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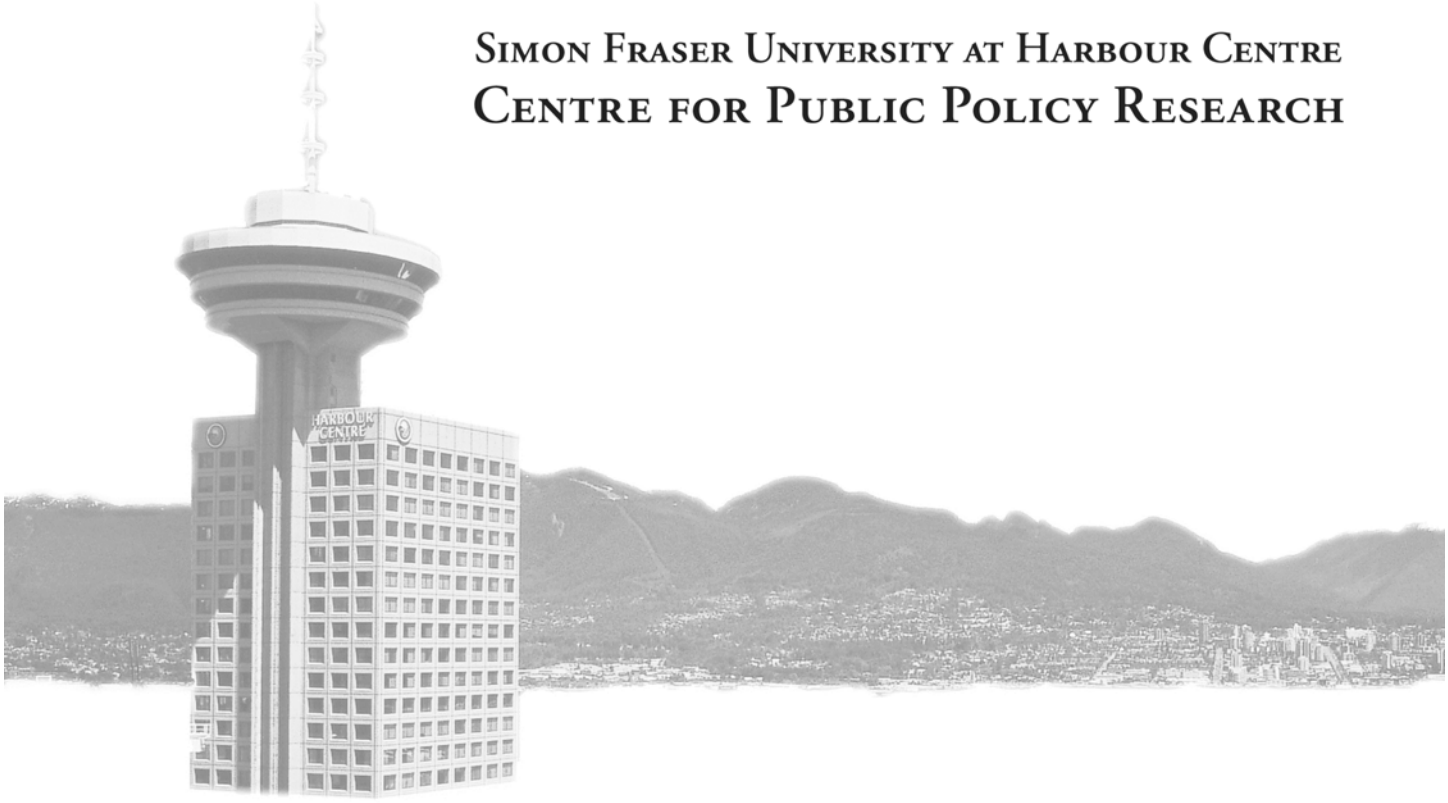

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CPR COMMENTARY
No. 3 • SUMMER 2004

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IUBAT

IUBAT – International University
of Business Agriculture
and Technology
Dhaka, Bangladesh

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About the Centre

Created in 1999, the Centre for Policy Research is a nonprofit research and educational institution, linked to IUBAT – International University of Business Agriculture and Technology.

