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# Energy and Sustainable Development in Bangladesh


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## Summary of Report


Bangladesh's situation is typical of most developing countries, i.e., additional funds to pursue sustainable development are not available even although decision makers may be aware of the correct strategy. The scarcity of resources can become so critical that in many cases a path contrary to that of sustainable development is followed. Often policy makers do not understand the implications of the development path they are pursuing. Capacity building of government agencies therefore is essential in charting a sustainable energy development path.

# Preface

Historically, in Bangladesh, data dissemination has always been treated as a sensitive issue by government departments. As a result, efficient data management has not evolved. Although some social and economic indicators are maintained and monitored by international agencies, the initial sources of these data are the state agencies. Most of these agencies make data available only for the current year. Historical data are either not maintained, or nearly impossible to dig out from old files and documents. Most data are gathered and processed in a particular format for the preparation of the national budget. The Bangladesh Bureau of Statistics (BBS) collects data for all the important sectors, and publishes a statistical yearbook. While data for a few sectors such as trade, revenue, and population are fairly accurate, those for agriculture, biomass use, transport, etc. are mostly estimates. In most cases, data is incomplete and not up to date. In some cases, the data can even be incorrect. In recent years, some agencies have stated constructing websites for disseminating information and a limited amount of data.

For this report personal communication directly with the relevant government agency was used to obtain data and information.

## Authors

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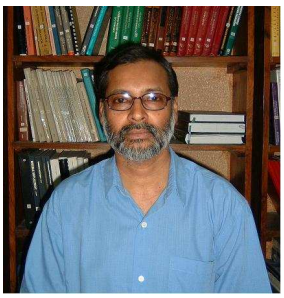

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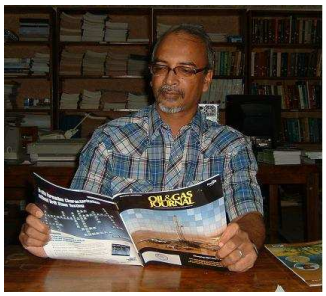


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# Executive Summary

This is a report on HELIO International's Sustainable Environment Watch (SEW) Indicators for Bangladesh. A description of the indicators can be found in HELIO's website[1].

Bangladesh is a small (144,000 sq km) and populous (144 million) country. Its Purchasing Power Parity (PPP) per capita income is below US$2000. Commercial energy consumption per capita is one of the lowest in the world at 115 kgoe. Domestic natural gas constitutes 69% of the primary commercial energy; the balance (oil and coal) is imported. Nearly 2% of the GDP is spent on energy import. The trade deficit is increasing yearly and external debt stands at $21.3 billion.

The eight HELIO SEW indicators for Bangladesh for the years are summarized in Table 1.

**Table 1: SEW Indicators for Bangladesh for the Year 2004**

| Indicators | Unit | 1990 | 2004 | Change |
|---|---|---|---|---|
| CO2 Emission | kg C per capita | 41.5 | 79.3 | Positive |
| Particulates – Dhaka City | Tonnes | 320 | 731 | Negative |
| Electrified Households | % | 10 | 33 | Positive |
| Clean Energy Investment | % of Energy Sector Investment | 0 | < 1 | Positive |
| Energy Import | % of Fossil in MJ | 35 | 32 | Positive |
| Non-Renewable Energy Sector Investment | % of GDP | 1.73 | 1.29 | Positive |
| Commercial Energy Intensity | MJ/US$ (PPP) | 2.45 | 2.36 | Positive |
| Renewable Energy Deployment | % of Primary Energy | 65 | 49 | Negative |

The eight SEW indicators have been graphically presented as a "STAR", and it shows that only two out of the eight indicators have significantly worsened since 1990. The worst deterioration has been in urban air pollution with "Particulates" nearly doubling. The other indicator, which is moving away from environmental sustainability, is renewable energy. Due to the rapid increase in the consumption of fossil fuels, the share of renewable energy (biomass) has decreased significantly, however in absolute terms, due to population increase, the quantity of biomass consumed has increased remarkably. The non-renewable energy sector investment as a percentage of GDP has reduced, but this should not be misinterpreted as an improvement; a severe energy shortage exists and the decline in investment indicates the Government's failure to keep pace with growing demand for energy.

The per capita carbon emission has increased substantially indicating significant economic growth, and since it is still much below the desired

[1] Home page – www.helio-international.org

global average, Bangladesh can continue to develop and increase its CO2 emission. The other positive trend is that access to electricity is increasing, as is clean energy investment, albeit at a very slow pace. The other indicators are nearly the same for 1990 and 2004, with the energy intensity showing a slight decrease, implying low GHG emissions accompanying economic growth. Even though the country's dependence on imported energy has decreased in percentage terms, the quantity imported has increased enormously and is a drain on scarce foreign currency.

## General Discussion of the Country

Bangladesh is located in South Asia on the eastern flank of India. Its southern boundary is the Bay of Bengal. It shares more than 4000 km of border with India, which is naturally its largest trade partner. In the extreme southeast Bangladesh's neighbour is Myanmar. Bangladesh is a small country with a total area of 144000 sq km. Although only 10000 sq km of this area is water, during the rainy season more than half of the country remains under water, and cultivation is obviously restricted to high ground. The major portion the water comes from rainfall and melting snow in the eastern Himalayas. These waters flow into the Bay of Bengal through Bangladesh and flooding is a regular occurrence.

The total permanent arable land is approximately 8.5 million hectares, which is about 60% of the land area. Out of this about 40000 sq km is irrigated[2]. The principal crop is rice, which is grown in roughly 10 million hectares land – some land being double and triple cropped. Other agricultural products include potatoes, jute and tea. Bangladesh has a large animal population[3] with 24 million cattle and 34 million goats – nearly all reared at the household level. Poultry production has changed dramatically in the last decade due to the advent of commercial poultry farms where less than 50% of the 150 million chickens are free range.

Despite the low growth of per capita income Bangladesh has been one of the most successful countries in reducing the population growth rate. The population growth rate of 3.9% in the early seventies has fallen to under 2%[4]. The growth rate is projected to fall further to 1.7% by 2015[5]. The present population is estimated to be 144 million. The urban population has grown at a much higher rate similar to in other rapidly developing countries. It has grown from 9.9% in 1975 to 24.3% in 2003, and is projected to be 30% by 2015[6]. According to a 2003 estimate, 43% of the population over the age of 15 are literate, i.e., are able to read and write. By this definition only 32% of the female population and 54% of male population are literate. Extreme poverty has been reduced in Bangladesh

[2] http://www.nationmaster.com/country/bg/agr&b_cite=1&b_define=1
[3] Banglapedia, 2006. Data for 1998, http://banglapedia.net/HT/L_0115.HTM
[4] http://www.cia.gov/cia/publications/factbook/geos/bg.html#People
[5] http://hdr.undp.org/statistics/data/pdf/hdr05_table_5.pdf
[6] http://www.lcgbangladesh.org/MDGs/docs/Bangladesh%20MDG%20progress%20report.pdf

from 28 percent in 1990 to 19 percent in 2002[7], and widespread starvation has practically disappeared. However, instances of near starvation do prevail in certain parts of the country especially at times when agricultural work is not available.

