Asian Energy Institute

AEI newsletter

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Contents

Editors **Mitali Das Gupta and Deepti Mahajan**

The AEI (Asian Energy Institute) is a network of 16 energy institutes from Asian countries. These include Bangladesh, China, India, Indonesia, Iran, Japan, Jordan, Korea, Kuwait, Malaysia, the Philippines, Pakistan, Sri Lanka, and Thailand. Besides, there are 14 associate members, both within and outside Asia. The AEI was formally established in August 1989. Its aims and objectives are to promote greater information exchange; facilitate sharing and dissemination of knowledge; undertake research and training activities that are of common interest to its members; and analyse global energy developments and their implications. TERI hosts the secretariat of the AEI at present. The secretariat publishes a biannual newsletter that informs the readers about the diverse research activities undertaken by the member institutes. Currently, the AEI is hosting the regional secretariat for REEEP (Renewable Energy and Energy Efficiency Partnership) in South Asia.

Editorial

*R K Pachauri**

Oil prices have been very close to the $100 mark in recent weeks, and the outlook does not look very bright. At the same time, there are still over a billion people across the globe who do not have access to electricity. Additionally, the issue of climate change is now so high in the consciousness of the public as well as several world leaders, that globally there is great pressure to reduce the emissions of GHGs (greenhouse gases) with a sense of urgency. All these factors clearly require that human society come up with a totally different scenario of energy in the future than what we have seen in the past. For these reasons, as well as for reducing air pollution at the local level, a movement away from fossil fuels is extremely critical to meet a range of objectives linked with the factors mentioned above.

Asia has to be in the lead in devising new energy solutions and establishing a new path of energy developments that move us in the right direction in the future. The reason behind the need for Asia to take the lead lies in the fact that economic growth on this continent is now the fastest of any region in the world. Consequently, the demand for energy in Asia will grow rapidly, and since changes will take place on a large base, the absolute impact that Asian energy demand would have on the global energy market would be substantial. Significantly, Asia has locations with very high population density, which makes people particularly vulnerable to the health related impacts of air pollution. But the most important rationale perhaps for moving from a fossil-fuel-based energy system to one that relies substantially on renewable energy arises out of observed and projected impacts of climate change. Since the share of GHG emissions from Asia is on the increase, the future course of development on the continent has to be an important part of the global solution in providing a significant reduction of emissions of GHGs. Even though the problem of climate change is the result of cumulative GHG emissions in the past, exercising the principal of common but differentiated responsibility (as included in the Framework Convention on Climate Change) would require Asia to play its part, both for global reasons and for creating an example for other parts of the world. Even though Asia historically contributed little to cumulative emissions of GHGs, by taking effective measures that would limit future emissions, Asian nations would gain much greater moral and political authority to bring about similar actions on the part of other countries in the world.

While the share of renewables in current energy production is still small, progress in this field in recent years has been very encouraging. The IPCC (Intergovernmental Panel on Climate Change), in its *Fourth Assessment Report of Working Group III*, has clearly assessed that placing a price on carbon would be the most important policy measure for bringing about reductions in GHG emissions. Therefore, if the world was to place an appropriate price on carbon, not only would large scale funding flow into R&D (research and development) for renewables, but this would also ensure that these technologies are disseminated extensively. Consequently, the healthy rate of growth of renewables in recent years would improve even further. Higher prices of oil, which often lead to corresponding increases in the price of other fossil fuels, would provide an even stronger incentive for development and use of renewable energy technologies.

The *Global Status Report* of REN 21 (Renewable Energy Policy Network for the 21st Century) has stated that investment in new renewable energy capacity, in 2005, was $38 billion, much higher than the $30 billion in 2004. The largest investment took place in Germany and China with about $7 billion each. These were followed by the United States, Spain, Japan, and India. Wind power registered the second highest addition with a growth of 24% to reach 59 GW (gigawatts) of installed capacity. The overall progress of annual investment in renewable energy for the period 1995–2005 is shown in Figure 1. As far as specific technologies are concerned, the growth in recent years has been quite impressive – as shown in Figures 2, 3, and 4.

Against this background, there is need for the countries of Asia to come up with a common perspective, on the basis of which some collective actions could be taken to benefit the region as a

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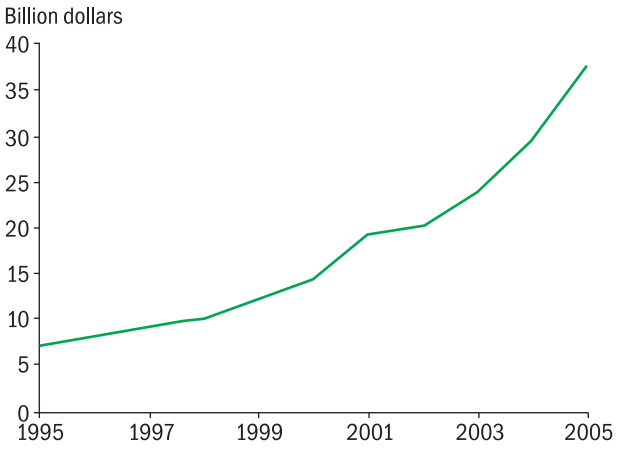

Figure 1 Annual investment in renewable energy, 1995–2005
Source *Renewables Global Status Report* (2006), REN 21

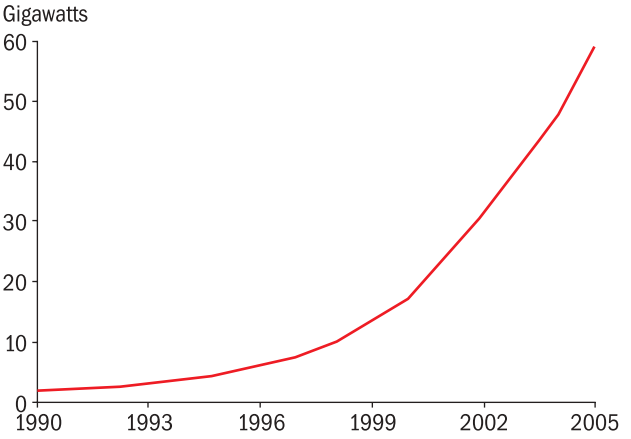

Figure 2 Wind power: existing world capacity, 1990–2005
Source *Renewables Global Status Report* (2006), REN 21

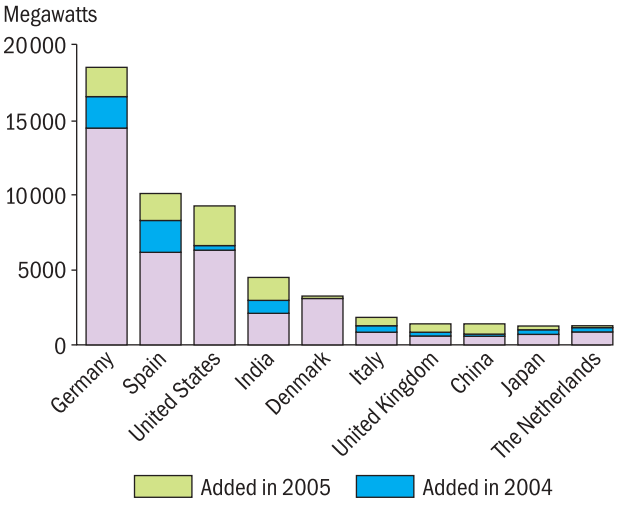

Figure 3 Wind power capacity, top ten countries, 2005
Source *Renewables Global Status Report* (2006), REN 21

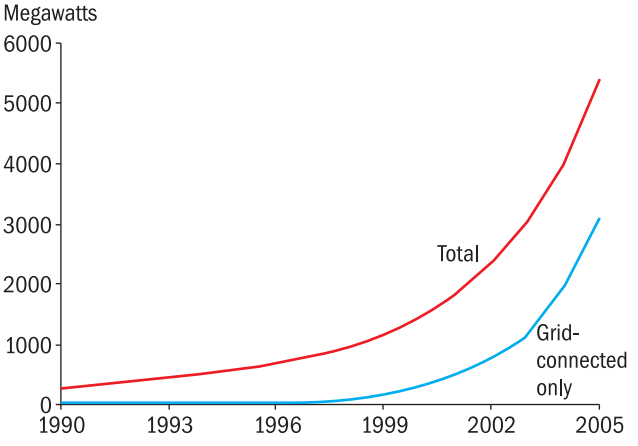

Figure 4 Solar photovoltaic: existing world capacity, 1990–2005
Source *Renewables Global Status Report* (2006), REN 21

whole. In particular, the establishment of large-scale capacity for production of renewable energy devices would bring about economies of scale that would help consumers in the region across international boundaries. Based on this write-up, a suggestion could be put forward that the AEI (Asian Energy Institute) becomes a catalyst for developing an Asian perspective and a plan of action for development of renewable energy technologies. One approach by which such an effort could be initiated is joint communication from the heads of the institutions which are part of the AEI, to the President of the Asian Development Bank, seeking seed funding for taking this initiative forward.

An attempt at accelerating renewable energy and energy efficiency in Asia is being made by the various activities of REEEP (Renewable Energy and Energy Efficiency Partnership). REEEP South Asia is housed in the AEI. This newsletter has a special focus on its activities and projects, as well as articles by officials of REEEP International. Comments from the readers on this editorial are greatly welcome and would help in making a beginning towards a brighter renewable energy future for Asia.

