETDF | Low Emission Technology Demonstration Fund |
| MEMR | Ministry of Environment and Mineral Resources |
| MHURC | Ministry of Housing and Urban-Rural Construction (China) |
| MMBFOE | Million Barrels of Fuel Oil Equivalent |
| MNRE | Ministry of New and Renewable Energy (India) |
| MOC | Ministry of Construction (China) |
| MOI | Ministry of Industry (Philippines) |
| MSW | municipal solid waste |
| MW | megawatt |
| NDRC | National Development and Reform Commission |
| NEPAD | New Partnership for Africa's Development |
| NFEE | National Framework for Energy Efficiency |
| NPC | National Power Corporation |
| NT2 | Nam Theun 2 Hydropower Project |
| O&M | Operation and Maintenance |
| ODA | Official Development Assistance |
| PDD | project design document |
| PDR | People's Democratic Republic |
| PEA | Provincial Electricity Authority |
| PLN | Perusahaan Listrik Negara (state electric company of Indonesia) |
| PNOC | Philippine National Oil Company |
| POME | palm oil manufacturing effluent |
| PV | photovoltaic |
| PV-GAP | Global Approval Program for Photovoltaics |
| PVRP | Photovoltaic Rebate Program |
| R&D | Research and Development |
| RE | Renewable Energy |
| REAP | Renewable Energy Action Plan |
| REC | Renewable Energy Certificates |
| REEEP | Renewable Energy and Energy Efficiency Partnership |
| REEF | Renewable Energy Equity Fund |
| ReEx | ReEx Capital Asia (previously known as the Renewable Energy Exchange) |
| REF | Renewable Energy Fund |
| REI | Reykjavik Energy Invest |
| REPP | Renewable Energy Power Program |
| RERA | Regional Electricity Regulators Association |
| RPS | Renewable Portfolio Standard |
| RRPGP | Renewable Remote Power Generation Programme |
| SADC | Southern African Development Community |
| SANERI | South African National Energy Research Institute |
| SAPP | Southern African Power Pool |

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| SB08 | World Sustainable Building Conference series – Melbourne 2008 |
| SHPDA | Small Hydropower Development Authority |
| SPEP | Small Renewable Energy Program |
| SPP | small power producer |
| SWH | Solar Water Heating |
| TNB | Tenaga Nasional Bhd |
| TREC | Tradable Renewable Energy Certificate |
| UNDP | United Nations Development Programme |
| UNEP | United Nations Environment Programme |
| UNFCCC | United Nations Framework Convention on Climate Change |
| UNSW | University of New South Wales, Sydney, Australia |
| VSP | very small power producer |
| VOC | Volatile Organic Compounds |
| WIREC | Washington International Renewable Energy Conference |
| ZEO | Zero Energy Office |