Against all odds the GDP growth has been a steady 5% for nearly two decades. The estimated 2004 GDP is 278 billion dollars (PPP) and GDP per capita (PPP) is $1980[8]. . The Ready-made Garments industry is the largest foreign currency earner in the manufacturing and industrial sectors. However, the largest foreign exchange earning are the remittances of millions of workers abroad. Apart from readymade garments Bangladesh exports jute and jute goods, leather and leather goods, tea, frozen fish and seafood. Up to now the impacts of globalization have been painless. The predicted devastating effect on the garments export industry hasn't materialized. The import list is enormous: machinery and equipment, chemicals, polymer resins, iron and steel, aluminum, textiles, several different foodstuff, petroleum products, coal and cement are the main items. Bangladesh also imported 3.7 million tons of crude oil and petroleum products in 2004.

The trade gap is widening every year, and external debt stands at 21.3 billion US dollars[9]. The government has taken several steps to increase industrialization and increase export. One key measure was decreasing the interest rate. The other important measure was the simplification of the procedures for setting up of an industry. As a result, the industry has grown on an average of 7% in last three years. Power supply disruption has been the biggest hindrance for further development. The Government is also trying to attract foreign direct investment in nearly all sectors. As a part of structural reform, the government is privatizing state concerns that are a financial drain. Although the private industrial and commercial sectors are growing rapidly, and in terms of employments are much bigger than the public industrial and commercial sectors, the public sector still plays the biggest role in the industry GDP because nearly the entire energy sector and the giant fertilizer industry are government owned.

The major environmental threats in the capital city, home to more than 10 million people, are air pollution and management of municipal solid waste. Banning of two stroke, three wheelers, introduction of lead free gasoline and the promotion of CNG vehicles have significantly improved the ambient air quality in the last four years. The banning of plastic bags has had a big impact on the cleanliness of the city roads and water drainage. The management of municipal solid waste is expected to improve further with the implementation of two CDM projects – a landfill project and a composting project.

The CIA World Fact Book[10] provides a good summary of the principal environmental pressures – "Many people are landless and forced to live on and cultivate flood-prone land. Water-borne diseases are prevalent in

[7] http://www.mdgbangla.org
[8] World Development Report, 2006. The World Bank
[9] http://www.cia.gov/cia/publications/factbook/geos/bg.html#Econ
[10] http://www.cia.gov/cia/publications/factbook/geos/bg.html#Geo

surface water. Water pollution, especially of fishing areas, results from the use of commercial pesticides, ground water contaminated by naturally occurring arsenic are major concern. Intermittent water shortages because of falling water tables in the northern and central parts of the country creates water crisis during winter dry season". A website[11] dealing with the UN Millennium Development Goals (MDGs) in Bangladesh notes that "Bangladesh faces serious challenges in the area of water and sanitation, particularly due to arsenic contamination of underground water. This has reduced the coverage of access to safe water to approximately 70 per cent. The use of sanitary means of excreta disposal has increased from 21 per cent in 1990 to 43.4 percent in 2000, but lags behind the planned goal of 80 per cent. Soil degradation and erosion, deforestation and severe overpopulation are the other principal environmental challenges of the country". Through social forestry programs, forest cover has been increased from 9 to 10.2 per cent during the decade 1990 to 2000 thus enhancing environmental sustainability[12].

The Millennium Development Goals: Bangladesh Progress Report[11], jointly prepared by the UN and the Government of Bangladesh and published in February 2005, notes how Bangladesh is consistently keeping on track in meeting the UN Millennium Development Goals. For Bangladesh, the goals to be achieved by 2015 include lowering of poverty rate to 29.4 percent (presently 44%), a 100 percent universal primary education (83% in 2003), reduction of child mortality to 50 per thousand live births (presently 63), improvement of maternal health or less fatalities in hundred thousand natal conditions to 143 (now 320), and increasing environmental sustainability by 20 percent.

Micro-credit is undoubtedly the biggest success story of Bangladesh's poverty reduction. For over a decade, its impact on the rural economy was substantial. It was expected that borrowers would be able to progressively borrow larger and larger sums and drive the rural economy by moving into small enterprises, but this expectation has not materialized. Different models are being experimented to promote small and medium enterprises.

The empowerment of women in Bangladesh is also intrinsically connected to the success of micro-credit schemes. Since over 90% of the borrowers are women, the spin-off benefits of gender equality flows automatically from the large micro-credit activities of NGOs. The Government has taken a noteworthy step to make education for female students free up to the 12th year, and is contemplating extending the scheme to the university graduation level. Women's participation in local government has also been assured through reserved seats. Women's access to birth control measures and maternal and child healthcare have also been improved significantly throughout the country.

Political instability is probably the biggest obstacle to achieving a higher growth rate. The two major political parties are constantly embroiled in

[11] http://www.lcgbangladesh.org/MDGs/docs/Bangladesh%20MDG%20progress%2
[12] http://www.mdgbangla.org

conflict, and regularly enforce strikes and shutdowns. Corruption is rampant at all levels of the government. In theory, there exists full political freedom, but in practice, due to the culture of intimidation and sometimes secret killings, most opposition is muted.

Table 2 lists some important relevant development indicators for Bangladesh. As can be seen Bangladesh's rank in the three indexes are very poor.

**Table 2: Relevant Development Indicators for Bangladesh**

| Indicator | Value |
|---|---|
| Human Development Index (and ranking)[13] | 0.52; ranks 139 out of 177 (2003) |
| Human Poverty Index (and ranking)[13] | 44.1%; ranks 86th among 103 developing countries (2003) |
| Environmental Sustainability Index[14] | 44.1; ranks 114 among 146 countries (2005) |
| Energy Sector GHG Emissions[15] | 40.4 million ton (CO2) (2004) |
| GDP and GDP per capita[16] | $278 billion, $1980 (both PPP, 2004 estimate) |

## Overview of National Sustainable Development Strategy

Bangladesh does not have a National Sustainable Development Strategy. The closest thing to a SD Strategy is the Poverty Reduction Strategy Paper (PRSP) document.

The chronology of the environmental and SD action plans is as follows.

