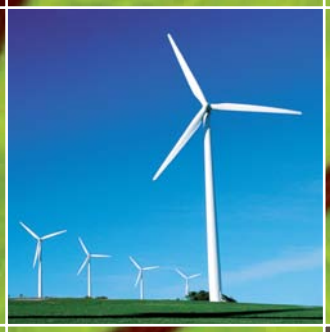

Regional Export Opportunities for Australia's Clean Energy Industry

Summary Report
August 2008

reeep
renewable energy & energy efficiency partnership

Prepared by: Renewable Energy and Energy Efficiency Partnership (REEEP) and Clean Energy Council, Australia

Clean Energy Council

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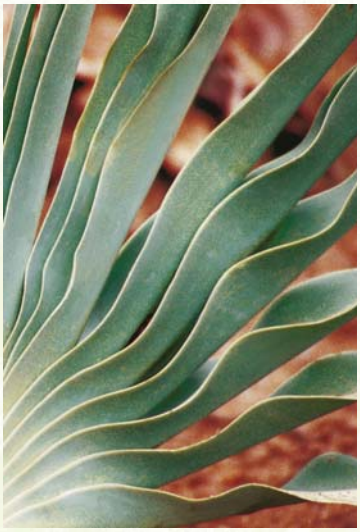
1.0 Executive Summary



1 EXECUTIVE SUMMARY

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 greenhouse gas (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 International Energy Agency (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 full report, which is summarised in this document, confirms the opportunities for commercial export 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 credits 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.

The full Regional Export Opportunities for Australia's Clean Energy Industry report is available on-line at http://www.cleanenergycouncil.org.au/exportops/.

2.0 Regional Assessment of Market Potential and Project Opportunities

2 REGIONAL ASSESSMENT OF MARKET POTENTIAL AND PROJECT OPPORTUNITIES

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 region.

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. India has made significant progress in the expansion of its clean energy activities, and other markets throughout Asia are moving more slowly, but no less determinedly, to utilise domestic energy resources.

Financing still remains a key issue. While local banks have 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. In parallel with these institutions, support is available from development banks and their private sector arms. Many of these groups are also showing increased interest in providing equity or quasi-equity. Export credit agencies, historically more focused on significant inward investments, will also consider the smaller scale typical of clean energy developments.

Sourcing equity is still more of a challenge than for other sectors, but a number of specialist funds and new entrants are offering increasing support to the market. The more traditional private equity houses and a number of insurance groups are making direct investments from dedicated pools of internal funds. This is all being led by the enormous quantity of funds made available via the carbon market through multilateral bank initiatives and private groups, reflecting the growth of the Kyoto Protocol's Clean Development Mechanisms (CDM).

What is very clear, however, is the continued immaturity of the renewable energy and energy efficiency markets, particularly where developers are concerned. 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.

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. 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.

2.1 CHINA

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.

In 2006, a Renewable Energy Law was enacted. 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 China

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.

The decrees governing issuance of the licenses for foreign service companies in construction, engineering design and urban planning have been considered trade barriers by some. They set requirements for capital registration, professional qualifications and the level of foreign professional staff. Such 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.

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 so the longer term goal of energy savings is not a priority for developers. At the higher end of the market, green certification 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.

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.

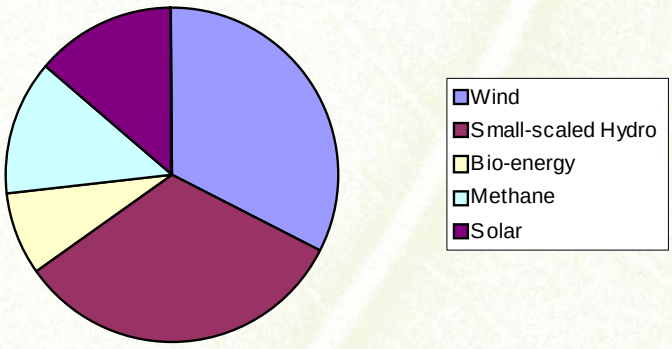


Figure 1: Renewable energy investment in 2007 in China

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.