The wind industry in India: policy, regulatory, and attitudinal issues

Rakesh Kacker*

Introducing a new technology or idea is a difficult task. On the one hand are genuine difficulties faced in introducing the innovation and on the other are those encountered in scaling it up to commercial proportions. The more difficult task is to make people accept the innovation, and obtain their cooperation and support in overcoming these inherent difficulties. The wind industry in India is no exception. Accordingly, after giving background information, this paper looks at the major problems faced by this nascent but fast growing industry. It then tries to address some of the reasons why the attitude of many people is either hostile or indifferent to this technology.

Growth of the wind industry

The wind industry in India has been growing rapidly in the last three years. The installed capacity has thus shot up to a little over 7000 MW (megawatts) as of March this year. This increase can be seen from Figure 1.

The bulk of this capacity is in Tamil Nadu, which accounts for about 50% of the total installed capacity, followed by Maharashtra, Karnataka, Gujarat, and Rajasthan. These five states taken together account for 97% of the installation (Figure 2).

The growth of the wind industry in India has been matched by an equally impressive growth internationally. The corresponding figures of installed capacity worldwide are shown in Figure 3.

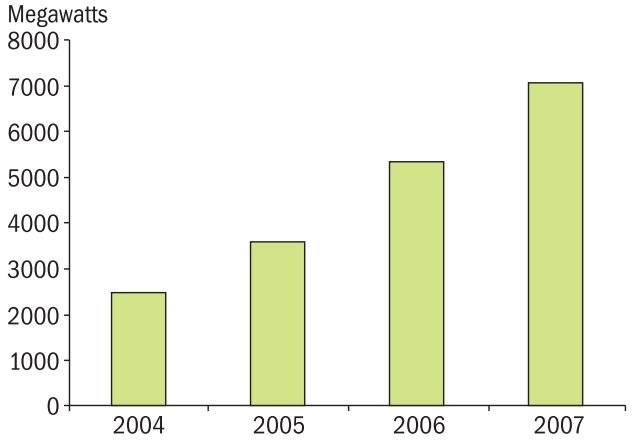

Figure 1 Growth of installed capacity of wind energy in India
Source <www.inwea.org>

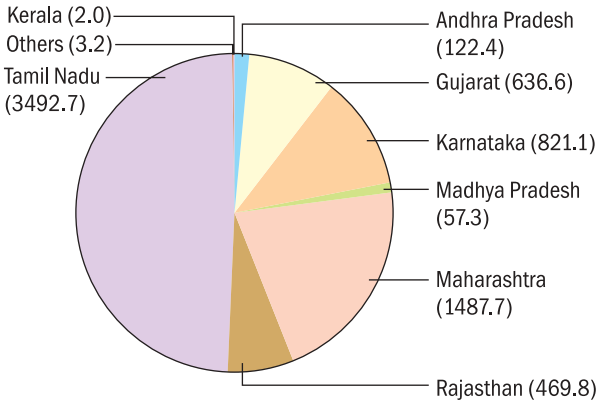

Figure 2 Cumulative installed capacity in MW as on 31 March 2007
Source <www.inwea.org>

Following are the major drivers of this growth.

- Renewable energy standards with fixed minimum procurement targets in renewable/wind energy.
- Fixation of preferential tariff for such procurements.
- Growing awareness about the problems of climate change.
- Rising fossil fuel prices and the capacity of wind to provide long-term stable energy prices.

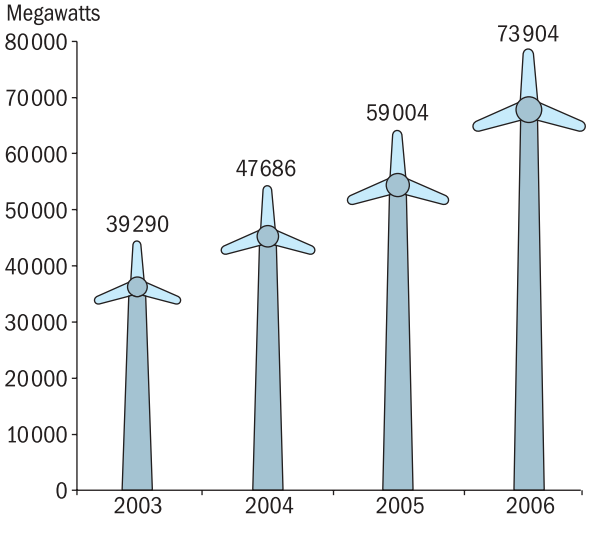

Figure 3 Wind energy: installed capacity worldwide
Source <www.wwindea.org >

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The views expressed here are the personal views of the author and do not necessarily reflect the views of InWEA.

Despite the various advantages of wind energy and growing competitiveness, the industry faces certain problems in India, which need to be addressed to ensure that growth is sustained in the future.

Renewable Portfolio Standards and tariff setting in India

In India, Section 86(1)(e) of the EA 2003 (Electricity Act 2003) requires each state's regulatory commission to fix the minimum percentage of consumption that must be procured from renewable energy sources. Most of the states have issued orders for an RPS (Renewable Portfolio Standard). A summary of these is provided in Table 1.

Apart from the five states mentioned in the table, the states of Andhra Pradesh, Kerala, West Bengal, Uttar Pradesh, Madhya Pradesh, Haryana, and Punjab have also fixed such limits. In a parallel measure, the state regulatory commissions have also fixed the tariffs for procurement of energy from renewables. In all states, except Rajasthan, one single tariff for the entire state has been fixed. In the case of Rajasthan, the tariffs have been fixed at two levels — a higher tariff has been fixed for districts with a lower capacity utilization factor. These tariffs have generally been fixed for a period ranging from 13 to 20 years. They are fixed for the entire period or provide for a fixed escalation. Thus, the investors in these states have guaranteed offtake at pre-determined prices. The main risk here is whether the turbines are able to generate the energy assumed in the tariff calculations and whether there is sufficient demand in the grid.

Another risk, which is now increasingly becoming important, is the rising cost of equipment and financing. To the extent that these differ from the assumptions made in the calculations, the investors would stand to lose.

These risks are inherent in the normative cost plus methodology that has been adopted for fixing the tariffs.

Table 1 Status of Renewable Portfolio Standard percentage fixed in different states

State	*RPS %*	*Comments*
Tamil Nadu	10	–
Maharashtra	3	Will increase to 6% by 2010
Karnataka	10 (maximum)	The commission has floated a consultation paper on the issue of increasing this limit
Gujarat	2	–
Rajasthan	2	This figure is for wind energy and would increase to 7.5% by 2012

Given the present market conditions, the use of the cost plus methodology is inevitable. However, this methodology has an inherent failing – it will not be able to respond to changes in the market parameters speedily. Regulation by its very nature involves a lengthy process of consultation, examination, and fixation of tariffs. Thereafter, there are also provisions for appeal and judicial review which could lead to even more delays.

Besides the problems associated with the cost plus methodology, there is also the issue of enforcement of orders issued under Section 86(1)(e) of the EA 2003. If these orders are to be enforced, there should be enough supply to ensure that the percentages fixed by the regulatory commissions can be adhered to by the utility and other consumers. The regulatory commissions must also specify the manner in which these orders would be enforced. So far, only the Maharashtra Regulatory Commission has specified the penalty for non-compliance and the manner in which this penalty will be recovered from the utilities.

Towards a national Renewable Portfolio Standard

In order to ensure adequate supply and have an effective enforcement mechanism, it would be necessary to introduce a system whereby the states rich in renewable resources can export such energy to the renewable-energy-deficient states. Such exchanges can be done either through physical transfer of electricity generated or through a paper-based trading mechanism. In the latter case, there will be no movement of energy but only of the entitlement for meeting the obligation cast on the utility/consumer through regulations under Section 86(1)(e) of the EA 2003.

Apart from making it easier for utilities/consumers to comply with regulations, this will also help in distributing the burden of developing renewable energy resources including wind. At present, renewable energy is not traded across states nor is energy produced in one state accepted as the means to comply with the RPS mechanism in other states. Once trading – either physical or paper – is permitted and encouraged, the states that do not have much renewable energy resources would also be required to fix orders and ensure that these orders are complied with. Eventually, a national minimum would need to be ensured so that all states contribute equitably towards the development of renewable energy resources.

Introduction of such a system would also help in initiating an element of market dynamism in the prices

of renewable energy. This would help in partially overcoming the difficulties associated with the cost plus regulated regime. It would also help in moving the industry eventually to a pricing system determined by market forces within the ambit of a national renewable energy support and procurement policy.

Wind energy potential in India

Directional change has the ability to free the industry from the constraints imposed by a regulated pricing mechanism and would help it move more speedily towards utilizing the full potential of wind energy in the country. According to official estimates, the total potential in the country is about 45 000 MW in gross terms. Out of this, only about 13 000 MW was considered feasible earlier. These estimates have been shown to be conservative. Tamil Nadu already has an installed capacity of 3500 MW as against the gross potential of 3050 MW and net potential of 1684 MW. The government has taken up the preparation of a Wind Atlas for India in association with RISO National Laboratory, Denmark, which is expected to be completed by 2008/09. It is expected that a better estimate of wind energy potential would be made available once this exercise is completed. Meanwhile, going by the conservative estimates and the present rate of annual capacity addition, there is a huge potential that remains unexploited. At the current rate of capacity addition, this potential will not be exhausted even by 2020.