1. The Bangladesh Conservation Strategy, 1995
2. National Environment Management Action Plan (NEMAP), 1996
3. Bangladesh: Poverty Reduction Strategy Paper (PRSP), 2005
4. Bangladesh's strategy for the Millennium Development Goals (MDG)
5. National Conservation Strategy, adopted 2005 but awaiting final approval

The 1995 Bangladesh Conservation Strategy is a command and control strategy to tackle some of the pressing environmental issues of the late eighties and early nineties however it does not deal with Sustainable Development (SD). Probably the biggest achievement in environmental management was the NEMAP, which was a massive countrywide national consultation of all sectors of society with special emphasis on grassroots participation. This plan was prepared by the Ministry of Environment and Forest (MoEF) to identify key environmental issues, including conservation and the improvement of environmental conditions, promoting sustainable

[13] http://hdr.undp.org/statistics/data/pdf/hdr05_table5.pdf
[14] http://www.yale.edu/esi/ESI2005_Main_Report.pdf
[15] Indicator 1 in this report; combustion of fossil fuels only.
[16] World Development Report, 2006. The World Bank.

development and raising the quality of human life. The Flood Action Plan, National Water Plan and Disaster Management Plan are a couple success stories in Bangladesh that have benefited from the NEMAP stakeholder consultation process. Despite an initial burst of activity, NEMAP implementation has effectively come to a halt due to the lack of funding. Nevertheless, it has made a big contribution by creating a large database of the country's environmental vulnerabilities. Examples of environmental issues that NEMAP has been able to bring to the forefront are: salinity encroachment in the Sundarbans; desertification in the Northwest; deforestation; soil degradation; wetland encroachment; and loss of biodiversity in different areas of the country. NEMAP is now the starting point for all environmental work in Bangladesh. It has also been used extensively to formulate the 2005 National Conservation Strategy.

The country's sustainable development activities are focused around the World Bank's PRSP and the UN Millennium Development Goals (MDG). The PRSP is probably the most comprehensive document available in the public domain that deals with sustainable development. The section on environment and sustainable development provides a reasonable discussion on the major environmental issues affecting Bangladesh. It also provides a Policy Matrix showing major goals and actions that need to be taken, along with responsibility allocation for ensuring sustainable development. However most recommendations are in general terms and the allocation of responsibility is weak. Most importantly the PRSP does not deal with the sticky issue of funding. Undoubtedly, both the World Bank and United Nations Development Programme (UNDP) will provide funding for some of the PRSP recommendations and the MDG goals. Nevertheless the extent of the funding and the seriousness of the implementation cannot be gauged and it is likely that some issues would remain unaddressed.

The updated National Conservation Strategy (NCS) is supposed to be a more comprehensive document on environment and SD, but a sectoral implementation approach has been recommended. With most ministries struggling with their core business and juggling scarce resources, this implementation approach is not likely to bring any real results. The NCS has not been placed in the public domain, and will only be made pubic after incorporating the suggestions that were made in a consultative national workshop held in May, 2005.

From the foregone discussion, it is clear that Bangladesh's SD policy is a mixture of cross-sectoral strategies, as in the MDG, and sectoral strategies, as in the PRSP and NCS. It has been suggested that a Sustainable Development Commission be established in Bangladesh to perform responsibilities relating to the formulation and implementation of a sustainable development strategy. SD activists are concerned about the lack of focus on SD and have urged the Government to first, set up a SD Commission under the Prime Minister. A subsequent step would be to formulate a comprehensive strategy taking into account the recent developments and thinking on SD, such as clean energy, GHG reduction, efficient resource utilization based on life cycle analysis and ecosystem protection.

Since the responsibilities for implementing the SD strategy is left to different ministries, in all probability no additional funding from government sources will be made available for its implementation. Ministries will be expected to manage within their current allocations from the annual development budget. The only additional funding that may be expected is that from bilateral and multilateral sources made available from time to time for implementing selected aspects of the SD strategy. The MoEF, which is the guardian of the NCS, expects to implement the strategy by a command and control type of structure. Since the MoEF is one of the least powerful ministries, the implementation will depend heavily on the commitment of the relevant ministry.

The greatest weakness of Bangladesh's approach to SD is that most of the actions are stated in general terms are not linked to any targets. Only one target is stated unambiguously, and that is to increase to 20% by 2015 the amount of land covered by forest[17]. Considering that approximately only 10% of the land is currently covered by forest this target is completely unachievable. Another example of the lack of specificity in the SD approach is the introduction of energy efficient cooking stoves in rural areas. This SD policy has been in place since the late seventies and has achieved very little success despite several well-funded efforts. Another drawback is that the strategy is very much rooted in the classical ideas of environmental management and has not incorporated the newer ideas of Sustainable Development.

In terms of the strengths of the strategy, it can be said that since a considerable portion is linked to the PRSP and the MDG, some funding in the next two decades is assured. The other is that the most significant environmental vulnerabilities have been identified.

## Other Energy Related Developments

There exists a heavy reliance on traditional fuels such as agricultural residue, tree residues, firewood and dung. An overwhelming number of rural households (> 95%) use biomass for cooking. Only the very well-to-do households use kerosene and LPG however these fuels are not use exclusively but rather are supplementary to biomass. Among the biomass users there is a progression from agricultural wastes/cow-dung to firewood as income levels increase. The over-exploitation of biomass has caused many designated forests to become deforested; every year it is becoming harder and harder for households to collect the desired quantity of biomass. The widespread use of crop residue as fuel and fodder and the collection of cow-dung from the land have resulted in a decrease in soil organic matter content. Opinions differ on how people have coped in an arena of dwindling supply of biomass fuels and increasing population but it is clear that the improved cook-stoves that were being promoted to address the projected crisis have not played a significant role. One thing that has probably played a key role in tackling the looming disaster is household and social forestry. It may be that the biomass crisis prediction

[17] International Monetary Fund, 2005. Bangladesh: Poverty Reduction Strategy Paper, IMF Country Report No. 05/410, http://www.imf.org/external/np/prsp/prsp.asp

of the seventies was premature and that prediction of "doomsday" has been postponed due to a variety of measures adopted by the biomass users.

Given the many priority areas that require funding the Bengali government is finding it increasingly difficult to fund energy development. The per capita energy consumption is approximately one-third that of its neighbours, India and Pakistan. Renewable energy deployment is extremely low. Since the pressure to increase the energy supply is intense, and multilateral funding has dried up, the government is constantly looking for bilateral sources. The requirements attached to these funding sources are often contrary to sustainable energy development.

Two energy related issues that are relevant to SD are:

1. development of coal resources; and,
2. opting for low efficiency gas turbines.

The policy of the government is to develop its potentially large natural gas resources but the lack of domestic funding is severely hampering progress. Even though international oil companies (IOCs) are very keen to develop Bangladesh's gas resources, clear-cut policies have not be formulated to attract adequate investment. Widespread distrust of foreign companies severely restricts the government from engaging IOCs in further exploration and development activities. The situation with independent power producers (IPPs) is also similar and is restricting power generation expansion. The development of the coal resources and purchase of low efficiency gas turbines through "supplier's credit" is a direct result of the government's desperate attempt to fund the energy sector and is one that runs contrary to sustainable development objectives. Not only have no provisions been made to collect coal bed methane but 1980s coal power generation technologies are being used. The lack of funding for developing its natural gas resources and to promote energy efficiency, coupled with concerns of energy security is forcing Bangladesh to take the path of unsustainable energy development.