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, Xinjiang, and the Hexi Corridor in Gansu; and the north-east and regions on the Tibetan Plateau. As wind generation costs are relatively competitive, wind resources in China present great potential for development. 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 and it is anticipated will reach a total installed wind power capacity of 5 million kW by 2010 and 30 million kW by 2020.

Special concessions for wind generation projects are an important factor for promoting large-scale development of wind power in China. 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. 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 ongoing opportunities for foreign inputs. 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 recognised manufacturing enterprises have come into being. 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. 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.

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.

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. Government promotion and policy since 2000 has also encouraged medium and large-scale methane projects in situations such as livestock and poultry farms, food processing, wine factories and urban sewage treatment plants.

Besides methane, application of technology for other bio-energy is still in the initial stages. 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-scale hydroelectric resources with great potential for development nationwide. China has strong capabilities and experience in hydro power development and aims to lift the total hydro power capacity to 300,000 MW by the end of 2020, from around 129,000 MW at the end of 2006.

GREEN BUILDING AND ENERGY EFFICIENCY IN CHINA

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. While efforts are underway to cut energy consumption per unit of gross domestic product (GDP) by 20 %, the consumption actually fell by just 1.23 % 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. 25% of the buildings in medium-sized cities and 10% of those in small cities are to be refurbished by 2020.

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 underdeveloped. Foreign consultancy companies find opportunities in more prestigious projects and multilateral or bilateral donor financed projects.

2.2 INDIA

The construction industry in India is growing rapidly and represents 10% of India's GDP.

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. Advisory services provided by the Centre to assist green building developers have also made a significant 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 across all sectors. 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. 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.

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 is an extensive regulatory and policy environment underwriting the promotion of green buildings and a large number of organisations actively engaged in promoting and supporting this sector.

2.3 INDONESIA

Primary energy demand is projected to grow at an annual rate of 2.7 % to reach some 360 Mtoe in 2030. Indonesia is currently a net energy exporter but is at the turning point of becoming a net energy importer. To secure energy supply Indonesia needs to address both demand and supply side issues.

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

Many of the problems the country faces have resulted from the policy of subsidising 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 % 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 programmes for energy conservation and energy diversification. Rural electrification programmes 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.

Renewable energy development in Indonesia is being encouraged by national targets for an optimal energy mix in 2025 that should see some 15% of energy being provided from biofuel, geothermal and other renewables.

Under a 2007 Presidential Instruction, a road map for biofuel aims to develop pro-growth, pro-poor, and pro-job biofuel projects in Indonesia. Investment in biofuel projects is seen as providing a sustainable source of energy supply, while helping to alleviate poverty and support national development. The envisaged approach underscores the need for a multi-sectoral approach and specifies the roles of eleven ministries in biofuel development.

ELECTRICITY LAW

The financial viability of the Indonesian state electricity firm, PLN, was severely damaged by the 1997 economic crisis. Efforts to restructure the electricity sector were initiated in 1998 to separate the commercial, social, and regulatory functions of PLN. The resulting law passed in 2002 allowed private investors to sell power to PLN while it retained control of the transmission and distribution systems. With the liberalisation 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 decentralisation 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

While the movement away from subsidies heightens the attractiveness of investments in energy efficiency and higher prices for electricity and fuels naturally drive consumers toward more efficient energy use, energy efficiency opportunities have received relatively little attention from government planners. The target to reduce energy intensity by 1 % 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. There have been recent steps to remove fuel subsidies.

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

Hydro Electricity. There are limited significant hydro electricity resources in Indonesia. Recent announcements (August 2007) note the planned development of two hydroelectric plants, in Papua and 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.