Its goals are to identify current and emerging economic and social issues facing Bangladesh; to analyse options for public and private sector responses; to recommend, where appropriate, particular policy options; and to communicate the conclusions of its research in an accessible and nonpartisan form, in both English and Bengali. Publications of the Centre are freely available at www.iubat.edu/cpr

Simon Fraser University in Burnaby (Vancouver), Canada, has entered into a memorandum of understanding with IUBAT. By this agreement, SFU will encourage participation by its faculty and students in projects of the centre.

While the centre takes care to assure the quality of published research, the conclusions of individual studies lie with the authors. Conclusions do not necessarily represent the opinion of IUBAT, SFU or the members of the centre's management committee.

About the Authors

Alimullah Miyan is a professor of business administration, Vice-Chancellor and Founder of IUBAT. Located in Dhaka, IUBAT is the first nongovernmental university established in Bangladesh.

John Richards is a professor of public policy at Simon Fraser University, in Vancouver, Canada. He holds the Roger Phillips Chair in social policy at the C.D. Howe Institute, and is a visiting professor at IUBAT.

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Acknowledgements

MANY PEOPLE HAVE CONTRIBUTED IDEAS TO THIS REPORT. WHILE WE thank them for their contribution, they do not necessarily agree with our recommendations, nor should they be held responsible for any errors of analysis.

Professor M. Nurul Islam, a professor at the Bangladesh University of Engineering and Technology, wrote in 2003 an important paper ("Energy Policy and Development Strategies for Bangladesh"). That paper has been of great help to us in preparing this report. Dr. Mujibur Rahman Khan retired as Director General of the Geological Survey of Bangladesh. He also served as Chairman of Petrobangla, and is a Professor in the College of Engineering and Technology at IUBAT. Dr. Khan read the many drafts of this report, and provided a valuable critical assessment of its recommendations.

In addition, we received useful comments from Professors F.R. Al Siddique and Mohammad Ashraf, both faculty members at IUBAT. Jay Zimmerman, at the University of British Columbia, provided additional information on renewable energy sources.

Geert van Kesteren, a renowned Dutch photojournalist, has visited many countries throughout the world – including Bangladesh. His intent in his photographs is to show the lives of ordinary people in the countries he visits. He has produced a portfolio of impressive photographs from his trip to Dhaka. With his permission, we feature a selection from his portfolio in this report.

Nadene Rehnby prepared the text for publication. Mitul Mahmud Khan and Sanchay Kanti Barua made possible the international communication between Dhaka and Vancouver.

Foreword

SIMON FRASER UNIVERSITY (SFU) HAS SINCE 1998 MAINTAINED AN AGREEMENT with IUBAT – the International University of Business Agriculture and Technology. This agreement encourages faculty and students at SFU to undertake policy research in Bangladesh, in conjunction with Bangladeshi scholars, and to publish their results via the Centre for Policy Research.

I am pleased to introduce the third major publication of the Centre. The Centre has supported meaningful nonpartisan research into public policy problems in Bangladesh, and has communicated the results widely. The Centre has also become a valuable link between researchers in Canada and in Bangladesh. I note that SFU Professors Mark Jaccard and John Richards, and Ms. Rose Murphy, a graduate of SFU's Resource and Environmental Management School, are co-authors of previous publications.

In the draft *National Energy Policy* released in May 2004, the Government of Bangladesh refers to "the importance of energy in socio-economic development." Adequate supplies of energy are crucial for the future prosperity of the country. I hope the analysis of energy policy undertaken by Professor M. Alimullah Miyan and Professor John Richards will prove helpful in advancing the necessary public discussion in Bangladesh about the country's future energy policy priorities.

Michael Stevenson, President
Simon Fraser University
Burnaby (Vancouver), Canada

Executive Summary

IN MAY 2004 THE GOVERNMENT OF BANGLADESH RELEASED A DRAFT *National Energy Policy* (NEP). The NEP refers to "the importance of energy in socio-economic development" (GOB 2004, 1). We agree. It is hard to exaggerate the importance of adequate supplies of energy for the future prosperity of Bangladesh. The government deserves credit for acknowledging the gravity of problems that exist in the energy sector – and the need for good policy to overcome the identified shortcomings.

Energy resources of Bangladesh

Many observers have attempted to persuade Bangladesh that there exist multiple energy sources available at reasonable cost and that, accordingly, the government should approve the export of natural gas. That is not our conclusion. We are more cautious, and after a review of various estimates of energy resources and future energy demand, we recommend against gas exports. In summary, here are the conclusions.