Bangladesh's import policy is heavily biased against energy efficient devices. The 1995 National Energy Policy (NEP) made the following suggestion for encouraging efficient use of energy: "Incentives for fuel efficiency for all categories of end-uses may be given". Not a single law has been formulated to promote it. Since most of Bangladesh's energy consuming devices are imported, import duties can greatly influence what type device is imported. Goods are considered to be luxury items purely on the basis of their price. Moreover, there is no provision for judging the durability or energy efficiency of an imported item. The most classic example of such a policy aberration is illustrated in the case of compact fluorescent bulbs (CFB). These were at one time classified as luxury items and a 60% tax was imposed. The highly energy inefficient incandescent bulb enjoyed a 15% tax. The transport sector, which consumes the bulk of the imported oil, is severely constrained by restricting rules and regulations that do not encourage efficiency. Exorbitant taxes and duties on transport vehicles and their accessories forces transport owners to continue using old vehicles for as long as they can. Fortunately, for the

past three years CNG vehicles had been promoted in Dhaka. Tax incentives have been offered for the import of CNG busses and CNG kits and cylinders for converting gasoline vehicles.

Except for coal, the Bengali government fixes energy prices and does so on an ad-hoc basis. In most cases prices are based on recovering immediate costs. Not only does this pricing system not allow for fund accumulation to support expansion and development, but depreciation costs are sometimes not recovered. Resource costs are not also accounted for.

Huge system losses, which are in reality "theft", make matters worse. Low energy prices will greatly assist in the achievement of the MDGs, but there is serious risk of energy profligacy and hence to increased per capita GHG emissions. The main thrust of such pricing is to provide energy at affordable prices. However this approach is, in most cases, unsustainable because the utility very quickly becomes a heavy burden on the treasury. This is precisely the situation occurring in Bangladesh; the utilities are in no position to finance their expansion thereby causing energy shortages.

The legacy of energy prices that do not reflect the true cost can be seen in the historical development of the energy sector. Most of the pre-1990 infrastructure was built through grants and no/low interest loans from bilateral and multilateral agencies. As a result, there was very little pressure on utilities to operate efficiently. The ready availability of cheaply extracted natural gas compounded matters. Since the early nineties, these easy sources of funds have been drying up and most developing countries are being forced to buy gas from IOCs and electricity from IPPs. The requirement to pay these foreign companies in convertible foreign currency is now forcing Bangladesh to gradually rationalise its energy prices.

An interesting recent development is the effort to tap the huge hydro resources of the Himalayas. The South Asian region, which is comprised of Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka is currently experiencing rapid growth in energy demand. Adequate energy supply is therefore a major challenge facing the economies in the region. This "solution" is the development of large hydro.

Natural gas developments have not been painless. In recent years two devastating blowouts have occurred. The first was in the Moulavibazar gas field in 1997. Large amounts of methane escaped into the atmosphere and the general vicinity of the blow-out area became unusable until the well was capped six months later. The most recent blow-out took place in 2005 in the Chattak gas field. A subsequent attempt to tap a relief well failed, shattering the public's confidence. Hundreds of villagers had to be relocated with many losing their livelihood from agriculture, fishing and business. An estimated 3 bcf of gas was lost through surface burning, leakage and seepage from these twin blow-outs. The environmental pollution was also substantial. Fortunately none of these accidents resulted in any human deaths.

Securing natural gas condensate lines is another problem area and is a potential environmental hazard. Pilfering from these condensate lines is a regular occurrence. A number of accidents have occurred injuring people and stopping the flow of condensates. Regular monitoring, marking of pipeline path and enforcing strict punishment for violators can make oil and gas transportation safe. However in a poverty-stricken country where people are willing to take great risks, designing and enforcing effective deterrents are difficult.

# Environmental Sustainability

## Indicator 1: Per Capita Carbon Emissions

Bangladesh has one of the lowest per capita carbon dioxide emissions in the world. There are two principal reasons for such low emissions. First, Bangladesh does not have many energy intensive industries such as steel and aluminium manufacturing. Second, nearly 70% of the commercial primary energy comes from natural gas. Table 3 presents a snapshot view of the primary energy consumption in 2004. As can be seen, even at the beginning of the 21st century, biomass still provides nearly half of the total energy. Less than 35% households have electricity connection, and only 4% households have natural gas supply. The Rural Electrification Board (REB) network covers approximately 40% of rural Bangladesh, but within the grid covered area only 40% households have electricity connection primarily because most households cannot afford the connection charge. Renewable energy (other than biomass and hydro) constitutes a very small percentage of the total energy consumption. This excludes the use of sunlight for various drying operations by households, commercial establishments and industrial units. In the past five years, NGOs, with support from the World Bank and other bilateral/multilateral organisations, have had some success with solar home systems. Present capacity stands at approximately 3 MW with nearly 60,000 installed units. The total installed wind capacity is less than 1 MW. Biogas and improved cook-stoves programs have had little success in the last 25 years.

**Table 3 Primary Energy Consumption in Bangladesh for 2004[18]**

| | Physical Units | Energy Units | (%) | % of Fossil |
|---|---|---|---|---|
| Natural Gas | 450 bcf | 445 million GJ | 35.1 | 69.1 |
| Oil | 3.7 million tons | 158 million GJ | 12.5 | 24.5 |
| Coal | 1.5 million tons | 41 million GJ | 3.2 | 6.4 |
| Hydro | 1.0 TWh | -- | -- | |
| Biomass | 50 million tons | 625 million GJ | 49.2 | |
| Solar PV | 3 MW (2 GWh) | -- | -- | |
| Wind | 1 MW (2 GWh) | -- | | |

Source: Complied by authors from various country sources. See footnote 18

[18] Natural Gas data from Petrobangla; Oil data from Bangladesh Petroleum Corporation; Coal data estimated from consumption in the brick industry; Biomass data projected from 1990 data available in the National Energy Policy and crosschecked with other sources

Compared to its present demand, Bangladesh has a large reserve of natural gas (R/P > 30)[19]. In terms of resources this ratio is close to 100[20]. On the other hand, Bangladesh's coal reserves are extremely modest. In addition, the extraction cost has been considered to be exorbitant because very expensive and complicated deep shaft mining must be used. In one estimate it was found that it would be cheaper to import coal from Indonesia or Australia rather than to mine coal in Bangladesh. Needless to say, importing coal from India is cheaper. However despite the anticipated amount of coal and associated extraction costs, these reserves are being developed with bilateral support. The justification is that by developing the reserves energy security will be enhanced.

With regard to coal, another example can be cited. In Bangladesh, more than 90% of all bricks are made using imported coal in highly inefficient and polluting traditional kilns. With an abundance of natural gas, a country using imported coal is a direct result of bad industrial and energy infrastructure planning. Moreover, use of coal has an adverse effect on the per capita carbon emissions and will increase with increased consumption of coal. Some other factors that will adversely impact this indicator are discussed in the section dealing with "Energy Intensity".

Bangladesh's fossil fuel consumption has increased steadily from 257 million GJ in 1990 to 644 million GJ in 2004. This has led carbon emission to go from 4.44 million tonnes in 1990 to 11.0 million tonnes in 2004 – a 2.5 times growth in emissions with an annual growth rate of 6.7%.

Bangladesh's per capita carbon emissions were 41.5 and 79.3 kg in 1990 and 2004 respectively.

## Indicator 2: Most Significant Energy-Related Local Pollutant

Urban air pollution is the most significant environmental issue in Bangladesh. The pollution level increases dramatically during the dry winter season because: (i) there is no rainfall between November and March; and (ii) hundreds of very polluting coal fired brick kilns operate along the highways just outside the city boundary.