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 include those that have been influencing geothermal prospects in Indonesia for many years. These relate to the costs of developing relatively remote resources, an inability to compete with subsidised fossil-based generation and poorly structured regulations. There has however been increasing activity with extensions to existing plants and Indonesia's state-owned oil and gas company, Pertamina, announced it will build three geothermal power plants with a total capacity of 1,060 megawatts, but no timeline for development was made public. In 2007, Indonesian officials announced plans to tender seven additional geothermal areas that would generate around 575 megawatts of electricity.

Solar PV. 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 programmeme to address this with GEF (Global Environment Facility) support floundered when the Asian financial crisis hit Indonesia. The underlying problem is that Indonesian banks and credit providers seek very high levels of collateral to cover borrowings.

Biomass. Biomass provides part of the informal energy delivery as in many countries within the region. It is not, however, reported on widely. Opportunities are recognised for the use of rice husk and waste fruit bunches (from palm oil production) as fuel sources.

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.

Biofuels. Over the period 2005-2010, the Government is seeking a 2 % 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 % of diesel consumption. For bioethanol, the Government plans to introduce a 10 % blend with gasoline using molasses and starch. It is expected that gasoline consumption will be reduced by 3 % by 2011-2015 and by 5 % 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.

2.4 MALAYSIA

Malaysia's primary energy demand is projected to grow at 3.5 % per year until 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 % per year through 2030. Indigenous oil reserves are projected to be depleted by 2030, thus shifting the economy to a net import dependency of some 32 % in 2030 from a net export position of 57 % 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

The country's peak electricity demand is expected to increase to some 20,000 MW by 2010 of which only 350 megawatt (MW) is expected to come from renewable energy. Although the Malaysian government set a target of renewable energy providing 5% of electricity generation by 2005, equal to between 500 and 600 MW of installed capacity this has not been achieved. The policy has been reinforced by fiscal incentives such as investment tax allowances and the Small Renewable Energy Program (SREP), to encourage the connection of small renewable power generation plants to the national grid. To date, though a number of projects have been registered, their total capacity still falls well below the 2005 target. The focus has been predominantly on biomass (typically waste from palm oil production) and the government continues to offer a range of incentives to encourage activity in this market.

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.

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.

RENEWABLE ENERGY

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. 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.

Under a UNDP GEF programme there has been a focus on BIPV. 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.

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.

Hydro Electric Energy. Malaysia's technically feasible hydro power 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.

2.5 PHILIPPINES

The Philippines' primary energy demand is projected to more than double to 111Mtoe in 2030 buoyed mainly by high growth in the demand for petroleum products in the transport sector. The economy will remain a net energy importer despite efforts to expand the energy resource supply base with renewable energy technologies and alternative fuels. It is estimated that 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 generating capacity stood at some 16,000 MW: 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 % of the total 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. A 2006 update sets a target to achieve a 60 % self-sufficiency level by 2010. The goals indicate a preference for clean and renewable energy sources.

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. There is a 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 institutionalise a system loss reduction programme 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 utilisation 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.

There are laws and regulations providing the policy and regulatory framework for the development of specific renewable energy resources, in particular geothermal, mini-hydro and ocean, solar and wind developments.

Large Hydro Power. The abundance of water resources makes hydro power 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, hydro power contributed 18% of the country's electricity requirements, and some 61 hydro power projects with a total potential capacity of 2,300MW have been identified for development.

Small Hydro Power. Estimates suggest the potential for small hydro schemes is of the order of 1300 MW but so far only 90 MW has been installed from some 51 mini hydro power facilities.

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. In addition, the Mini-hydroelectric Power Incentive Act, creates special tax and commercial incentives and privileges, provided there is at least 60% Filipino ownership.

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. Exclusive incentives exist for geothermal contractors under 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 800 MW of additional capacity from 21 indicative geothermal power projects.

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 and the interior of Luzon, Mindoro, Samar, Leyte, Panay, Negros, Cebu, and Palawan where land is higher.

A 25 MW Wind Farm was inaugurated 2005 at Bangui Bay, Ilocos Norte. This project is also the first in the Philippines to have an Emissions Reduction Purchase Agreement (ERPA) under the Clean Development Mechanism.