While policy and regulatory issues are crucial, there are other important issues which need to be addressed simultaneously. These include the need for proper micro-site forecasting of wind energy generation and associated issues of grid integration and management; providing links between states and regions for better management of fluctuations in wind energy; and utilization of carbon credits to reduce the cost burden of developing the available wind energy resources. The wind industry is rapidly growing and it should be possible to find equitable solutions that ensure that we utilize our natural resources appropriately.

The cost of not using wind energy

Since wind is a renewable resource which cannot be stored, non-utilization of wind energy potential is a permanent loss of the country's assets. In many ways, this is very similar to the flaring of natural gas in the early stages of development of the oil industry. There was considerable noise over the flaring of gas, and various estimates were made of how much the country was losing every year. There has unfortunately not been similar concern over the loss of our renewable energy resources.

We must compute the loss due to non-utilization of wind and deduct it from our national income to ensure that there is proper accounting of and reflection on the true efficiency and productivity of our economy. On the assumption that we would be able to add 3000 MW in the next two years, the annual loss thereafter would be 35 000 MW. This loss can be minimized by taking action now. How much does it cost us if such an action is not taken? The quantum of this loss has been estimated on the following assumptions.

- The total quantum of unutilized capacity is 35 000 MW.
- The marginal cost of wind-based electricity is Rs 3.50 per unit.
- The marginal cost of non-renewable energy is Rs 5.50 per unit (justification of this number may be seen in the following section of the paper).
- The average capacity utilization factor is 22%.

On the basis of these assumptions, the annual loss comes to Rs 140 billion. As fossil fuel prices continue to rise, these losses would only increase. Solutions to avoid this loss and make better use of wind energy can only come forth if there is adequate understanding and knowledge about the true benefits of wind energy.

Wind energy: attitudinal problems

Most people have two common problems with wind energy. These are:

- The electricity generated by wind turbines is expensive.
- Wind being intermittent cannot be used in any significant amount.

Is wind energy really expensive?

Figure 4 clearly shows that the cost of traded power has steadily gone up—the bulk of traded electricity is sold at prices that have gone up from a range of Rs 2–3 per unit in 2004/05 to Rs 4–6 per unit in 2006/07. Market information suggests that now the bulk of power is sold at prices above Rs 6 per unit (Figure 4). Since this power can be scheduled whereas wind cannot be (although wind energy production can be forecast), some deduction on this count needs to be made. On a rough basis, it would be safe to assume the marginal cost of power at Rs 5.50 per unit.

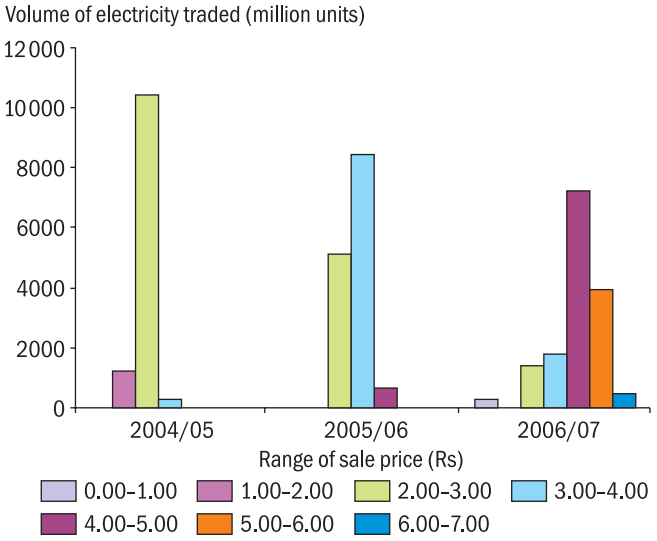

Figure 4 Volume of electricity by the trading licensees and its sale price
Source <cercind.gov.in>

The above analysis does not take into account the environmental benefits of wind energy, the positive implications of wind energy for energy security, and also the fact that unlike fossil-fuel-based energy, wind energy can provide stable prices for 20 years. Thus, wind being a cheaper option is certainly no longer in doubt – the only question is whether this margin is Rs 2 per unit or more.

Is wind energy unmanageable because it is intermittent?

Wind energy being intermittent, people are apprehensive of utilizing it. It is certainly correct that wind is intermittent (again to be emphasized that it can be forecast – production of wind energy is not random) which places certain limitations on its use. However, it must be noted that currently wind energy produces only about 2% of the electricity generated in the country. In Denmark, wind energy contributes 20% of the electricity generated. In the state of Karnataka in India, this number is 10%. With proper grid management and inter-connections between states and regions in the country, it is certainly possible to inject more wind energy into the system. At the national level, we are still far away from what other countries have achieved or what some states in India have achieved. Therefore, if there are problems in the absorption of wind energy, the problem lies in the domain of grid management and not in the nature of wind energy.

Finally, it is relevant to point out that apart from wind, managing hydro with fluctuating rainfall and managing fossil-fuel-based stations designed for base load operations in the absence of sufficient peaking power stations also pose problems in grid management, apart from fluctuations in demand and unscheduled break-down of fuel supply chain and generating stations themselves. In spite of these challenges in management of the grid, by and large the grid management system has worked successfully. There is no reason why the same system cannot manage the challenges posed by the intermittent nature of wind energy, especially at the present negligible levels of grid penetration. However, unlike fossil-fuel-based plants, wind energy plants have the risk of the grid not being available.

It also needs to be noted that while fossil-fuel-based plants enjoy a two-part tariff system, wind and other renewable energy sources have a single-part tariff system. This also needs to be factored into the comparative evaluation of fossil-fuel-based plants and renewable energy plants. One also needs to take into account the recent high prices of fossil fuels, which have led to low utilization of liquid-fuel-plants — the cost of this low utilization is to be borne by the utilities, and ultimately the consumer and the tax payer.

All these issues and challenges call for a positive outlook towards the greater utilization of wind energy in particular, and renewable energy in general. The recent growth of the industry, as well as the rapidly growing realization of the true benefits of renewable energy, brings hope for the future.

Project finance for wind energy: a banker's perspective

Jotdeep Singh and Rahul Rai*

India has tremendous wind energy potential that has generated significant interest, domestically and globally. According to the Ministry of New and Renewable Energy, Government of India, the installed capacity of wind turbines as on 31 March 2007, was around 7.1 GW (gigawatts), constituting about 5% of India's installed generation capacity. With this, India stands fourth in the world in terms of wind energy installations.

Wind energy is capital-intensive and hence the cost of financing constitutes a large variable in wind energy economics. It has a low marginal cost of operation and a high proportion of up-front capital costs, owing to which wind energy projects are usually considerably debt funded. In India, most financing for wind farms has usually been in the form of balance-sheet lending, rather than project finance based on the expected cash flows from the wind farm alone. Here, we examine the case for project-specific finance for wind energy.

Project finance, as defined in the Basel II Accord (issued by the Basel Committee on Banking Supervision, International Convergence of Capital Measurement and Capital Standards in November 2005) is 'a method of funding in which the lender looks primarily to the revenues generated by a single project, both as the source of repayment and as security for the exposure. Project finance may take the form of financing of the construction of a new capital installation, or refinancing of an existing installation, with or without improvements. In such transactions, the lender is usually paid solely or almost exclusively from the money generated by the contracts for the facility's output, such as the electricity sold by a power plant. The borrower is usually an SPE (special purpose entity) that is not permitted to perform any function other than developing, owning, and operating the installation. The consequence is that repayment depends primarily on the project's cash flow and on the collateral value of the project's assets.'

Financing wind farms through project finance has evolved to become a standard business practice in Europe. With the emergence of India as a destination for installation of wind farms, there is an increasing demand from project sponsors and investors for project financing facilities.

Project financing enables sponsors of large projects to leverage their assets with minimal or no utilization of existing corporate credit. In a typical transaction, the project assets and cash flows are segregated from the project sponsors and independently evaluated by the lenders. The credit appraisal and lending decision are based on the inherent economics of the project as opposed to the credit standing or balance sheet of any sponsor, even though the sponsor's reputation and track record in other ventures matter significantly.

Usually in India, lenders will insist on recourse to project sponsors' main balance sheet or indirect credit supports in the form of guarantees and warranties from project sponsors and related third parties to mitigate specific payment risks. The nature and extent of any credit support can vary greatly based on the lenders' risk assessment. The need for such credit support can be minimized as and when the project risks (or perceived project risks) are mitigated. Some issues that create greater uncertainties in India, as compared to the more mature wind markets of Europe, are elaborated below.

Offtake payment risk

Usually for wind farm projects in India, electricity sales are made to the SEBs (state electricity boards). A stand-alone financial appraisal of most of the SEBs in India will indicate their inability to meet financial commitments, since in most cases tariff collection by the SEBs from the final consumers does not cover cost because of subsidy in tariffs. Ideally, the power purchase agreement would be with a utility that has an investment grade or better credit rating, and one that is motivated by an enforceable regulatory requirement, such as a renewable portfolio standard, to meet its obligation to take electricity under such an agreement. The agreement must be structured to provide the project company with sufficient revenue to

- pay its project debt obligations and all other costs of operating and maintaining the project, and
- to provide the project company and its lenders, as assignees of the project company, with a reasonable opportunity to cure any default.