Particulates are of the greatest concern in urban areas. Old and badly maintained vehicles are the major sources. For the purpose of determining this indicator the annual load of particulates in the Dhaka city was used. The particulate load from brickfields is not considered because the number of brickfields around Dhaka city has reached its limit meaning that the pollution load from this source is likely to remain constant. Moreover, the pollution load in 1990 from a smaller number of more polluting kilns was nearly the same as in 2004 from a larger number of less polluting kilns. In addition to vehicular and brickfield pollution, there are several other sources of particulate pollution in the Dhaka city notably: urban

[19] Government of Bangladesh, 2005. Hydrocarbon Unit, Ministry of Energy and Mineral Resources.
[20] USGS-Petrobangla Report on Natural Gas Reserves and Resources of Bangladesh, 2001.

construction; movement of people; natural gas combustion in urban household cook-stoves; and fossil fuel burning industries in and around Dhaka city. However within the scope of this study and timeline, it was not possible to account for these additional sources.

The annual load of particulates has been calculated using the inventory of vehicles in Dhaka city. Table 4 provides the estimate in 1990 and 2004. The particulate emission has significantly worsened since 1990. This, however, must be judged in the correct context; between 1990 and 2004 there has been a nearly 4-fold increase in the number of vehicles on the streets of Dhaka. On a proportional basis the pollutant load should be close to 1200 tonnes, whereas the value is only 761 tonnes. The reason why the load is not as high as one would predict is because by 1998 Dhaka's air quality had become one of the worst in the world as a result of particulate and hydrocarbon emissions. The most offending vehicles were the 2-Stroke 3-Wheelers. These were completely phased out in 2002, and almost at the same time the government introduced CNG. Nowadays all 3-Wheelers are 4-Stroke and use CNG. In addition, nearly all taxis and a large number of cars and jeeps are CNG driven, as is a portion of the bus fleet. These measures have had a tremendous positive impact on the pollution level in Dhaka city. However, despite the gains from these measures, the pollutant level is slowly creeping up due to the increasing number of vehicles (see Table 4). The current particulates level in Dhaka city is twice what is was in 1990.

**Table 4: Particulates Emitted from Vehicles in Dhaka City**

| | **Total Number of Vehicles Excluding Motorcycles** | **Motorcycles** | **Particulates in Tonnes**[21] |
|---|---|---|---|
| 1990 | 41,000 | 45,000 | 320 |
| 2004 | 155,000 | 100,000 | 731 |

Source: Estimated by the authors using vehicles data for Dhaka city. For 1990, Bangladesh Bureau of Statistics (BBS,1995). For 2004, Bangladesh Road Transport Authority (BRTA, 2005)[22]

# Social Sustainability

## Indicator 3: Households with Access to Electricity

Rural electrification has always been in the election manifesto of all political parties, and despite the severe resource constraints, all governments have pursued it seriously. It is the stated policy of the government to bring all villages under the electricity network by the year 2020. Table 5 summarizes the status of rural electrification in Bangladesh, while Table 6 gives the achievement of the electrification program. Experts maintain that given the inaccessibility of many places, 100%

[21] Emission factors from – Pricing and Infrastructure costing for Supply and Distribution of CNG and ULSD to the Transport Sector in Mumbai, TERI, August, 2002; Urban Transport, Energy and Environment – A Case of Delhi, Institute of Transportation Studies, University of California Davis, September, 2000.
[22] Bangladesh Road Transport Authority, 2006. Personal communication.

coverage is not economically feasible and that a more realistic figure is 80%. The percentage of electrified households is however another matter. Unless rural poverty is tackled, less than 50% of the households in electrified villages will be able to enjoy the fruits of the government's electrification program. The definition of what constitutes an "electrified village" is fairly arbitrary. The utility considers a village electrified if a trunk line and few feeder lines traverse the village. If a household is within 200 yards of the utility line, a connection is given to a household free of charge. Otherwise, households have to pay for the connection charge, which can be significant.

The quality of service is very poor. The total available generation capacity is approximately 4000 MW[23] although the dependable generation capacity is much lower. The peak load on certain heavy demand days exceeds 5000 MW; 500 MW of excess load is a regular occurrence. The utility manages these peaks by load-shedding. As rural households are the lowest priority customers they often have to endure power cuts at times when it is most needed, i.e., during the evening hours. For rural customers six to eight hours of power cut during the day is standard. The poor quality of supply is severely affecting irrigation, and in recent months, farmers have started to protest. The rural electrification program is not likely to increase the quality of life in rural households unless generation is increased.

In 1990, the utility was not only supplying the full peak load, but actually had a 25% reserve margin. However, access to electricity was only 10%. Thus, the success of rural electrification measured in terms of merely providing connections must be heavily discounted.

**Table 5: Status of Rural Electrification (June, 2003)**

| Number of Rural Units (PBS) | km of Line Energized | Number of Villages Electrified | Number of Thana Included | Consumer Connected (Million) | Estimated Cost of the Project (Million US$) |
|---|---|---|---|---|---|
| 67 | 156,000 | 38,500 | 410 | 4.7 | 800 |

Source: REB (2003)[24]

**Table 6: Electrified Households in the year 1990 and 2004**

| | Population | Households | % Electrified[25] |
|---|---|---|---|
| 1990 | 107 million | 20.2 million26 | 10% |
| 2004 | 139 million | 27.0 million27 | 33% |
| Annual Growth Rate | 1.9% | 2.1% | 11.7% |

[23] Bangladesh Power Development Board, 2006. http://www.bpdb.gov.bd
[24] Rural Electrification Board (REB), 2003. Internal document, Personal communication.
[25] Government of Bangladesh, 2005. Power Division, Ministry of Energy and Mineral Resources.
[26] Government of Bangladesh, 1990. Task Force Report.
[27] Banglapedia, 2006. Households data for 2001 extrapolated to 2004 using a 2.1% growth rate, Home page: http://banglapedia.net

## Indicator 4: Clean Energy Investment

The concept of energy efficiency and conservation are fairly new in Bangladesh; it was not until 1995 when the first energy policy was adopted that any attention was paid to these issues. Until1990, Bangladesh enjoyed plentiful supply of cheap natural gas and significant investments in the energy sector from bilateral and multilateral sources. It was not until the early nineties, when World Bank funding for the energy sector in developing countries started shrinking, that policy makers and energy planners took any notice of the role of energy efficiency. By 1995, energy supply and security had become sufficiently important issues for Bangladesh. This prompted policy makers to include these issues in the National Energy Policy (NEP). The 1995 NEP recommended that heat rates of newly constructed power plants must be of international standard, and also suggested tax and duty incentives for energy efficient devices. Fortunately for Bangladesh, due to business-as-usual practices, high-efficiency combined-cycle natural gas power plants are being constructed for base-load power, although for peaking load, the utility is opting for the cheapest low-efficiency gas turbines. The government has not initiated any substantive measures for implementing the NEP guidelines as they relate to energy efficiency. This is not surprising given the declining level of investment in the energy sector; the government does not have any funds to spare for such measures.