Some 345 MW of capacity from 16 additional wind power sites is expected to be added between 2008 and 2010. Pre-commercialisation 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.

Solar PV. The Philippines has one of the longest histories with PV systems in Asia (outside Indonesia). The majority of its programmes have been aid-driven, with mixed results. Many of the programmes 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).

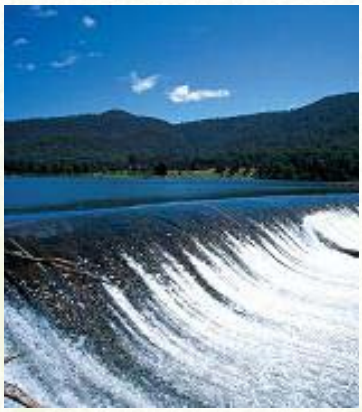
The US$300 million Sunpower Solar Wafer Fabrication plant in Sta. Rosa Laguna is expected to supply about 6 % of the world market for PV cells – 20 % of which will be sold to the local market at a discount to encourage the establishment of a downstream solar industry in the country.

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.

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.

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.

Biofuels. Early in 2007 a Philippine Congress Act launched the Philippines' Biofuels Program to reduce dependence on imported fuels. Within two years, gasoline is to have a 5% bioethanol content which is to be increased to 10% in four year's time. The law also mandates an immediate 1% biodiesel blend for all diesel engine fuels with the blend increasing to 2% in two years time. 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.



2.6 THAILAND

Thailand's primary energy demand is projected to grow at 4.6 % annually over the next 25 years, mainly from increased demand for oil in the transport and industrial sectors.

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.

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.

CLEAN ENERGY REGULATORY FRAMEWORK

Since 1992, the Thai Government has issued numerous laws and decrees to promote and support energy efficiency programmes. The ENCON Act was considered a major step for Thailand in the promotion and implementation of energy efficiency (EE) and renewable energy programmes. 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 programmes.

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) programmes. As of September 2006, the total installed capacity of IPPs was 3,136 MW (approximately 15 % of total capacity).

RENEWABLE ENERGY

The Thai Government has also been trying to promote the utilisation of renewable energy as another means to diversify energy sources. It aims to establish a 3-5 % Renewable Portfolio Standard (RPS) for all new generating capacity installed. 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.

While widespread diffusion of renewable resources has been hampered by their high cost relative to other energy sources and the limitation of available renewable resources, especially biomass, higher purchase prices for electricity sold to the national grid from renewable energy facilities and investment subsidies have meant that by the end of 2007 proposals had been received from 265 renewable energy projects that should produce 1,716 MW of power. 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. A number of wind farm proposals are anticipated in the near future.

Wind Energy. 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, the constraints of specific financing, distance from the grid, poor wind data and limited local technology are limiting wind energy development.

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.

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.

Hydro. Thailand's estimated hydro power 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. This activity is directed into rural villages and installations are reported to be limited and insufficient to build a strong local manufacturing capability.

Thailand is however anticipating interconnection to the Nam Theun 2 Hydropower Project being constructed in Laos and due to begin operation in 2010 providing approximately 5636 GWh of generation annually.

Biomass. 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.

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 programme 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 % of petroleum-based diesel by 2012.

Thailand has established a significant ethanol industry producing some 1.3 million litres per day 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.

2.7 VIETNAM

Vietnam's primary energy demand is projected to grow to 142 Mtoe in 2030, as a result of industrialisation of the economy. The country is expected to become a net energy importing economy beyond 2020; with the energy import dependency projected to reach 15 % 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 % 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 urbanisation spreads. The combined contribution of renewables, including large hydro and geothermal plants, in the total primary energy supply will fall to around 22 % in 2030. Despite this, energy supply from renewables other than biomass (wind, solar PV, geothermal, waste-to-energy, and hydro power) is expected to increase. Hydro power production, in particular, is projected to grow by 4.9 % 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 a number of key elements aimed at ensuring adequate, stable and long-term energy supplies for development; encouraging the economical and efficient use; developing new and renewable energy resources, such as small hydro, wind power, solar energy, and geothermal and promoting rural energy with the target of providing access for all by 2010.