* The authors are from Rabo India, a 100% subsidiary of Dutch banking major Rabobank.

This is usually not the case in India as no SEB has an acceptable credit standing if looked at from the numbers on the balance sheet, nor are the renewable targets backed by enforcement.

Many SEBs have nevertheless had an acceptable track record in payments to wind projects. However, in times of economic stress or changes in government policy, this situation may change, and a compound effect of political and credit risk may introduce significant uncertainty in wind farm lending, particularly in view of the long tenure of the project debt.

A significant step towards project finance in India could be taken if renewable targets are enforced, and if there is a separate agreement among the lenders as parties, in which the utility acknowledges and agrees to security interest of the lenders and their step-in rights. The consent agreement should include restrictions on amending such documents.

Also delays in payments by SEBs to wind farms, a usual feature today, would have to stop. The date of payment would become sacrosanct, and government owned SEBs would have to adjust their procedures to reflect the seriousness of payment dates. Under project finance, delayed payments are considered a case of default. If a utility has demonstrated chronic late payments, no matter how consistently they have paid eventually, this would constitute a significant credit risk. However, in our experience, the performance of some of the SEBs has improved over a period of time and the payments are increasingly being received with lesser delays.

Political risk

There are risks related to policy uncertainty that may arise from change in governments. In some states, the PPAs (power purchase agreements) with the SEBs do not cover the entire tenure of debt. Even when they do, there is no absolute guarantee that a government will not change it in the future.

Additionally, political violence and local protests are other elements of risk in India. For instance, the farmers' protest in Maharashtra, in April 2007, stopped activities at a wind farm site. Such risks add to the perception among lenders that India's wind farm approval processes may not be as developed as in the West.

Grid risk

Wind projects in India encounter challenges in adequately integrating their operations with the transmission grid on schedule and ensuring its reliable availability. The non-suitability of the grid infrastructure to accept variable loads is seen as a key risk. With the low proportion of wind energy in total generation, this issue has not warranted much attention yet, but with increase in the share of wind energy, it is expected to pose a challenge. To compound this issue, most of India's transmission and distribution networks suffer from underinvestment in the areas where a favourable wind profile is found. There have also been cases where the wind farm is ready for operation but part of the infrastructure, as far as the SEB is concerned, is not ready for offtake, thereby creating challenges with regard to connectivity. Strong government signals, through 'must run' directives for renewable energy installations, would force grids to put in place procedures to work with wind energy.

Wind profile risk

Wind profile is another significant credit concern for a windfarm project. The more accurate and the more historical data that is available for assessing the wind profile of a particular site, the less is the uncertainty involved. The C-WET (Center for Wind Energy Technology) and some others have done commendable work in spotting high wind potential areas, and related measurements that have helped the wind sector take off in India. This now needs to be taken to the next stage, with more sophisticated measurements, and measurements at heights for which present-day windmills are being developed.

Wind power has enjoyed steady growth over the last decade, and that growth is expected to continue both in Europe and in India in the coming years. Given the increasing number of credible sponsors with well-established relationships with the lending community, the improving credit position of many of the utility offtakers, and the increasingly favourable regulatory environment, some project financing for Indian wind farms can be expected in any case. However, for a major shift towards non-recourse project finance in wind energy in India, some of the suggestions made above could help considerably.

How to find money for your renewable energy project?*

Frédéric Crampé#

Although there is no shortage of funds for financially viable projects, the immature nature of the green energy market makes it hard for entrepreneurs and financiers to find each other.

REEX (Renewable Energy Exchange)[1] aims to fill this gap by connecting capital with clean energy projects. REEX is uniquely positioned as a financial intermediary, focusing on renewable energy and energy efficiency sectors in Asia. In other words, the company helps project developers to raise finance through matchmaking with financial institutions, development banks, corporate investors, clean energy private equity funds, and carbon funds. 'Our goal is to accelerate the implementation of green projects, so we are not asking for exclusive mandates with clients,' says REEX Chairman Mike Allen. 'It's up to REEX to be faster and better at fund-raising. Project developers appreciate keeping their flexibility and we are confident in the business model as we have tight relationships with a large group of investors and lenders. Incentives are aligned since REEX gets a success fee only at financial closure.'

REEX began in Singapore in mid-2006, supported by an advisory board of people from major institutions—REEEP (Renewable Energy and Energy Efficiency Partnership), DEG, EcoSecurities, E+Co, CVC Group, SEFI/BASE, IUT Global, and Greenbank Capital. It was funded by REEEP and DEG, the development finance arm of Germany's KfW Bank. REEX is sourcing and reviewing biofuel and infrastructure power generation investment opportunities across Asia (wind, biomass, biogas, and hydro, among others). For the pre-selected projects, REEX provides the necessary added value to end up with a bankable deal ready for debt and/or equity financing. As of February 2007, REEX has 20 projects in the pipeline, ranging from $5 million to several hundred million. For example, REEX will soon be closing a $16 million financing transaction for a 11.5 MW (megawatts) biomass power plant in Malaysia using Palm Empty-Fruit-Bunches. Other deals in advanced due diligence phase include the expansion of an energy service operations company with projects in Guam and the Philippines, an M&A (mergers and acquisitions) transaction for a solar business, and seed capital for a biogas developer with power plant projects in Vietnam, India, and Indonesia.

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* From the REEEP (Renewable Energy and Energy Efficiency Partnership) South-east Asia and Pacific Regional Secretariat.

General Manager, REEX (Renewable Energy Exchange).

1 For further information on REEX, please visit <www.reexasia.com>.

About REEEP

REEEP (Renewable Energy and Energy Efficiency Partnership) is an active, global public-private partnership that structures policy and regulatory initiatives for clean energy, and facilitates financing for sustainable energy projects. Backed by national governments, businesses, banks, and NGOs, REEEP is uniquely placed to contribute to international, national, and regional policy dialogues.

The REEEP International Secretariat, Vienna, engages political, financial, and business support to reduce the risk inherent in implementing new policy and financing initiatives. With a network of eight regional secretariats, and more than 3500 members, REEEP has the ability to affect change worldwide. The regional secretariats are located in Central Europe, East Asia, Latin America, North America, Russia, and the FSU (former Soviet Union), Southern Africa, South Asia, South-east Asia, and the Pacific. Through its relationship with the MEDREP (Mediterranean Renewable Energy Programme), REEEP has representation in North Africa.

The partnership has funded more than 98 high quality projects across the world that remove market barriers to clean energy in the developing world and economies in transition. These projects are beginning to deliver new business models, policy recommendations, risk mitigation instruments, and training tools.

Mixed blessings

Marianne Osterkorn*

Biofuels offer many socio-economic benefits, but these need to be balanced against environmental impacts.

The maize industry in South Africa is diversifying and prospering. Ethanol Africa, a South African company that plans to produce ethanol from yellow maize, wants to soon list on London's AIM (Alternative Investment Market). There are around 9000 commercial maize producers in South Africa. The country produces 8.8 MT (million tonnes) of maize on average per year, making it the country's largest produced crop. Ethanol could provide a new and much welcome source of earnings.

Ethanol Africa, which is one of the companies leading this move, plans to open eight ethanol plants over the next six years, the first of which will be located in Bothaville. All will be located inland in the central and eastern part of the country. 'The socio-economic benefits of biofuels are extremely clear—there's a huge positive argument for it,' emphasizes Jo Kruger, the company's Managing Director.

The prospect is an exciting one. Employment could increase significantly as a result of development of biofuels. A 2003 study by Earthlife Africa suggested that if South Africa substituted 15% of its petrol with bioethanol, 62 000 direct jobs would be created. This is one reason why Ethanol Africa plans to eventually spread its operations to other African countries such as Zambia, Mozambique, and Tanzania. This is also a major reason why several African governments, such as that of South Africa, have opted to take the biofuels route. In South Africa, maize, sugarcane, soya, and lesser-known perennial plants are all feedstock options.

But while it is hard to dispute the numerous economic and low carbon benefits arising from the industry's development, several environmental problems (as well as some positive environmental spin-offs) are already becoming visible.

The maize industry has been criticized for using fossil fuels at every stage in the production process. Its cultivation uses fertilizers and tractors, followed by energy used for processing and transportation. According to the World Conservation Union, 'maize farming appears to use 30% more energy than the finished fuel produces, and leaves eroded soils and polluted waters behind.' Some studies confirm that at the very least, maize shows only a marginal positive energy balance in comparison to other crops, while others show its energy balance to be negative.

Since the sugar–bioethanol chain, which has provided huge benefits for Brazil, could also create jobs and income for several African countries, many countries are considering it as an option. A UK–Brazil–South Africa partnership study published in July 2006, on behalf of the UK Office of Science and Innovation, said that sugar cultivation could be more than doubled to 1.5 million hectares in the southern African region over the next 10–15 years. If so, sugarcane production would meet more than twice the current regional sugar consumption need while creating 7.3 billion litres of bioethanol each year. It is an attractive option and 'has the potential to be among the lowest cost and lowest CO_2 fuel chains,' according to the study's authors.

According to the South Africa Sugar Association, there are about 47 000 registered sugarcane growers in South Africa, producing an average of 22 MT of sugarcane. About 80% of the production comes from large commercial players.