There is only a limited prospect for increasing the sustainable supply of biomass fuels. For certain biomass sources, it is crucial to reduce present exploitation rates, in order to reduce environmental degradation.

The most important commercial source of energy in Bangladesh is natural gas. Estimates of remaining recoverable reserves are in the range of 11 – 16 trillion cubic feet (TCF). Estimates of undiscovered reserves are necessarily speculative. Even if optimistic undiscovered reserve estimates become justified, projected domestic needs for natural gas – primarily in power generation – are very large.

Domestic coal deposits can play a role in supplying energy needs, primarily in power generation. Excluding the Jamalganj field, recoverable coal reserves are equivalent to about 8 TCF of natural gas.

There is a small potential to expand domestic hydropower. Reliance on imported hydropower from Nepal poses serious risks, both political and geological.

For geopolitical reasons and lack of available financing, there is no prospect for development of nuclear power.

New renewable energy sources, such as photovoltaic (PV) power and wind power, have very limited potential.

Consumption of imported petroleum will increase. However, use of compressed natural gas (CNG) for transport has considerable potential and can limit the need for imported petroleum.

Managing the energy sector

In all countries, managing the energy sector is a demanding activity for government. It entails coordinating the activities of various government agencies and of the relevant state-owned enterprises (SOEs). There is also an important role for private firms in the energy sector. While implementation of major reforms is difficult both administratively and in terms of reconciling interest groups, the nature of required reforms can be described succinctly.

Hire well trained managers able to make efficient decisions, and protect them from undue political interference. This means that SOEs engaged in production and distribution of energy should be expected to cover costs. SOEs engaged in exploring for and producing primary energy products, such as natural gas, must realise reasonable unit costs and transfer surpluses to the government.

Invest in better safety nets for employees displaced from SOEs, and thereby lessen political pressure to maintain inefficient employment levels.

Enable a much larger level of investment in the energy sector. To the extent the energy sector SOEs can realise reasonable efficiency and the government can obtain financing on reasonable terms, such SOEs should be encouraged to increase their investments. However, the level of investment required to achieve reasonable energy supply is too great to be financed by government or by donor agencies. Greater openness to private investment is required.

Create a credible regulatory authority able to provide a stable, predictable legal framework for the energy sector. A regulatory authority should supervise both SOEs and private firms in the energy sector. It must assure investors that they can invest with confidence, and assure customers that both private and state-owned firms will behave responsibly with respect to prices charged and reliability of service.

Enable the judicial system to address corrupt practices in both private and public firms in the energy sector.

Energy policy goals

A successful energy policy must satisfy many goals. Here, we state them in general terms:

Energy policy must be concerned not only with current supply, but with the country's long term needs. For example, in assessing any surplus of natural gas available for export, it is important to consider domestic energy needs long into the future, for a period of, say, 50 years.

Energy policy must be concerned with efficiency of production and distribution, as well as quantity. The energy sector is among the most complex sectors of the economy. It raises problems of managing state-owned enterprises and regulating private sector participants in the energy sector. In general, customers should pay the cost of the energy they consume. Government subsidy to supply energy below cost is an inappropriate use of government revenue. In the past, corruption in certain energy sectors – such as meter reading – has eroded public faith in the possibility of creating an efficient energy sector, and has encouraged customers to rely on "second best" options such as captive power generation.

Energy policy must enable improvements in energy access among all Bangladesh citizens. Most government energy investments have favoured urban over rural areas. An efficiently organised energy sector can bring immense benefits to both rural and urban citizens, to the poor and those with higher incomes.

Energy policy must reduce the pressure placed on the country's physical environment. Low-income countries rely heavily on biomass fuels to meet their energy needs. The energy demand from a growing population is threatening the country's physical environment. Sustainable development requires wide distribution of commercial forms of energy that will enable the population to ease the pressure placed on over-exploited biomass energy sources. More efficient use of biomass fuels is also required.

Recommendations

Realising these goals requires several clear strategic decisions by the Government of Bangladesh. We do not attempt an exhaustive list of specific recommendations. We restrict ourselves to six crucially important policies.

RECOMMENDATION ONE

Given what is known of natural gas and other mineral reserves, the Government of Bangladesh should not approve natural gas exports. It should designate natural gas for domestic energy needs, of which electrical generation is the most important. It is important that the Government instruct Petrobangla and the Geological Survey to undertake continued exploration of potential energy resources in Bangladesh.