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 % to 5 % in total energy consumption in 2006-2010 and from 5 % to 8 % 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 and is expected to take effect in 2009.

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. 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.

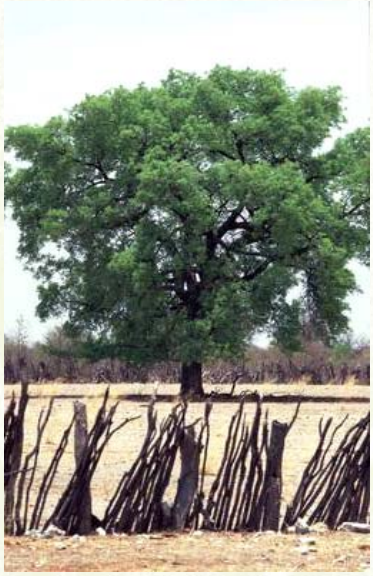
Over 50% of Vietnamese people live without electric power and only some can be expected to be electrified via the national grid. There exists, therefore, a considerable potential role for hydro electricity, biomass and solar power. This includes both grid-connection of the larger renewable energy systems,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

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. There have been a number of initiatives to utilise PV for rural electrification.

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 there are a number of modest bilateral programmes looking to develop provincial solar power initiatives. A recent announcement suggests that a 3MWp plant is to be built to assemble imported French and German panels near Ho Chi Minh City and that this will expand to 5MWp production in its second stage.

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 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 hydro electricity.



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. 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.

Hydro Power. In 2003 hydroelectric power in Vietnam provided 50% of the nation's total electrical capacity of 6,000 MW. Current developments include nearly 4,000 MW of large-scale hydro (the largest Son La will be some 2,400MW in capacity) and additional plants are also understood to be under consideration, financed by the government or international assistance programmes.

There are also grid-connected mini-hydro systems that generate about 60 MW of power, from 48 distinct systems ranging from 100 kW to more than 7.5 MW and 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 1,000 Watts.

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 in capacity. It is estimated that investments in this least-cost remote power source could reach US$20 million over a five-year period.

3.0 Carbon - The Kyoto Protocol, Flexible Mechanisms, Voluntary Markets

3 CARBON – THE KYOTO PROTOCOL, FLEXIBLE MECHANISMS, VOLUNTARY MARKETS

Integral to the evolution of the clean energy market, and a growing influence on decisions around the financing of projects, the carbon market is playing an increasingly important role. What follows seeks to provide a brief introduction to the Kyoto Protocol and how credits generated through project activities can be traded. In parallel with this market there is growing activity in the "voluntary" carbon market for activities that fall outside those covered by Kyoto, as outlined in the next section.

3.1 THE KYOTO PROTOCOL

The 1992 United Nations Framework Convention on Climate Change (UNFCCC) is an international convention which has the objective of stabilising levels of greenhouse gasses (GHGs)[1] in the atmosphere at a level that prevents dangerous interference with the climate system. 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, the Protocol's 'first commitment period'.

3.2 THE CLEAN DEVELOPMENT MECHANISM

The Kyoto Protocol allows industrialised countries with targets to meet part of their commitments through three so-called 'flexible mechanisms' and it is these systems that are of increasing interest to commercial entities participating in the regional clean energy markets, in particular access to credits through the Clean Development Mechanism (CDM).

The CDM enables developing countries to attract investment for projects involving clean energy and other measures that reduce or sequester greenhouse gas emissions and that contribute to the sustainable development of the host developing country by promoting the transfer of less carbon-intensive technologies and encouraging international investment.[2] Under the CDM, valid reductions in emissions

[1] Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (NOx), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).