But sugar production has created major concerns in recent years. Future potential is limited in South Africa and one reason for this is the industry's large consumption of water. Sugarcane is a water–intensive crop that remains in the soil for the whole year. A 2005 WWF (World Wildlife Fund) study found that 600–1000 litres of water is used to produce 1 kg of sugar, or one million litres of water to produce 12.5 tonnes of commercial cane. Solutions are needed, especially in arid countries. WWF's response has been to create a Sustainable Sugar Initiative, through which it plans to develop a set of standards for use by investors and producers. In South Africa itself, there is little physical room for sugarcane expansion. Kruger estimates that at most there could be enough for two sugarcane-based ethanol plants. However, new plantations and plants in neighbouring countries such as Mozambique will be under pressure to consider these issues.

Perhaps some of the most interesting developments are in the more unusual tropical plants being considered as biofuel feedstock, many of which show a higher yield

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than maize and sugarcane. Simon Wilson is managing a South African biodiesel project for REEEP (Renewable Energy and Energy Efficiency Partnership) which is funding several biofuel projects in Africa. He points out that the issue is a complex one — studies have noted negative environmental impacts from many of these plants, which are often grown on land that is degraded and not viewed as entirely arable. 'Given that marginal land is often a refuge for wildlife and biodiversity, it is likely that energy crops will have some of their greatest impact on these resources, as is already being seen in South East Asia with the expansion of oil palm plantations into secondary forests which in turn is having a clear impact on orangutan populations, for example,' he explains. Africa is an enormous and unique continent, and the development of biofuels, whether through traditional crops or tropical plants, is in many ways a step into the unknown.

Annie Sugrue, the South African coordinator for the international NGO (non-governmental organization), CURES (Citizens United for Renewable Energy and Sustainability), is interested in the potential benefits of biofuels, but says that 'the issues are not fully understood.' She believes that a full life-cycle analysis for different crops needs to be done.

Nevertheless, some positive environmental benefits have been noted from plants being considered as biofuel feedstocks in South Africa. According to Sugrue, perennial crops including jatropha, moringa (a tree whose bark, leaves, and other parts can all be used), and two local plums, could be the way forward, not least because they are more productive. Jatropha, the tree cultivated by biodiesel company D1 Oils in Southern Africa, can generate 2.5 tonnes of biofuel/hectare in comparison to, for instance, soya, which averages 0.8 tonne/hectare.

There are other benefits too — 'We have lots of arable land but it's degraded, but long-term crops such as these help to stabilize and improve it over time,' Ms Sugrue says. Many sustainability campaigners favour the development of food forests that include different types of plants (trees and bushes) of different species and different heights.

It is a tricky problem. The financial gains from developing biofuels are attractive, since a high import demand is likely from mature economies in the European Union and Far East. But many of the environmental issues still need to be worked through. REEEP as an organization will continue to support the development of biofuels to reduce GHG (greenhouse gas) emissions, but the partnership will always ensure that projects have a comprehensive approach — that biofuel production considers sustainability, economic development, and land use holistically. REEEP does not support biofuel production that involves deforestation or displacement of food crops.

Putting down roots

Binu Parthan*

Only an in-depth, integrated approach to energy access ensures a sustained income rise.

Shaffiudin is an entrepreneur who not only wants to increase his income but also wants to help other inhabitants of Chintapally, a town 150 km from Hyderabad in the Indian state of Andhra Pradesh. He ran a telephone kiosk and photocopying service for months, but found it difficult to expand his business due to lack of capital. Moreover, power failures due to grid problems led to loss of income. It was a situation he could have been locked in indefinitely because of the conservative approach of most Indian banks to business in poor communities.

In 2006, he was spotted by S^3IDF (Small Scale Sustainable Infrastructure Development Fund). Russell deLucia, S^3IDF's founder, calls his organization a social merchant bank. It is a fund that helps develop small-scale environment-friendly enterprises, which in turn help the poor increase their earnings and well-being either as providers or users of infrastructure services — energy, water, communications, and transport. Funding ranges from $100 to $5000, and 60 investments have been made while 130 are in the pipeline.

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'In a lot of our deals, poor people end up owning the assets,' says deLucia, and this distinguishes the projects from the few alternatives in existence. S³IDF differs from micro-finance providers who tend not to handle infrastructure investment.

'For most of our projects, either we find a local entrepreneur who wants to help solve an infrastructure problem or we actually invent a new business,' he explains. The micro-entrepreneur acts as the lynchpin of a project that can flourish locally and help make more money for people in poor communities. In this case, Shaffiudin's entrepreneurial skills were already developed, and his business was already in place. What he needed was reliable power (used for his billing service) and sympathetic bankers. S³IDF's expertise helped to overcome many of the financial obstructions. The organization provided him a loan of $1300 to install new printers and computers for digital imagery and email access, facilities from which both the local community and students could benefit.

Shaffiudin is gradually repaying the loan with income derived from charging customers, who may, in turn, increase their own income through the services available. This spider's web effect, arising from one initial outlay is the hallmark of the social merchant banking pioneered by deLucia and his colleagues.

The new ICT (Information and Communications Technology) centre uses computers powered by rooftop solar panels, a typical feature of S³IDF projects, which often use clean energy. They are more reliable than traditional power sources, and can become viable through administration of special funding structures. Funding from the REEEP (Renewable Energy and Energy Efficiency Partnership) was included in the S³IDF transactions.

In general, S³IDF prefers to use credit guarantees rather than full loans as this encourages local banks to participate in projects from the start, but in Shaffiudin's case, the bankers' ignorance of the business model obstructed this route. 'Our mission is to try and change the mindset of local banks; we continue the dialogue with them afterwards to convince them to complete full loans to such enterprises,' says deLucia.

Now that the project is implemented, it can act as a model to demonstrate the viability of such projects. In future, it will be replicable in other parts of the town and further afield, and funded by local institutions such as the rural network of smaller grameen banks.

The work is typical of the approach of both S³IDF and SELCO (Solar Electric Light Company), with whom it sometimes collaborates. Often using innovative financial structures, S³IDF and SELCO create the first infrastructure link in a value chain that generates new incomes. SELCO works mainly on the technology side, providing solar lighting and electricity, clean water, and wireless communications. It has sold, serviced, and financed over 70 000 solar electric units to its customers. It works with a number of different financial partners, in addition to S³IDF. SELCO was deliberately created as a for-profit company rather than an NGO (non-governmental organization), in order to encourage transparency and accountability in the organization's work, forcing good business sense into all its programmes so that they are tuned into local economic conditions. 'It's a massive challenge. Governments may sometimes provide the finance, but who takes up the task of creating a supply chain?', asks Harish Hande, SELCO's Director.

Both S³IDF and SELCO are working on dozens of pro-poor projects in India that benefit from REEEP backing, and focus on improving access to different kinds of infrastructure – from ICT to electricity, heating, cooking and lighting, and thereby generate income. For instance, REEEP is funding an S³IDF project to substitute kerosene with LPG (liquefied petroleum gas) stoves fitted with pressure cookers.

S³IDF provides a single comprehensive source of funding, and technical and financial expertise to poor people ignored by conventional banks. Given the success of the Chintapally project, it is difficult in hindsight to see why banks are so reluctant to get involved in the first place. But deLucia believes that most mainstream Indian banks would neither understand nor establish contact with customers with such requirements. They would not be aware of the technology involved, and would nearly always demand collateral in return for a loan, something unavailable to the poor. Only small loans of below $100 do not require collateral. Their loans do not reach those below the poverty line as they deal mainly with middle-class and wealthy people. In many cases the poor often do not have knowledge of the process of procuring a loan.

S³IDF adopts a somewhat different approach than organizations that focus on macro goals to improve energy and computer access. One such approach is embodied in the visionary initiative spearheaded by Prof. M S Swaminathan over 10 years ago, and formalized in 2003, as a consortium of NGOs, academics, and corporations in the National Alliance for Mission 2007. This initiative's goal is to make 'every village a knowledge centre' by bringing the benefits of Internet connectivity to India's rural population living in over 600 000 villages. The

Government of India has funded and placed this vision in the framework of the NeGP (National e-Governance Plan), with the aim to provide governance and other services, in an integrated manner, at the doorstep of the citizen. It seeks to establish a network of more than 100 000 CSCs (common services centres) as internet-enabled front-end delivery systems or access points for various government and private services to the citizens. This is primarily targeted towards rural areas of the country, based on an entrepreneur-based PPP (public–private partnership) model, with an equitable geographical spread. The roll-out of the CSCs is proposed by the end of 2007.

deLucia and Harish Hande applaud the government's intentions, yet have chosen a more hands-on entry point. They bring themselves to focus on market linkages. Such linkages can be overlooked by the government which concentrates on the big picture yet does not necessarily have the resources to steward along the interconnected factors that facilitate success at a micro-economic level and contribute to greater success at the macro level.

The linkage approach means ensuring that the new technology, be it telephony, heating, lighting or computers, is not just physically installed but meshed with both income generation strategies and human networks in the wage-earning and financial community. This social penetration strategy is more likely to generate sustained development in markets and earnings. It is possible, suggests Hande, that 80% of the computer centres will not be working in two years' time because of the lack of consideration of these factors.