For many purposes, the most useful form of commercial energy is electricity, and the very low per capita supply of electricity is a major constraint on national economic development. Natural gas is the optimal fuel for electricity generation in Bangladesh, and available reserves should be designated for a programme of accelerated investment in generating capacity, not for export or for expanded fertilizer production.

In order to make rational policy decisions over the strategic use of energy resources, the government needs reliable geological information. To get this information, continued exploration is important.

RECOMMENDATION TWO

The Government of Bangladesh should place a very high priority on establishing the credibility of an energy regulatory commission.

Bangladesh's need for investment in the energy sector is acute, and neither the government nor donor agencies can provide adequate investment funds. It is crucial to establish a regulatory regime that encourages private investment, while also assuring customers that prices remain reasonable and service remain reliable.

RECOMMENDATION THREE

The government should encourage the Rural Electification Board (REB) to develop a network of small-scale (10 – 100 MW capacity) gas turbine plants whose power would, on a priority basis, be distributed independently of the national grid.

The REB has a record of administrative competence that makes it an ideal agency to undertake experiments in investment by independent power producers (IPPs). To the extent the REB can obtain public financing, or the more successful local cooperatives (Palli Biddyut Samitees) can arrange financing, gas turbines may be publicly financed. However, the scale of new power capacity required in rural areas is very large. Private investment will be required. The REB customers would be expected to cover the costs of generation, transmission, and distribution. In exchange, they should have priority access to the power generated. Any power surplus to local needs would be sold to the national grid.

RECOMMENDATION FOUR

The government should encourage the sale of coal for domestic cooking in rural areas. This would also require the distribution of suitable stoves.

This innovation has the potential to reduce the health problems associated with indoor pollution, and to relieve pressure on forest resources.

RECOMMENDATION FIVE

The government should continue to facilitate substitution of CNG for liquid petroleum fuels.

The government can consider modest subsidies to encourage owners of automobiles and commercial vehicles to convert to CNG. If use of CNG is to be extended to large numbers of vehicles, there is a need for further expansion of CNG filling stations. More can be done to increase safety of use: standardise fueling connections, assure adequate training among those supplying CNG, and so on.

RECOMMENDATION SIX

The government should undertake high profile social marketing activities intended to improve utilisation of biomass fuels in rural areas.

There is a potential to increase adoption of more efficient stoves and expand forest plantations. These are examples where government public education activities can have a meaningful impact on energy policy.

মূল বক্তব্য

বাংলাদেশ সরকার ২০০৪ সালের মে মাসে একটি খসড়া জাতীয় জ্বালানি নীতি (জা:জ্বা:নী) ঘোষণা করে। এই জা: জ্বা: নী:তে "আর্থ সামাজিক উন্নয়নে জ্বালানির গুরুত্ব" সম্বন্ধে বক্তব্য রাখা হয় (বাংলাদেশ সরকার ২০০৪,১)। এ ব্যাপারে আমরা একমত। বাংলাদেশের ভবিষ্যৎ সমৃদ্ধির জন্য পর্যাপ্ত পরিমাণে জ্বালানি শক্তি সরবরাহের গুরুত্ব সম্বন্ধে অতিরঞ্জনের কোন অবকাশ নেই। জ্বালানি খাতে বিদ্যমান সমস্যার গভীরতা অনুধাবন করে বিদ্যমান সীমাবদ্ধতা দূর করার জন্য উপযুক্ত নীতিমালা প্রণয়নের প্রয়োজনীয়তার উপর গুরুত্ব আরোপ করায় সরকার প্রশংসা পেতে পারেন।

বাংলাদেশের জ্বালানি সম্পদ

অনেক পর্যবেক্ষক এ মর্মে বাংলাদেশকে প্রভাবিত করার চেষ্টা করেছেন যে এ দেশে যুক্তিযুক্ত মূল্য সম্পন্ন জ্বালানির বহুবিধ উৎস আছে। এই যুক্তির ভিত্তিতে তাঁরা বক্তব্য দিয়েছেন যে প্রাকৃতিক গ্যাস রপ্তানির বিষয় বাংলাদেশ সরকারের অনুমোদন করা উচিৎ। আমরা এ যুক্তির সাথে একমত নই। আমরা এ ব্যাপারে আরো সতর্ক এবং জ্বালানি সম্পদ সমূহের অনুমিত পরিমাণ এবং ভবিষ্যৎ চাহিদা পর্যালোচনা করে, গ্যাস রপ্তানি না করার পক্ষে আমরা সুপারিশ করছি। সংক্ষেপে আমাদের বিশেষণের ফলাফল নিম্নরূপঃ