In comparison to the 1995 NEP, the updated 2004 NEP is more pro-active on conservation, energy efficiency and renewable energy. The government has implemented some energy efficiency and conservation measures. However, as they are badly funded and lack seriousness, no impact has been observed. One example is the plan to replace all incandescent bulbs with energy saving ones in public buildings, but the program is progressing at an extremely slow pace. There exists huge potential in Bangladesh for energy saving bulbs because the largest peak in the daily load curve is the evening peak and is due predominately to lighting. Despite the fact that utilities have had to resort to load-shedding, the potential of energy saving bulbs in tackling the evening peak has not been explored with any seriousness. The utility's efforts have been limited to awareness raising campaigns through newspaper and television advertisements.

With regards to renewable energy, the government's only role has been to cooperate with bilateral/multilateral organizations. Most of these cooperative ventures have been the implementation of grants for pilot studies on renewable energy. The most significant is the construction of a 1 MW wind generator at a cost of US$ 1.25 million. In the last two years, mainly through the efforts of NGOs such as Grameen Shakti, some success has been achieved in clean energy investment. Both the 1995 and 2004 NEPs contain a recommendation for the creation of a Renewable Energy Development Agency (REDA) along the lines of the Indian REDA, which has been immensely successful in promoting renewable energy in India. This agency has not materialized. Lately, the government under an UNDP project entitled Sustainable Environment Management Project (SEMP) launched a large-scale effort to identify and streamline policies to

promote renewable energy projects. However, the final outcome and success of this effort remains in doubt because such efforts have, to-date, yielded very little results.

Clean energy investment in Bangladesh in 1990 was negligible. In 2004, this has risen to only a few million dollars, including the investments made by NGOs. This constitutes less than 1% of the total investment in the energy sector.

## Economic Sustainability

### Indicator 5: Resilience to External Impacts: Energy Trade

Until very recently, the country's only exploited energy resource was natural gas. Since the commissioning of the Barapukuria coal mine, Bangladesh has claim to have two energy resources. However, the contribution of the coal extracted from this coalmine is a very small proportion of the total primary energy. Currently nearly 2 million tons of coal must be imported.

Until 2002, the entire transport sector was oil dependent. In 2002, the government started a CNG program, but limited it to the conversion of gasoline vehicles. While a large number of CNG buses have been imported, the major portion of the transport sector is still dependent on imported oil (although some oil (NGL) is domestically available from natural gas processing). Since 1990, the oil demand has registered a steady growth of 7% per year. In the last two years, the impact of the high oil prices and use of CNG as a transport fuel is being felt; the growth rate has declined to 5% per year.

The importation of oil using scarce foreign currency has always been a big issue in Bangladesh. Even though the oil import bill is a small portion of the GDP (Table 7) at the high price of US$ 50/bbl, it is the scarcity of foreign currency that is of major concern. There have been times when the foreign currency reserve has been reduced to such an alarmingly low level that worries about the oil import bill has plagued the nation. The onerous burden of importing oil was felt last year when the price of crude oil rose above US$ 50 per barrel. As can be seen from Table 7, nearly 2% of the total GDP is eaten up by oil imports. The oil import bill is a significant portion of the exports and has jumped from being 5-6% of the total imports just a few years ago to over 12% in 2004 and was expected to reach 15% in 2005. Despite the various ongoing efforts of the government, the transport sector oil demand will keep on rising, and that means this vulnerability will continue into the future.

**Table 7: Fuel Import Burden of Bangladesh**

| | Oil + Coal | (%) of Non-Renewable | Import Cost | (%) of GDP |
|---|---|---|---|---|
| 1990 | 90.8 million GJ | 35 | US$ 300 million | 1.3 |
| 2004 | 199 million GJ | 31 | US$ 1100 million | 1.8 |

Note: Import cost data not available. Estimated using that year's average coal and oil prices

## Indicator 6: Burden of Energy Investments

The provision of adequate funding for energy sector investments has become the biggest challenge for all the Bengali governments, and the past three governments have failed in this regard. The supply of energy is unreliable and below demand. The two main reasons behind this are: 1) mismanagement – electricity and gas theft (euphemistically known as "system loss"); and 2) lack of transparency in dealing with international oil companies (IOCs) and independent power producers (IPPs). In the last four years only one large power plant has been constructed and only two exploratory wells have been drilled.

In terms of volumes of gas discovered, over 80% of the gas exploration and development activities in Bangladesh have been carried out by IOCs. The situation with power plants is, however, slightly different. Using bilateral and multilateral aid, the government has built approximately 70% of the generation facilities with most of the new ones being used to meet intermediate/peak load. The government is in a quandary regarding IPPs and IOCs because of the requirements of payment in foreign currency. Therefore, either directly or indirectly the government has been discouraging IPP and IOC investments. Since the present energy supply is far below demand, significant investment would be required to keep up with increasing demand.

The Government of Bangladesh has been making steady investments over the years in energy infrastructure including gas transmission and distribution, electricity transmission and distribution, and oil distribution network. The electricity distribution network is being expanded both in urban and rural areas. In the past five years, the government has been developing a coal mine, and exploring the possibilities of opening up another one. The investment made by the government, which is readily available in published reports, has been used to compute this Indicator. To smooth out the data, a three-year average (present plus the previous two) has been used.

For the investments in gas exploration and development, the annual investment data obtained from the government department responsible for overseeing gas sector investments by IOCs have been used. For power plants and the newly commissioned coalmine, annual investment data were not available. Therefore, the total investments over the past five years were averaged to give an annual investment value.

Table 8 shows that the energy sector investments have declined since 1990. The declining investments have had a big impact on the economic well-being of the country. Several years ago, the World Bank estimated that annual losses amounting to US$ 1 billion could be attributed to unreliable power supply alone.

**Table 8: Non-Renewable Energy Sector Investment**

| | **1990** | **2004** |
|---|---|---|
| GDP[28] | US$ 22.5 billion | US$ 61 billion |
| Non-renewable energy investments | US$ 389 million[29] | US$ 789 million[30] |
| % of GDP | 1.73% | 1.29% |

Note: The 2004 investment was computed by authors using data from various country sources

# Technological Sustainability

## Indicator 7: Energy Intensity

Bangladesh's per capita commercial energy consumption is one of the lowest in the world, and is only one-third that of its neighbours, India and Pakistan. There is a constant pressure on the government to increase the commercial energy supply. The redeeming feature of the low energy consumption with respect to the GDP is that Bangladesh's energy intensity is very low. India's per capita income is only 1.3 times that of Bangladesh, but has an energy intensity 2.3 times higher than that of Bangladesh. There are several reasons for this, the most important being: 1) India's self-reliant policy has forced the construction of many highly energy intensive industries like steel and aluminium manufacturing, which were in the initial stages internationally non-competitive; and 2) India being a large economy has managed to develop many indigenous technologies, which invariably are highly energy inefficient compared to the state-of-the-art or advanced technologies. In contrast, Bangladesh did not pursue a self-reliant policy and is obviously disadvantaged in the arena of developing one's own technologies due to its small economy. The only large, energy intensive activity in Bangladesh is the fertilizer industry. Bangladesh is therefore fortunate not to have very many inefficient energy intensive industries and in it use of imported technologies (predominately from Japan and Korea). If the present trend can be continued, Bangladesh should be able to develop and achieve poverty alleviation at very low per capita CO2 emissions. The recent trend, however, has been in the opposite direction with low-level and energy inefficient technologies being imported from China and India. Rapid industrialization and intense competition implies that private entrepreneurs are opting for technologies that have lower first-cost. These low-cost technologies are in most cases