[2] 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

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.[3] The rationale for this is that emissions reductions anywhere on the planet provide an equivalent benefit in mitigating climate change. Furthermore, 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 basic requirements that seek to ensure that they provide real and measureable emission reductions, satisfy the additionality criteria and do not result in the diversion of existing development assistance resources. Credits taken from any such projects must also be supplemental to those generated by the recipient countries domestic actions. Domestic action is required to constitute a significant effort in Annex 1 countries - the EU-15, which have 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.[4]

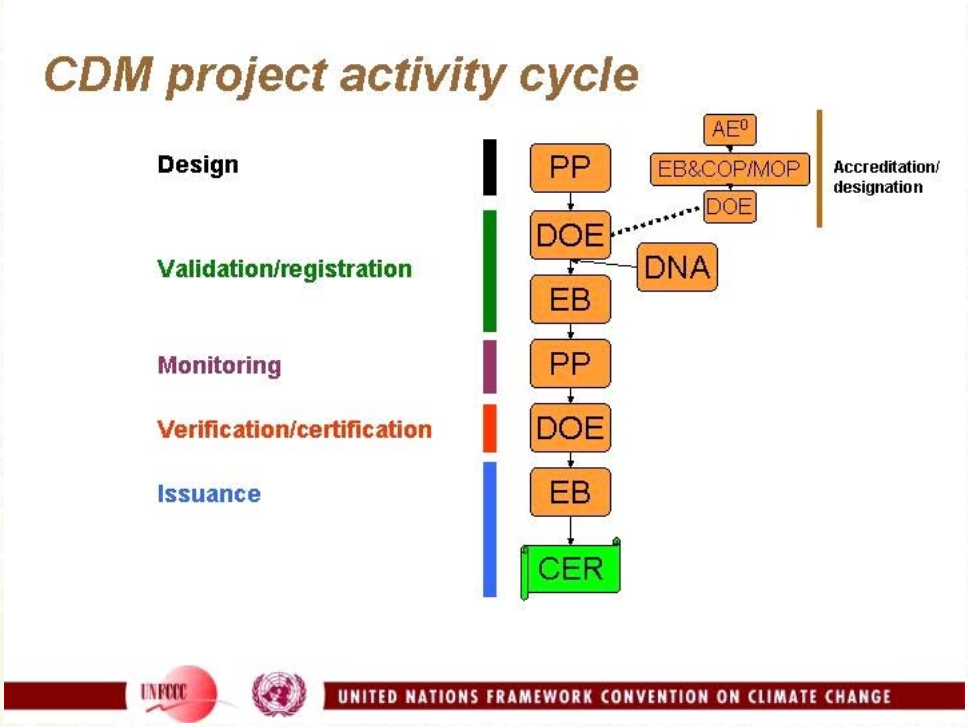
It is anticipated that during the first commitment period over 2.5 billion CERs will be issued for more than 3000 CDM projects.[5] This suggests that the CDM is an effective tool to mobilise large quantities of private and public investment for developing countries, to promote the transfer of low carbon technologies and to enable them to shift to a less carbon intensive economy.

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.[6]

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 Executive Board (EB).[7]

[3] Article 12(2) Kyoto Protocol
[4] 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
[5] see UNEP RISOE CDM Pipeline at www.cd4cdm.org
[6] 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.
[7] 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



Access to and utilisation of credits generated through these mechanisms is overseen by the CDM Executive Board (EB) through which all projects must be registered. 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.

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.[8]

[8] http://cdm.unfccc.int/DOE/list/index.html

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.[9] 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.

3.3 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.[10]

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.[11] 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.

[9] see www.cdm.unfccc.int
[10] The World Bank (May 2007) *State and Trends of the Carbon Market 2007* at p.8 hereinafter World Bank 2007
[11] World Bank 2007 at p.8

A review of the value of CDM in the international carbon market and the price for credits generated through such schemes demonstrates that there is a substantial market (over US$64 billion in 2007) and that the price for CERs has remained relatively stable and that there will be a significant demand for CERs through until 2012 given the obligations under Kyoto.