* নবায়নযোগ্য জৈব (বায়োমাস) জ্বালানি সরবরাহ বৃদ্ধির সুযোগ খুবই সীমিত। পরিবেশগত অবক্ষয় কমানোর জন্য কোন কোন জৈব জ্বালানির ক্ষেত্রে বর্তমান ব্যবহারের মাত্রা কমানো অতীব জরুরী।

* বাংলাদেশের সবচেয়ে প্রধান বাণিজ্যিক জ্বালানির উৎস প্রাকৃতিক গ্যাস। বর্তমানে অবশিষ্ট উত্তোলনযোগ্য মজুদের পরিমাণ অনুমান করা হয়েছে ১১-১৬ ট্রিলিয়ান কিউবিক ফিট (টি সি এফ)। অনাবিষ্কৃত মজুদের পরিমাণ অনুমান করা কঠিন এবং তা অনেক ক্ষেত্রেই কল্পনা প্রসূত। যদি ধরেও নেয়া যায় যে অনাবিষ্কৃত মজুদের আশাব্যঞ্জক অনুমান যুক্তিসংগত, প্রাকৃতিক গ্যাসের অনুমিত ভবিষ্যৎ চাহিদা, বিশেষভাবে বিদ্যুৎ উৎপাদনের জন্য, অনেক বেশি।

* দেশীয় কয়লার মজুদ, জ্বালানির চাহিদা কিছু পরিমাণে মিটাতে পারে, বিশেষ করে বিদ্যুৎ উৎপাদনে। জামালগঞ্জের কয়লা ক্ষেত্র বাদ দিলে, উত্তোলোন যোগ্য কয়লা মজুদের পরিমাণ হবে প্রায় ৮ টি সি এফ প্রাকৃতিক গ্যাসের সমান।

* আভ্যন্তরীণ পর্যায়ে জল বিদ্যুৎ সম্প্রসারণের সুযোগ খুবই সীমিত। নেপাল থেকে আমদানীকৃত জল বিদ্যুতের উপর নির্ভর করা রাজনৈতিক এবং ভূতাত্ত্বিক কারণে অত্যন্ত ঝুঁকিপূর্ণ।

* ভূ-রাজনৈতিক কারণে এবং অর্থায়নের অভাবে, পারমানবিক শক্তি উন্নয়নের সম্ভাবনা নাই বললেই চলে।

* নূতন নূতন নবায়নযোগ্য জ্বালানি উৎস যেমন ফটো ভোল্টাইক (পি ভি) বিদ্যুৎ এবং বায়ু বিদ্যুৎ ইত্যাদির সম্প্রসারণের সুযোগ অত্যন্ত সীমিত।

* আমদানিকৃত পেট্রোলিয়াম ব্যবহারের পরিমাণ ভবিষ্যতে বৃদ্ধি পাবে। তবে, পরিবহনের ক্ষেত্রে সি এন জি ব্যবহারের প্রচুর সম্ভাবনা রয়েছে এবং এর ফলে পেট্রোলিয়াম আমদানির চাহিদা সীমিত করা সম্ভব হবে।

জ্বালানি খাতের ব্যবস্থাপনা

সব দেশেই, জ্বালানি খাতের ব্যবস্থাপনা সরকারের জন্য একটি কষ্ঠসাধ্য কাজ। এর মধ্যে রয়েছে বিভিন্ন সরকারি সংস্থাসমূহ এবং তৎ সম্পর্কিত রাষ্ট্রীয় মালিকানাধীন প্রতিষ্ঠান (এস:ও:ই:) সমূহের কাজের সমন্বয় করা। জ্বালানি খাতে বেসরকারি ব্যবসায়ী প্রতিষ্ঠান সমূহেরও উলেখযোগ্য ভূমিকা আছে। যদিও প্রশাসনিক এবং বিভিন্ন সুবিধাভোগী শ্রেণীর স্বার্থ সমন্বয় জনিত অসুবিধার জন্য বড় আকারের সংস্কারমূলক পদক্ষেপ গ্রহণ ও বাস্তবায়ন করা কঠিন, তবু প্রয়োজনীয় সংস্কারগুলির অতি সংক্ষি বর্ণনা দেয়া সম্ভবঃ