[28] Calculated from data in Table 9. GDP per capita × Population
[29] Bangladesh Bureau of Statistics (BBS) 1995. *Statistical Yearbook of Bangladesh*.
[30] Personal communication, 2005. Public sector investments: IMED, Planning Division, Ministry of Finance and Planning, Government of Bangladesh; IOC investment: Petrobangla; IPP investment: Estimated from Bangladesh Power Development Board data.

energy inefficient. Since energy costs are either low, or not paid in full, the running costs are not important for Bangladeshi industrialists.

Table 9 gives a snapshot view of the economic and energy data of Bangladesh along with the energy intensity for the years 1990 and 2004. A slight decrease in the energy intensity can be observed. This is a good sign, but a serious shortage of electricity prevails in the country. It is not clear whether if all consumers were adequately supplied there would be a corresponding gain in productivity. This has certainly not happened in those developing countries that are growing rapidly.

Bangladesh may be doing well in terms of energy intensity, but in terms of hydro and renewable electricity, Bangladesh is lagging behind many rapidly developing countries like India and China. This comparison, however, may not be completely fair because both China and India have large renewable energy potential. However when one considers the fact that only a small percentage of the potential in those countries have been harnessed, Bangladesh's performance in the renewable energy sector is very poor.

**Table 9: Economic and Energy Data of Bangladesh**

| Parameters | Unit | 1990[31] | 2004[32] |
|---|---|---|---|
| Per capita GDP | US$ | 210 | 440 |
| Per capita GDP (PPP) | US$ | 98033 | 1980 |
| Population | Million | 107 | 139 |
| Commercial Primary Energy (Oil+Gas+Coal) | Million GJ | 257 | 64434 |
| Commercial Energy Intensity of GDP (PPP) | MJ/US$ | 2.45 | 2.36 |

## Indicator 8: Renewable Energy Deployment

Renewable energy other than biomass and hydro constitute a very small percentage of the total energy consumption. This of course excludes the use of sunlight for various drying operations by households, commercial establishments and industrial units. In the past five years, NGOs with support from the World Bank and other bilateral/multilateral organizations have had some success with solar home systems. At present the capacity stands at approximately 3 MW with nearly 60,000 installed units. The total installed wind capacity is less than 1 MW, and the biogas and improved cook-stoves programs have had little success in the last 25 years. The following are some of the reasons behind the low renewable energy deployment:

1. the true potential has not been determined;
2. the prevalence of extreme poverty in precisely the areas of the country where renewable energy can be deployed;

[31] World Development Report, 1993. The World Bank.
[32] http://www.unicef.org/infobycountry/bangladesh_bangladesh_statistics.html
[33] http://globalis.gvu.unu.edu/indicator_detail.cfm?IndicatorID=140&Country=BD
[34] From Table 3.

3. subsidized or "no tax" fossil fuel supply;
4. lack of capacity within the country to deploy new and emerging technologies; and,
5. neglectful attitude of the government.

The above reasons are fairly generic, and apply equally well to all developing countries to a greater or lesser degree. But for Bangladesh all the five factors are significant and highlight the general level of indifference towards renewable energy. For example, if Bangladesh is compared to India, factors 2 and 3 apply to both country situations, but with respect to the other three factors, India is far ahead of Bangladesh, and is reflected in the higher level of renewable energy deployment in India.

The 1995 National Energy Policy[35] had very little emphasis on renewable energy, conservation and energy efficiency. It dealt with renewable energy in a perfunctory manner. The policy guidelines were extremely general for those to be of any real value in promoting renewable energy. The promotion of renewable energy in Bangladesh is mostly driven by bilateral/multilateral efforts. NGOs are the principal recipients of grants for promoting renewable energy. However, the electricity utility known as the Bangladesh Power Development Board (BPDB) and Local Government Engineering Department (LGED) are participating in some wind and solar home system (SHS) projects.

In last two years, UNDP has spent a significant amount of money on renewable energy potential study and promotion through a project entitled Sustainable Environment Management Project (SEMP). This is being followed by another project entitled Sustainable and Renewable Energy (SRE)[36] to stimulate the implementation of renewable energy projects. Recent efforts include piloting on solar energy (SHS), biomass (gasification), wind, and hydro (micro). In the following three paragraphs, the present situation with respect to SHS, Wind and Biomass are summarized.

**Solar Home System (SHS)**

Following the recent successes, the Infrastructure Development Company Limited (IDCOL) will bring a total of 140,000 rural households under the solar power system by 2009. Initially IDCOL had a target of financing 50,000 SHSs in a five and half year period from January 2003 to June 2008 with financial assistance from the World Bank and Global Environment facility (GEF). This target was successfully achieved by September 2005, three years ahead of schedule. IDCOL's solar electrification programme is mainly being implemented in remote areas far from the existing grid at a total cost of 35 million USD. Fourteen NGOs and Micro Finance Institutions (MFI) including BRAC Foundation and Grameen Shakti are the implementing partners. Table 10 gives a summary of the current deployment of SHSs.

[35] Government of Bangladesh, 1995. National Energy Policy.
[36] http://lged.org/sre/

**Table 10: Summary of the Current Deployment of Solar Home Systems (SHS)**[37]

| Stakeholders | Number of installed SHS and locations | Installed capacity |
|---|---|---|
| Grameen Shakti | 42,000 SHSs all over the country | 2150 kW |
| Bangladesh Rural Advancement Committee | 10,456 SHSs all over the country | 300 kW |
| Electricity Utilities + Local Govt. Engineering Dept. | Various | 170 kW |
| All Others | 3192 Solar Home Lighting System | 165 kW |

## Wind

Wind energy utilization in Bangladesh is in its infancy. Several locations in the coastal belt have been assessed to evaluate the wind energy potential. The scope of utilisation of wind energy resources for water pumping and power generation can be greatly enhanced by the application of wind-diesel hybrid systems. Wind-solar hybrid systems have numerous applications and Local Government Engineering Division has installed one such system. This is a 10 kWp system located in the Saint Martin's Island in the Bay of Bengal[38]. One small unit has also been installed at the tourist resort of the Kuakata sea beach. Despite the limited wind prospect, Bangladesh's first wind power project[39] has been put into operation on a pilot basis in July 2005 at Muhari of the Feni district at a cost of 1.23 million USD. One MW of electricity generated on a trial basis from four windmills is being supplied using the distribution cables of Palli Biddut Samity and the Muhari Irrigation Project. Bangladesh Power Development Board's initial plan is to install 10 MW of wind power, although the total technical potential has been estimated to be 2,000 MW in the coastal belt, using 30 windmills per square kilometre.