'Poverty is a complex issue. If you do not create a linkage (between technology, markets, and people), the technology is of no use,' states Hande. In another project supported by REEEP, SELCO and its partners funded dozens of new solar-powered sewing machines operated by self-employed seamstresses living in Ahmedabad, in Gujarat. The women earlier used manual sewing machines. The unit output from each sewing machine leapt from two to eight shirts per day, massively increasing productivity. The financial institutions were not convinced that this would be viable, that the women would be able to produce the work on a regular basis, and that there would be a market for the extra shirts. The REEEP funding in this case was specifically used to convince financial institutions and purchase some of the required equipment. It was SELCO's job to make them understand that this was possible by creating market linkages. 'I have always wanted to disprove the myth that you cannot run a commercial venture while trying to reach social objectives,' states Hande. He currently has REEEP funding to establish income-generating activities in connection with solar installations, including a project to install 30 new solar-powered telephone booths in Mangalore and 40 solar home lighting systems in Udupi, pioneered by a local entrepreneur as in the Chintapally case. 'Transaction costs are high and the REEEP cash buffers the costs,' he says.

Many of the projects can get extra funding from carbon credits sold to Western carbon offset companies, since a 40 watt solar panel used instead of a diesel generator, for instance, saves about 250 kg of CO_2 per year. According to Hande, more clean energy projects might go ahead if the government removes a new uniform tax which affects clean energy, and introduces tax incentives instead. Hande thinks that more progress can be made if state governments work with local banks. Banks have a specific portfolio on, for instance, agricultural business, but renewable energy is not considered separately.

deLucia uses renewable energy wherever possible, both for environmental reasons and also because 'it can be quite cost-effective when the grid is unreliable,' he explains. In some areas, peak use of the grid is so expensive that clean energy may be a viable option, especially if innovative finance is used. Clean energy is also suitable for rural areas where no grids exist in the first place, or where there are serious voltage fluctuations.

About REEEP South Asia Regional Secretariat

Shirish Garud*

REEEP SA RS (Renewable Energy and Energy Efficiency Partnership, South Asia Regional Secretariat) was established in 2005 under the AEI (Asian Energy Institute), for the monitoring of REEEP projects and preparation of case studies. Since then, the Secretariat has expanded its activities manifold. It now plans to spread its activities across all the countries in the region, and develop joint projects/activities with other secretariats. During the current year, six projects have been approved for the region under the sixth call for funding. The selected projects cover a diverse range of areas including energy efficiency projects and micro-finance options for renewable energy.

Energy scenario in South Asia

South Asia (comprising India, Pakistan, Nepal, Sri Lanka, Bhutan, Bangladesh, and Maldives), with a population of above 1.3 billion, is home to about one-fifth of the world's population. With South Asia poised for higher growth, sustainable energy supply is critical. Energy demand projections show that the demand for energy in this region is set to increase sharply over the next three decades. Availability of adequate energy that ensures, or at least is compatible with, long-term human well-being and ecological balance, is key to sustainable development in the region. The South Asian region thus faces the challenge of meeting the rapidly increasing energy demand as well as conserving natural resources and protecting the environment.

According to the EIA (Energy Information Administration), the primary energy consumption of South Asia increased by nearly 52% in the period between 1993 and 2003. The per capita primary energy consumption for South Asia is about 0.61 toe (tonnes of oil equivalent), which is very low as compared to the world average of 1.68 toe. Similarly, the per capita consumption of electrical energy is 393 kWh (kilowatt-hour), which is lower than the world average of 2429 kWh. The energy intensity, however, is one of the highest. Energy intensity, measured as total energy use per unit of GDP (gross domestic product), is about 0.65 toe/$1000 for South Asia as compared to a world average of 0.29 toe/$1000.

The total installed power generation capacity in South Asia is about 148 000 MW (megawatts), dominated by India (with an 82% share), followed by Pakistan (11%). The extent of the network and electricity access remains limited, especially for the rural sector within the region. Electricity demand in most of South Asia currently outstrips supply, and the region is characterized by shortages of supply as a result of limited generating capacity; low plant load factors due to ageing generators and poor maintenance of equipment at existing plants; and loss of power and theft over transmission lines (REEEP 2006).

A large proportion of the power generated comes from thermal power plants mainly because of heavy dependence of India on coal-based generation. Bangladesh and Pakistan too are heavily reliant on thermal plants for power generation. In the case of Nepal, Bhutan, and Sri Lanka, the generation mix is dominated by hydropower. Only India and Pakistan have nuclear facilities that account for 3% and 2% of each country's electricity generation respectively (REEEP 2006). Out of the installed power generation capacity in the region, renewable constitutes only about 5%.

Another critical issue in South Asia is that of access to energy. A large segment of the population does not have access to commercial energy sources and is dependent on traditional biomass. Traditional biomass is one of the main sources of energy in Bhutan, Maldives, Nepal, and even India. About 60% of the region's population does not have access to electricity (Table 1). Further, the countries in the

Table 1 Level of electrification in South Asia

	Electrification (%)	*Population without electricity* (million)
Bangladesh	20	104
India	43	579
Nepal	15	19
Pakistan	52	65
Sri Lanka	62	7
South Asia	41	775
World	72	1644

Source IEA (2004)

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region, except Bangladesh, are heavily dependent on imports for commercial fuels like oil and gas. Table 2 provides an overview of the energy sectors of six South Asian countries – India, Pakistan, Nepal, Sri Lanka, Bhutan, and Maldives.

Regional Secretariat activities

The activities of the SA RS serve to fulfil the overall objectives of the REEEP programme. During the year 2006/07, the Secretariat has been monitoring the ongoing projects, and has been handling the response to the sixth call for proposals by the REEEP IS (International Secretariat). The South Asia Secretariat plans to engage in additional activities to make its presence felt in the region. A meeting of experts was organized to identify regional priorities.

Following are the priorities identified at the meeting.

Policy and regulation

- Decentralization of policy development and facilitation by working with utilities, municipal corporations, and district committees.
- Paying heed to market distortions for off-grid applications and energy efficiency issues.
- Promotion of grid-based renewables through market-based instruments.
- Technology intervention as means to promote new financing and policy instruments.

Business and finance

- Creation of opportunities for bundling of project investments to provide adequate scale that will attract finance.
- Provision of finance for multi-country implementation of projects on demonstration of technologies.
- Mechanisms for mitigating or managing investment risk.
- Addressing specific needs for financing and developing credible ESCOs (energy service companies).
- Provision of finance to address problems of the small-scale sector.
- Access to finance available through carbon market and other such mechanisms.
- Development of management and decision-making tools to enhance capacity of stakeholders, and help in project development and implementation (these tools should address the gaps in conventional decision-making by stakeholders such as interaction with banks and financing institutions which are new to the concept of energy efficiency and renewable energy utilization).
- Development of partnerships among stakeholders within the region (these partnerships are expected to address barriers in development of projects such as gaps in technology and inexperience in implementation of projects).
- Addressing procurement policies in large government sector organizations in order to decide procurement on life-cycle savings and energy efficiency.

The findings of the experts' meeting were reported and discussed during the Regional Secretariat's meeting in September 2007 and the regional board representatives' meeting in Vienna in October 2007.

REEEP SA RS plans to organize the following events.

- Global project managers' meeting: The Secretariat is privileged to host REEEP's annual global project managers' meeting in February 2008. This meeting is likely to be attended by about 40 project managers from across the world.
- Special event on 'risk management in renewable energy projects': Scheduled for February 2008, this event will be organized during the DSDS (Delhi Sustainable Development Summit), immediately after the global project managers' meeting. With increasing interest in renewable energy projects and the increasing renewable energy market size, risk management in these projects is becoming crucial. The special event will thus cover an important but often neglected issue.

The SA RS also plans to organize a workshop on energy efficiency in hotels and small-scale industries in Bhutan, and further promotional activities in other countries. It seeks to develop best practices, with case studies focusing on successful projects in energy efficiency and renewable energy. Experts from the regional secretariat will contribute articles and papers on relevant topics to reputed publications.

Table 2 South Asia overview

	India	*Pakistan*	*Nepal*
I Energy provision			
Main sources of energy	For electricity ▪ Thermal – 84% ▪ Hydro – 12% ▪ Nuclear – 3% ▪ Others – 1%	For electricity ▪ Thermal – 63.7% ▪ Hydro – 33.9% ▪ Nuclear – 2.4% For energy (in general) ▪ Oil – 30% ▪ Natural Gas – 50% ▪ Coal – 6.5% ▪ Hydro –12.7% ▪ Nuclear – 0.8%	▪ Hydro – 92% ▪ Thermal (mainly coal) – 8%
Reliance on imported energy	▪ Small amount of imported coal for electricity generation ▪ Oil and gas imports – 70%	Oil imports – around 16.4% of the country export earnings	▪ Electricity – 10% of electricity demand is imported from India ▪ Coal – 97% imported ▪ Net importer of petroleum products
Extent of the network	▪ Rural household electrification – 44% ▪ Urban household electrification – 88%	▪ Half of population has access to electricity	▪ 40% of the population has access to electricity: 33% are connected to the grid and 7% use alternative sources ▪ High disparity in electricity in rural and urban areas
Capacity concerns	▪ Currently 'peak' and energy deficits. 100 000 MW needed to meet the increasing demand by 2012 ▪ Five regional transmission and distribution networks need to be interconnected to create a National Grid adding 60 000 km of lines by 2012	▪ Half of population has access to electricity ▪ The current issue is to cover actual and future deficits. By 2010 it will be necessary to add 5500 MW	▪ Power shortage leading to power imports and high reliance on hydro ▪ Slow expansion of the grid because of geographical difficulties ▪ Need for coordinated use of renewable energy sources
Potential for renewable energy	▪ Wind power – 45 GW ▪ Small hydro – 15 GW ▪ Biomass power – 19.5 GW ▪ Biomass gasifiers – 16 GW ▪ Biomass cogeneration – 3.5 GW ▪ Urban and industrial waste-based power – 1.7 GW	▪ 2010 – 0.84 Mtoe ▪ 2015 – 1.6 Mtoe ▪ 2020 – 3 Mtoe ▪ 2025 – 5.58 Mtoe ▪ 2030 – 9.2 Mtoe	▪ Hydro potential – 83 GW ▪ Other renewable energy potential is yet to be determined
Potential for energy efficiency	NA	NA	NA