* কার্যকর সিদ্ধান্ত গ্রহণের জন্য, ভাল প্রশিণপ্রাপ্ত ব্যবস্থাপকদের নিয়োগ দান এবং তাদেরকে হয়রানিমূলক রাজনৈতিক হস্তক্ষেপ থেকে রক্ষার ব্যবস্থা করা। এর অর্থ হল জ্বালানি শক্তি উৎপাদন ও বিতরণে নিয়োজিত রাষ্ট্রীয় মালিকানায় প্রতিষ্ঠানসমূহ (রা: মা: প্র:) তাদের বিক্রয় মূল্যের মাধ্যমে খরচ উঠিয়ে নিতে দেওয়া। যেসব রা: মা: প্র: প্রাথমিক জ্বালানি শক্তি - যেমন প্রাকৃতিক গ্যাস, অনুসন্ধান এবং উৎপাদনে নিয়োজিত, তাদের দায়িত্ব হবে যুক্তিসংগত মূল্য নির্ধারণ করা এবং তাদের উদ্বৃত অর্থ সরকারের নিকট হস্তান্তর করা।

* অদক্ষতা সম্পন্ন জনবল বজায় রাখার রাজনৈতিক চাপ কমানোর জন্য রা: মা: প্র: সমূহ থেকে ছাঁটাই হয়ে যাওয়া কর্মচারীদের পুনর্বাসনের জন্য আরও বিনিয়োগের ব্যবস্থা করা।

* জ্বালানি শক্তি খাতে আরো বড় ধরনের বিনিয়োগের ব্যবস্থা করা। যে সব রা: মা: প্র: যুক্তিসংগত মাত্রায় দক্ষতা মান বজায় রাখতে সক্ষমতা অর্জন করেছে এবং যে ক্ষেত্রে সরকারের পক্ষে যুক্তিসংগত শর্তে তহবিল সংগ্রহ সম্ভব, সে সব প্রতিষ্ঠানগুলিকে তাদের বিনিয়োগ বাড়ানোর জন্য উৎসাহিত করা উচিৎ। তবে যুক্তিসঙ্গত পরিমাণে জ্বালানি শক্তি সরবরাহ নিশ্চিত করার জন্য যে পরিমাণ বিনিয়োগ প্রয়োজন হবে তা কেবল সরকার বা দাতা সংস্থা সমূহের মধ্যে যোগান সম্ভব নয়। এজন্য বেসরকারি বিনেয়োগের সুযোগ সম্প্রসারণ করা প্রয়োজন হবে।

* জ্বালানি খাতে স্থায়ী ও ভবিষ্যৎবাচ্য (predictable) আইন কাঠামো প্রণয়নে সক্ষম একটি বিশ্বাসযোগ্য নিয়ন্ত্রণকারী সংস্থা সৃষ্টি করা। জ্বালানি খাতে নিয়োজিত স: মা: প্র: ও বেসরকারি ব্যবসা প্রতিষ্ঠানগুলির পরিদর্শনের দায়িত্ব নিয়ন্ত্রণকারী সংস্থার হাতে থাকবে। এই সংস্থাটিকে নিশ্চিত করতে হবে যে বিনিয়োগকারীরা যেন আস্থার সাথে বিনিয়োগ করতে পারে এবং ভোক্তারাও যেন নিশ্চিত হতে পারে যে বেসরকারি ও সরকারি প্রতিষ্ঠানগুলি জ্বালানি দাম নির্ধারণে এবং নির্ভরযোগ্য সরবরাহের ক্ষেত্রে দায়িত্বশীল পার্যায়ে কার্যক্রম পরিচালনা করবে।

* বিচার ব্যবস্থা মাধ্যমে জ্বালানি খাতে নিয়োজিত সরকারি ও বেসরকারি ব্যবসা প্রতিষ্ঠান সমূহের দুর্নীতিমূলক কাজ নিয়ন্ত্রণের ব্যবস্থা করা।

জ্বালানি নীতির ল্যসমূহ

একটি কার্যকর জ্বালানি নীতিতে বিভিন্ন লক্ষ্যের প্রতিফলন থাকে। এই লক্ষ্যমূহের একটি সার্বিক রূপরেখা নিম্নে দেওয়া হলঃ