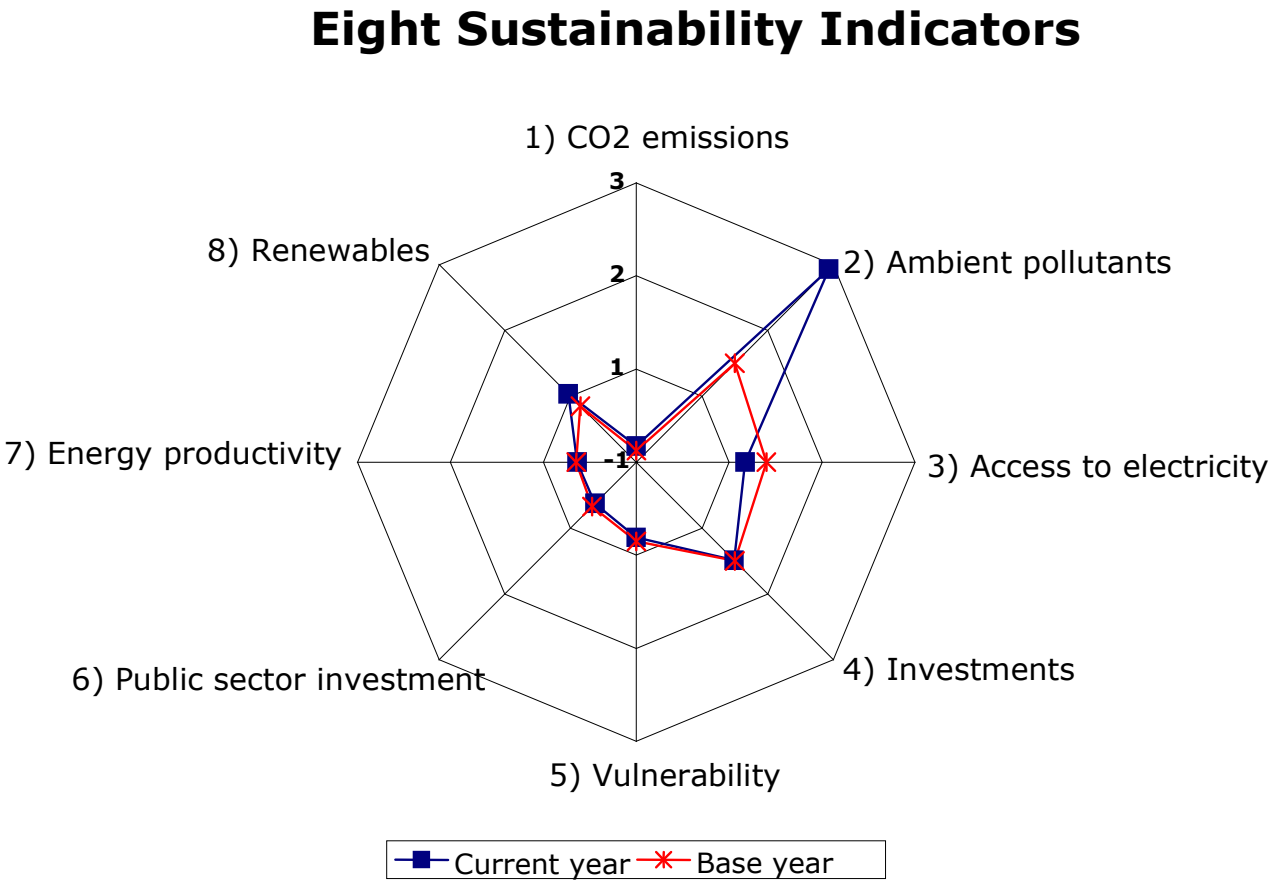
## Biomass

In 1990, biomass constituted 65% of the total primary energy, but in 2004 this declined to 49% (see Table 3). The principal reason for this decline was due to the large increase in the consumption of commercial energy. In absolute terms, however, the total quantity of biomass consumed increased by more than 30%. This increase has been the result of an increasing population mainly in the rural areas. During a fourteen year period (1990 to 2004) a number of households have shifted away from biomass due to urbanization and increasing prosperity. However, this transition rate is sufficiently slow meaning that biomass will continue to be the primary cooking fuel for years to come. The NEP clearly states that a shift from biomass to commercial fuels is essential to prevent unsustainable biomass extraction. Loss of soil organic matter is also being linked to over exploitation of agricultural residue.

[37] http://www.inforse.dk/asia/word_docs/Bangladesh-Country%20Status.doc
[38] http://www.lged-rein.org/project_ongoing.htm.
[39] http://english.people.com.cn/200507/09/eng20050709_195186.html.

In estimating the indicator for renewable energy deployment the problem that arises is that the achievements of the "New Renewables" are completely camouflaged by biomass. However given the importance of biomass in the Bangladesh primary energy mix, the Indicator should be based on biomass consumption. Thus, renewable energy deployment in 1990 and 2004 were 65% and 49% respectively.

## HELIO SEW Star



## Conclusions and Recommendations

From the HELIO sustainable development indicators, it is clear that even though most indicators are moving towards the goal of sustainable development, a few are not.

Economic growth, exploitation of domestic natural gas and stable democratic government are the contributing factors in moving the majority of the indicators in a positive direction. Indicators 2 and 8, i.e. urban pollution and renewable energy deployment, show a worsening of the situation as a result of neglectful attitude towards SD issues.

Bangladesh's situation is typical of most developing countries, i.e., additional funds to pursue SD are not available even though the country may be fully aware of the correct strategy. The scarcity of resources can become so critical that in many cases a path opposite to that of SD is followed. Of course in many instances the policy makers are not fully aware of the SD implications of the development path they are pursuing. Therefore, capacity building of government agencies is essential in charting a sustainable energy development path.

As in most developing countries, there are plenty of policies that run counter to the effective planning and implementation of activities aimed at keeping GHG emissions low and preserving the environment while promoting growth. The following problems have been identified.

1. energy policies that encourage wastage and discourage efficiency improvement;
2. import policies that do not discriminate between efficient and non-efficient devices;
3. funds shortage that cause inferior technologies to be used;
4. energy security concerns that prompt the promotion of coal; and
5. governance problems that allow wastage and theft of energy products to thrive.

Addressing these problems are the key to setting Bangladesh on a path towards sustainable energy development. Even though it may appear that some of these issues can be easily addressed, in reality it isn't so. For example, Bangladesh's import policy is designed to bring in revenue for the government; energy insecurity is a direct function of the poverty status of the country.

However, the shortage of funds is the single most important factor that directly or indirectly influences all other issues. Since the early nineties, Bangladesh has been opting for inferior technologies in almost all sectors. Needless to say, these low-cost technologies are highly energy inefficient. The effect of this decision is evident in the worsening energy intensity of the economy. Bangladesh does not have the luxury to make decisions on the basis of life-cycle costing. Tackling these difficult issues will require generous, sustained and long-term support from industrialised countries because developing countries are in no position to overcome these barriers on their own.