While the EU governments continue to dominate the market, having purchased some 33% of the assets available under the flexible mechanisms, Japan is a very significant single country player in the market.

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 Joint Implementation (JI) will continue and possible modifications to the rules that govern their use.

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.

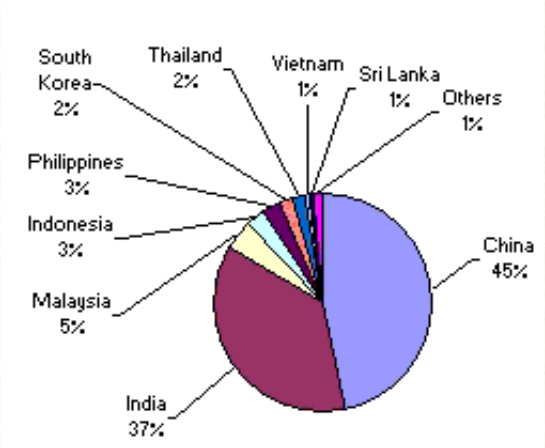
The potential size of the carbon market will ultimately be dependent upon the level of ambition agreed to by the international community to reduce GHG emissions. Within the Ad-Hoc Working Group (AWG), which is only addressing Annex I emissions, a range of reductions of between 25%-40% below 1990 levels 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.[12]

3.4 EXPERIENCE WITH RE/EE CDM IN ASIA

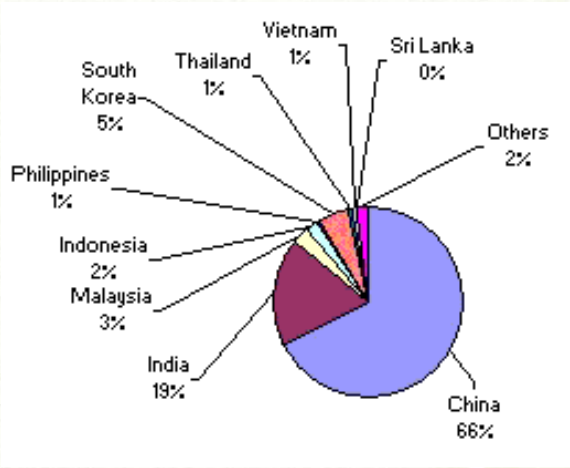
The following figures show the breakdown of CDM projects in the Asia Pacific Region. As has already been noted, China and India attract the largest share of CDM investments. However, other Asian countries are becoming more involved in projects, in particular the Republic of Korea, Indonesia, the Philippines,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

[12] Decision 1/CP 13 contained in FCCC/CP/2007/6/Add.1 at p.3

Percentage of CDM Projects



Volume of CERs generated by 2012



Source: UNEP/RISOE April 2008

Figure 2: CDM projects in the Asia Pacific region

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 (hydrochlorofluorocarbons). 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.[13] China has a very well organised DNA and clear processes for approval, operation and management of CDM projects.

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.

[13] IGES *CDM Country Fact Sheet: China* (March 2008) p.5

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.[14] 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.[15]

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.[16]

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 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.[17]

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 more than 10 project activities in each of the Philippines, the Republic of Korea, Malaysia and Indonesia and 5 project activities in Thailand.[18] Other countries in the region are becoming involved in the CDM and have developed one or two projects each with the emphasis in the renewable sector.

[14] IGES *CDM Country Fact Sheet: India* (March 2008) p.6
[15] BMU 2007 at p.16
[16] Nitu Goel, TERI, presentation to the Asia-Pacific Consultations for the Gleneagles Dialogue, 18-19 July 2007.
[17] IGES *CDM Country Fact Sheet: India* (March 2008) p.7
[18] See UNFCCC CDM project statistics and IGES Country Studies for Indonesia, Thailand, The Philippines,

To date, only 2 DNAs have been fully established in Pacific Island countries 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 generating operations. Both of these projects involved Australian companies.