	India	*Pakistan*	*Nepal*
II Energy market			
Ownership	Limited private ownership: ▪ Over 88 % of the electricity generation is owned by the states and the central government, as well as almost all transmission facilities. Private distribution is limited to the states of Orissa, Delhi, West Bengal, Maharashtra, Gujarat, and UP ▪ The main gas utility (Gas Authority of India) is state-owned as well as other firms in the refining and distribution activities	The main companies are state owned: ▪ The WPDA (Water and Power Development Authority) owns three generators, one transmission, and eight distribution companies ▪ The PAEC (Pakistan Atomic Energy Commission) owns two nuclear power plants ▪ The KESC (Karachi Electricity Supply Company) is partially publicly owned, however plans exist for its full privatization ▪ Other IPP (independent power producers)	▪ State owned monopolies in the electricity and oil industries run by the Nepal Electricity Authority and the Nepal Oil Corporation
Structure/extent of competition	▪ Vertical separation in generation, transmission, and distribution ▪ No competition at the electricity retailing level ▪ Competition in generation is allowed by the Electricity Act (2003)	▪ The companies owned by WPDA are vertically separated but KESC operates as a vertically integrated utility ▪ PAEC nuclear power plants and other IPP are connected to the national grid ▪ Transmission is responsibility of the Dispatch Company ▪ Competitive bidding schemes have been established for attracting new generation capacity	▪ The Nepal Electricity Authority is vertically integrated utility ▪ No competition at any industry level
III Energy policy and regulation			
Existence of an energy framework and programmes to promote sustainable energy	▪ An integrated energy policy is being developed by the Planning Commission of India ▪ A National Electricity Policy, including the development of renewable energy, run by the Ministry of Power ▪ A National Tariff Policy provides guidelines for purchase of renewable power	▪ The Energy Security Action Plan issued in 2005 is the most recent policy enacted by the government. ▪ The National Environment Policy in Pakistan (2005) stated that the government would promote energy efficiency and renewable energy sources. ▪ A draft of new Policy for Development of Renewable Energy has been published (January 2006)	No specific policy focusing on sustainable energy. However, there are the following programmes: ▪ The Biogas Support Programme ▪ The Renewable Energy Project ▪ The Energy Sector Assistance Programme
Role of government	▪ Ministry of Power: prepares power sector policies ▪ Planning Commission: currently developing an integrated energy policy ▪ Other policies are prepared by the respective government departments, including: • Ministry of New and Renewable Energy • Ministry of Coal • Ministry of Petroleum and Natural Gas • Department of Atomic Energy • Central Electricity Authority	▪ The NEC (National Economic Council) makes energy policy and approves plans related to the electricity sector ▪ The NEC works to plans formulated by the Energy division of the Planning Commission	▪ The National Planning Commission developed a Five-year Plan that included energy planning

	India	*Pakistan*	*Nepal*
Government agencies in sustainable energy	▪ The Ministry of New and Renewable Energy: promote renewable energy technologies at a Central Government level. ▪ The Bureau of Energy Efficiency under the Ministry of Power ▪ State level agencies for promoting and implementing renewable energy programmes	▪ The Alternative Energy Development Board in charge of facilitating, promoting, and encouraging the development of renewable energy	▪ The Alternative Energy Promotion Centre in charge of promoting alternative sources of energy in rural areas
Energy regulator Date of creation	▪ CERC (Central Electricity Regulatory Commission) was established in 1998 <http://www.cercind.org/> ▪ 18 States have also formed their own SERCs (State Electricity Regulatory Commissions)	▪ The NEPRA (National Electric Power Regulatory Authority) established in 1997 <http://www.nepra.org.pk/> ▪ The OGRA (Oil and Gas Regulatory Authority) created in 2000	▪ Tariff Fixation Commission. It is not, however, considered a Regulatory Authority
Regulatory framework for sustainable energy	▪ The Electricity Act (2003) mandates SERCs to specify a percentage of energy to be procured from renewable energy sources. ▪ The Energy Conservation Act (2001)	NA	▪ Electricity Act 1992 (Regulations –1993)
Regulatory roles	▪ CERC roles include regulation of tariffs for generation companies and promoting competition. ▪ SERCs roles include tariff regulation and promotion of cogeneration and electricity generation from renewables	▪ NEPRA: licensing, tariff regulation, market surveillance in the electricity industry ▪ OGRA: licensing, tariff setting, promotion of competition, market surveillance in the oil and gas sectors	▪ The Tariff Fixation Commission fixes the electricity tariff and other charges on the basis of the rate of depreciation, reasonable profit, changes in consumer price index, and so on ▪ Administration of subsidies and transfers to low-income groups

	Sri Lanka	*Bhutan*	*Maldives*
I Energy provision			
Main sources of energy	Electricity: ▪ Hydro – 37% ▪ Thermal (mainly oil) – 63% Primary energy: Biomass (47%); Oil (43%); Hydro (3%)	Electricity: Hydro – 99.9%	The main power generation source is diesel
Reliance on imported energy	▪ Net importer of oil ▪ Primary energy imports – 43%	▪ Net importer of oil ▪ Primary energy imports – 50% ▪ Electricity is imported from India during winter months	Net importer of fossil fuels.
Extent of the network	▪ Urban – 85% ▪ Rural – 47% ▪ Estate – 50%	▪ Rural – 30% ▪ Urban – higher but rate not known	▪ 200 inhabited islands have electricity supply but not all have continuous supply
Capacity concerns	Limited capacity for increasing hydroelectric generation. New capacity should be met mainly with thermoelectric supply	▪ No capacity concerns for the moment. Bhutan has excess supply that is exported to India.	▪ Capacity largely fossil fuel dependent ▪ The government is exploring renewable energy as an option for replacing generators destroyed by the Tsunami

	Sri Lanka	*Bhutan*	*Maldives*
Potential for renewable energy	▪ Biomass electricity – 1.8 GW ▪ Wind energy – 2.4 GW ▪ Small hydro – 250 MW	▪ Small hydro plants – 30 GW ▪ Solar and wind energy resources mapping are developing	▪ Medium to good potential for wind power
Potential for energy efficiency	NA	Many small and medium enterprises have potential for implementing energy efficiency technologies	NA
II Energy market			
Ownership	State owned companies CEB (Ceylon Electricity Board) and CPC (Ceylon Petroleum Corporation) are responsible for electricity and petroleum supply	▪ BPC (Bhutan Power Corporation) is a state-owned utility. Other energy generators are state-owned as well. ▪ Petroleum products are distributed by three private owned companies: Bhutan Oil Distributors, Damchem Petroleum Distributors, and Druk Petroleum Corporation. The petroleum supply comes form two Indian public companies: Bharat Petroleum and Indian Oil Corporation	The STELCO (State Electric Company Limited) is a State owned utility providing electricity in 23 islands. The other islands have power organized by the island community or private owners
Structure / extent of competition	▪ CEB is a vertically integrated power utility. ▪ Competition and generation and retail level exists. IPP supply energy competitively to CEB	▪ BPC is vertically integrated – generation, transmission and distribution. There are other state-owned generators ▪ There is no competition	▪ STELCO is a vertically integrated utility ▪ There is no competition
III Energy policy and regulation			
Existence of an energy framework and programmes to promote sustainable energy	▪ A national energy policy is under preparation ▪ The Electricity Reforms Act includes privatization and other reforms in the electricity sector ▪ Sri Lanka Rural Electrification Policy (2002) has the objective to expand access to electricity to 75% of population by 2007 ▪ Renewable Energy for Rural Economic Development, project under implementation	▪ Electricity Act (2001) ▪ An Integrated Energy Management Master Plan is currently under development ▪ There is no specific programme to promote sustainable energy, however some donor agencies are supporting projects on sustainable energy	▪ There is no specific energy policy or sustainable energy programme. However the energy policy is embodied in a National Development Plan 2001–2005. In the energy sector, this plan proposed the use of sustainable energy for power generation, and the use of efficient, low emission combustion systems in transport and electricity generation
Role of government/department	▪ The Ministry of Power and Energy play the central role in the energy sector	The DoE (Department of Energy) under the Ministry of Trade and Industry is responsible for the overall planning and development of the energy sector	▪ The Ministry of Planning and National Development is responsible for overall planning, including the energy sector