* জ্বালানি নীতি শুধুমাত্র বর্তমান সরবরাহের ক্ষেত্রে সীমাবদ্ধ থাকতে পারে না, এতে দেশের দীর্ঘমেয়াদি চাহিদার প্রতিফলন থাকতে হবে। উদাহরণ স্বরূপ বলা যায়, রপ্তানির জন্য উদ্ধৃত প্রাকৃতিক গ্যাস পর্যালোচনার ক্ষেত্রে, ভবিষ্যতের আভ্যন্তরীণ জ্বালানি চাহিদা বিবেচনা করা অত্যন্ত গুরুত্বপূর্ণ। সম্ভবত আগামী ৫০ বৎসরের চাহিদার বিষয় বিবেচনায় আনা উচিৎ হবে।

* পরিমাণগত দিকের সাথে উৎপাদন ও সরবরাহের দক্ষতার বিষয়গুলি অবশ্যই জ্বালানি নীতির আওতাভুক্ত হতে হবে। জ্বালানি খাত একটি জাতীয় অর্থনীতির অত্যন্ত জটিলতম খাতগুলির অন্যতম। এর একদিকে রয়েছে রাষ্ট্রীয় মালিকানায় প্রতিষ্ঠানগুলির ব্যবস্থাপনা জনিত সমস্যা এবং অন্যদিকে রয়েছে জ্বালানি খাতে অংশগ্রহণকারী বেসরকারি ব্যবসা প্রতিষ্ঠানগুলির নিয়ন্ত্রণের প্রশ্ন। সাধারণ নিয়ম হিসাবে বলা যায় যে, ক্রেতা যে পরিমাণ জ্বালানি শক্তি ব্যবহার করবে তার ব্যয়ভার ক্রেতারই বহন করা উচিৎ। সরকারি ভর্তুকি দিয়ে প্রকৃত খরচের চেয়ে কম হারে জ্বালানি শক্তি সরবরাহ করা সরকারি রাজস্বের অনুপোযোগী ব্যবহার। অতীতে, জ্বালানি খাতের কোন কোন ব্যাপারে দুর্নীতি, যেমন মিটার রিডিং, একটি কার্যকর জ্বালানি খাত গড়ে তোলার ব্যাপারে মানুষকে আস্থাহীন করেছে। এবং ফলে অনেক গ্রাহকই বিকল্প ব্যবস্থার উপর নির্ভর করছে, যেমন নিজস্ব বিদ্যুৎ শক্তি উৎপাদনের ব্যবস্থা।

* জ্বালানি নীতির মাধ্যমে বাংলাদেশের সমস্ত জনগণের জ্বালানি শক্তির সুবিধা ভোগ করার পথ সুগম করতে হবে। জ্বালানি খাতে অধিকাংশ সরকারি বিনিয়োগেই পলি-এলাকার চাইতে শহর এলাকাকে বেশি প্রাধান্য দেয়া হয়েছে। একটি দক্ষ সুসংঘটিত জ্বালানি খাত সকলের জন্যই অপরিমেয় সুবিধা বয়ে আনতে পারে। এই সুবিধা গ্রামের ও শহরের এবং ধনী দরিদ্র সবাই ভোগ করতে পারবে।

* জ্বালানি নীতির মাধ্যমে অবশ্যই দেশের প্রাকৃতিক পরিবেশের উপর চাপ লাঘব করতে হবে। নিম্ন-আয়ের দেশসমূহ জ্বালানি শক্তি চাহিদা মিটানোর জন্য জৈব (বায়োমাস) জ্বালানির উপর খুব বেশি নির্ভরশীল। ক্রমবর্ধমান জনসংখ্যার জ্বালানি শক্তি চাহিদা মিটানোর চাপের ফলে দেশের প্রাকৃতিক পরিবেশ সংকটজনক পর্যায়ে পৌঁছে গেছে। টেকসই উন্নয়নের জন্য প্রয়োজন হল ব্যাপক আকারে বাণিজ্যিক জ্বালানি শক্তি সরবরাহের ব্যবস্থা করা, যাতে অতি ব্যবহৃত জৈব জ্বালানির উৎসগুলির উপর চাপ কমানো যায়। অন্যদিকে জৈব জ্বালানির আরোও দক্ষ ব্যবহারের উপরও জোর দেয়া প্রয়োজন।