3.5 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. Not surprisingly, the greatest demand for credits from voluntary market sources is from North America (34%) and Europe (47%).[19] 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% and a move from the traditional forestry based projects with renewable and energy efficiency projects taking a more prominent role.

The main buyers in the voluntary market are businesses that are seeking to fulfil obligations related to their corporate social responsibility (CSR) policies. 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.[20]

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.

The flip side of less regulation is that the price of credits in the voluntary market tends to be lower than in the regulated markets.

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.

In 2007, the Global Sustainability team at RMIT Melbourne 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

[19] *State of the Voluntary Carbon Market 2008* at p.9
[20] 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

credits generated, certification standards used, prices and buyers. Whilst most of the companies are involved in carbon sequestration through native and plantation tree planting, some are engaged in RE and EE projects.

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.

4.0 Australia's Market Capacities and Opportunities for Export

4 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.

4.1 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.

4.2 AUSTRALIA'S ENERGY EFFICIENCY MARKET AND INDUSTRY CAPABILITY

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

This Guide looks at Australia's performance to date, the capability of the industry, and current government strategies and programmes.

4.3 PURSUING RENEWABLE ENERGY BUSINESS WITH CHINA

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

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.

5.0 Australian Government Initiatives

5 AUSTRALIAN GOVERNMENT INITIATIVES

The new Federal Labour 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 programmes 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 programmes to assist the growth of the Australian clean energy industry and maximise opportunities for Australia in the global clean energy market. The relevant Government initiatives for the purposes of this report are as follows.

Advanced Electricity Storage Technology (AEST) [DRET]: a research and grant programme designed to increase the commercial tractability on intermittent electricity.

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.

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.

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.

Clean Business Australia [DIISR]: a partnership with business and industry aimed at delivering energy and water efficient projects.

Clean Energy Enterprise Connect Centre [DIISR]: funding of AU$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.

Clean Energy Export and Investment Programs [Austrade]: aimed at promoting clean energy capability and facilitating export and investment opportunities.

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 AU$150 million over five years divided into two initiatives: Australian Solar Institute and Clean Energy Program.

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 AU$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.

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.

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.

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..

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.

National Framework for Energy Efficiency (NFEE) [DRET]: a joint initiative of the Federal, State and Territory Governments the Framework aims to realise 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.

Renewable Energy Fund (REF) [DRET]: the aim of the fund is to accelerate the development, commercialisation and deployment of renewable energy technologies in Australia.

Renewable Energy Equity Fund (REEF) [DEWHA]: this is designed to supply venture capital for small innovative renewable energy companies.

Renewable Remote Power Generation Program (RRPGP) [DEWHA]: the aim of the Programme 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.

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.

Solar Homes and Communities Plan [DEWHA]: this plan is designed to encourage the long-term use of photovoltaic technology to generate electricity.

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.

National Solar Schools Program [DEWHA]: this program will help Australian schools to take practical action to participate in Australia's response to climate change.

Commercialising Emerging Technologies (COMET) [DIISR]: this is a merit based assistance program with the aim of increasing the commercialisation 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.

6.0 Opportunities in Village Level Energy Delivery

6 OPPORTUNITIES IN VILLAGE LEVEL ENERGY DELIVERY

There is growing awareness of the potential for cleaner and 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 billion people in the Asia-Pacific region, do not have access to modern energy services for basic cooking, heating and lighting. This market is an integral part of the clean energy market within the region and even though its structure and sources of finance may differ from what may be seen as mainstream (centralised energy or grid connected generation) it is a significant market that will only continue to expand. An essential element of significant progress in responding to the needs of this market segment will be increased access to micro-finance.

Despite the absence of a specific Millennium Development Goal (MDG) 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, sterilisation, 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 fuelwood, 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 International Finance Corporation (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 hydro electricity 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.

6.1 MICRO FINANCE

At a recent workshop in Manila - Financing Village-Level Energy for Development in Asia-Pacific - highlighted that efforts to expand the provision of clean/cleaner/ 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 financing the 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.