	Sri Lanka	*Bhutan*	*Maldives*
Government agencies in sustainable energy	▪ There is no separate agency for promotion of sustainable energy. This is handled by the ministry of Power and Energy ▪ The Energy Conservation Fund has been established in order to finance and promote projects related to energy conservation and energy efficiency	▪ Renewable Energy Division under the Department of Energy ▪ National Environment Commission is responsible for environment protection	The Ministry of Energy, Environment, and Water has a specific role in energy supply and environmental protection
Energy regulator Date of creation	▪ The Public Utility Commission of Sri Lanka created in 2002 <http://www.pucsl.gov.lk/>	BEA (Bhutan Energy Authority) <http://www.bea.gov.bt/>	Maldives Electricity Bureau <http://www.meew.gov.mv/mea/>
Regulatory framework for sustainable energy	▪ The Electricity Reforms Act (2002) ▪ The Public Utilities Commission of Sri Lanka (2002) ▪ The Energy Conservation Fund (1985)	▪ The Electricity Act 2001 has no specific mentions for Sustainable Energy	NA
Regulatory roles	▪ Licensing, tariff regulation, standards setting, and promotion of competition	▪ Regulation of tariffs, standards, codes, principles, and procedures	NA

Mtoe – million tonnes of oil equivalent; GW – gigawatt; MW – megawatt
Source REEEP (2006)

Reference

IEA (International Energy Agency). 2004
World Energy Outlook
Paris: IEA

REEEP (Renewable Energy and Energy Efficiency Partnership). 2006
Policy and regulatory review
Vienna: REEEP

REEEP projects

Following are summary reports of three REEEP projects

Financing for bundled small-scale rural renewable energy ventures in India

REEEP Project 2007/08

e3V (Environment Energy and Enterprise Ventures Private Ltd), Yes Bank Ltd, and the GEI-A (Global Environmental Institute – Americas) are jointly implementing a project titled 'Financing for bundled small-scale rural renewable energy ventures in India'. The project is supported by REEEP and the Blue Moon Fund, in conjunction with GEI-A and private capital from team members.

At present, small-scale RE (renewable energy) ventures in rural India have difficulty in accessing finance. Major banks in India do not have established internal practices dedicated to financing bundles of subject ventures. Further, banks in India have extremely limited experience in successfully integrating and securing carbon finance with conventional financing for such bundles. As such, the challenge is to provide these ventures with access to reasonably-priced capital that permits them to defray the associated high upfront costs. The e3V/Yes Bank/GEI-A team aims to address this issue, and to define and make operational a new credit practice in Yes Bank focused on financing small-scale RE ventures in rural India.

The project will target small-scale (defined by the team as ventures requiring under £100 000) RE ventures in rural India. The team will work together to

design, develop, and pilot the new credit practice that will integrate lending modalities to finance subject ventures. The programme will work in three vectors. In the first vector, the strategy, threshold criteria, operational procedures, and a model financing structure will be articulated. In the second vector, a pipeline of attractive transactions will be identified and presented to the new operation. The team will then screen potential ventures and allocate financing for a bundle of commercially attractive transactions. The initiative will work to aggregate carbon emission reduction units from the bundle to augment financing. Finally, the team will script the structuring documents for customized financial instruments to complement Yes Bank's lending practice, with a facility offering tailored investments for subject transactions.

The project will open access to finance for small-scale RE ventures and demonstrate to other financial institutions how this can be done. Finally, the programme will illustrate how carbon financing can be assembled for bundles of small-scale RE ventures. It will work with institutions known to the team which can deliver bundles of commercially viable subject ventures that provide RE-based energy services to help eradicate poverty in rural India.

The project will promote environmental sustainability through reductions in GHGs (greenhouse gases). In basing the project at a major commercial bank in India, the team is developing an open financial system for subject ventures that does not rely on subsidies but encourages a rule-based, predictable and non-discriminatory financial framework. Finally, the project creates a global partnership between purchasers of emissions credits in the OECD (Organization for Economic Co-operation and Development) and local RE ventures in India.

e3V, Yes Bank and GEI-A team members have served as advisers to commercial, foundation, and government clients, on financing for subject transactions in the agriculture sector. The team has the experience base, credit profile, fiscal discipline, sector knowledge and management structures to successfully design, develop and manage the lending practice and equity fund.

Removal of financial and institutional barriers in mainstreaming biomass gasifier systems for thermal applications in India

REEEP Project 2007/08

A major portion of energy is consumed in the SMiE (small and micro enterprise) sector to meet low-grade thermal energy requirements such as water heating, steam generation, and hot air generation. These thermal requirements are presently met either through combustion of fossil fuels like coal, lignite, diesel, and fuel oil, or through electricity. Every year, about 246 MT (million tonnes) of agro-residues are produced out of which about 100 MT remain unutilized. Most of the biomass utilized is consumed for generating heat with methods that are energy inefficient.

There are over one million SMiEs that burn biomass fuel for different industrial processes. There are 22 major industrial sectors where boilers supply process heat up to a temperature of 150 °C. Besides, they are used in the commercial sector, for instance, in hotels, guest houses, and hospitals. The use of biomass gasifiers for thermal applications is most appropriate in this temperature range and hence can be very effectively utilized to meet this thermal energy demand.

TERI (The Energy and Resources Institute) has initiated a study for removal of financial and institutional barriers in mainstreaming biomass gasifier systems for thermal applications in India and increasing their adoption in SMiEs and the institutional sector. One of the objectives of the project is to upscale the current financing mechanism through the creation of a revolving fund for existing gasifier manufacturers in India. The revolving fund will finance manufacturers, users, and LSPs (local service providers) through alternative financing options. The saved energy costs will be used to repay the loan amount. A separate line of credit will be formed to overcome financial barriers and to facilitate large-scale penetration of gasifier technology in India. The fund will provide initial capital for acquiring gasifier systems on flexible terms and conditions. It will offset the risk involved in adopting the technology, especially during the initial stages of penetration. Besides, there will be specific training modules for different target groups such as users, marketers, manufacturers, LSPs, financial institutions, among others.

Both small industries and conventional financing institutions hesitate to invest in new technologies such as gasification. The problem of energy accessibility for small industry sector could be solved through introduction of locally available biomass resources. The project also holds scope for livelihood generation. It will address issues like credit mobilization, delivery mechanisms, quality control and working capital requirements.

Extensive and continued discussions will be held with all stakeholders to formulate schemes for diffusion of products developed and their

demonstration in a near-commercial and sustainable manner. For monitoring the development of the project, a PSC (Project Steering Committee) comprising of energy experts, industry association representatives and senior officials from the Ministry of New and Renewable Energy will be constituted. The committee shall meet at least once in six months. A monitoring team comprising of TERI professionals will conduct concurrent monitoring of the project at appropriate intervals. The team will be guided by the PSC. Project evaluation will be conducted by an independent agency/consultants guided by the PSC after completion of one year. Management Information System will be developed by TERI to track changes in the monitoring indicators, and will be a vehicle of communication, information and feedback.

The creation of a chain of stakeholders involved in financing, manufacturing, sales, upgradation of technology, and utilization of services, will create market and business opportunities in the biomass energy sector. The project will contribute to addressing poverty through income generation, and unsustainable growth through its focus on clean and renewable energy.

Linking income generation to energy services: solar lights for silk farmers

REEEP Project 2006/07

With increase in the pace of economic growth and infrastructure development all around the globe, the gap between the rich and poor is widening. Basic minimum amenities, like energy services and clean water, are still beyond the reach of the poor.

SELCO (Solar Electric Light Company) India's mission is to create affordable energy services for the poor by providing innovative products and piggybacking on creative financing. SELCO in its 13th year of operation has debunked the myth that solar energy is expensive for the poor. Partnering with local financial institutions, micro-finance institutions and nationalized banks, SELCO has created innovative financial products to make solar power affordable for the poor.

In 2006/07, SELCO applied for financial assistance from REEEP (Renewable Energy and Energy Efficiency Partnership) to create innovative linkages between energy services, income generation and financing. The project has helped SELCO in creating many innovative financial models for renewable energy services over a period of twelve months. It has implemented 10 different projects using five financial models and partnering with eight financial institutions including SEWA (Self Employed Women's Association) in Gujarat. In all REEEP supported projects, SELCO has linked energy services (like solar lighting and cooking) to income generation, leading to improvement in the quality of life for the client while ensuring the payment of the loan.

One of the 10 projects provided reliable electricity to rural households which reared silk worms for a living. Frequent power cuts and unsafe methods of lighting (candles and kerosene lamps) hampered their work thus leading to loss in income. The silk farmers needed light inside the farm to feed and re-arrange the silk worms but non-availability of electricity forced them to use either kerosene lamps or candles resulting in reduction in quality of the end product. Many a times, wax drops from candles would kill numerous silk worms leading to substantial financial losses. On surveying, SELCO found that solar lights would be an ideal solution for these farmers but the initial high cost was a barrier. SELCO, using the REEEP funding, created guarantee funds in a local financial institution called VSS (Vana Samrakshana Samithi) — an agricultural cooperative society bank. Against these guaranteed funds, the cooperative society financed 33 farmers for solar lights. As the farmers conduct all their trade (in silk and milk) through the VSS, loan instalments are deducted from the payments.

This initiative has proven that if appropriate linkages are created, flexible financing is provided, and value-added energy services are designed according to the consumers' needs, wonders can be done. The establishment of these linkages also proves that solar power is a viable option.

A silk farmer checks silk worms with a SELCO solar light

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