সুপারিশ সমূহ

উপরে উলিখিত লক্ষ্যগুলি অর্জন করতে হলে বাংলাদেশ সরকারকে অনেকগুলি সুনির্দিষ্ট কৌশলগত সিদ্ধান্ত নিতে হবে। আমরা এখানে সব বিষয় সম্বলিত বিশদ সুপারিশমালা প্রণয়ন করি নাই। আমাদের সুপারিশ ৬ টি অত্যন্ত গুরুত্বপূর্ণ নীতির ক্ষেত্রে সীমাবদ্ধ থাকবে।

সুপারিশ এক

প্রাকৃতিক গ্যাস ও অন্যান্য খনিজ সম্পদের মজুদের জানা তথ্যের ভিত্তিতে বাংলাদেশ সরকারের প্রাকৃতিক গ্যাস রপ্তানির বিষয় অনুমোদন দেওয়া উচিৎ হবে না। সরকারের উচিৎ হবে আভ্যন্তরীণ জ্বালানি শক্তি চাহিদা মিটানোর জন্য, প্রাকৃতিক গ্যাসের পূর্ণ ব্যবহার করা। আভ্যন্তরীন চাহিদার মধ্যে সবচাইতে গুরুত্বপূর্ণ বিদ্যুৎ উৎপাদন। বাংলাদেশের জ্বালানি উৎসসমূহের ব্যাপারে সার্বক্ষণিক অনুসন্ধান চালানোর জন্য, পেট্রোবাংলা এবং জিওলজিক্যাল সার্ভেকে, সরকারের নির্দেশ প্রদান গুরুত্বপূর্ণ।

বেশির ভাগ কাজেই সবচাইতে দরকারি বাণিজ্যিক জ্বালানি হল বিদ্যুৎ এবং মাথাপিছু খুব কম হারে বিদ্যুৎ সরবরাহ জাতীয় অর্থনৈতিক উন্নয়নের একটি প্রধান অন্তরায়। বাংলাদেশে বিদ্যুৎ উৎপাদনের জন্য যথোপযুক্ত জ্বালানি প্রাকৃতিক গ্যাস। একটি বিশেষ কর্মসূচির মাধ্যমে বিদ্যুৎ উৎপাদন ক্ষমতা বৃদ্ধিতে বিনিয়োগ বৃদ্ধি করা উচিৎ এবং এর জ্বালানি উৎস হবে বর্তমানে মজুদ প্রাকৃতিক গ্যাস। রপ্তানি বা রাসায়নিক সার উৎপাদনে গ্যাস ব্যবহার বাঞ্ছনীয় নয়।

জ্বালানি উৎস সমূহের কৌশলগত ব্যবহারের যুক্তিনির্ভর নীতিগত সিদ্ধান্ত নেওয়ার জন্য সরকারের প্রয়োজন নির্ভরযোগ্য ভূতাত্ত্বিক তথ্যাদি। এ সব তথ্যাদি সংগ্রহের জন্য সার্বক্ষণিক অনুসন্ধান চালানো প্রয়োজন।

সুপারিশ দুই

একটি বিশ্বাসযোগ্য জ্বালানি নিয়ন্ত্রণ কমিশন স্থাপনের প্রতি বাংলাদেশ সরকারের অধিকতর প্রাধান্য দেয়া উচিৎ।

বাংলাদেশে জ্বালানি খাতে বিনিয়োগের প্রয়োজন ব্যাপক। এই পুঁজি সরবরাহ সরকার বা দাতা সংস্থাসমূহের পক্ষে সম্ভব হবে না। বেসরকারি ব্যবসায়ী খাতকে এ বিনিয়োগে উৎসাহী করার জন্য একটি নির্ভরযোগ্য নিয়ন্ত্রণমূলক ব্যবস্থা অত্যন্ত জরুরী। অন্যদিকে এই নিয়ন্ত্রণ ব্যবস্থার মাধ্যমে ভোক্তারাও নির্ভরযোগ্য সরবরাহ এবং জ্বালানির যুক্তিসংগত মূল্য সম্বন্ধে আশ্বস্ত হতে পারবে।

সুপারিশ তিন

সরকারের উচিৎ হবে পলি-বিদ্যুৎ বোর্ডকে (আর ই বি) ছোট আকারের (১০-১০০ মেগাওয়াট মতা সম্পন্ন) গ্যাস টারবাইন স্থাপনে উৎসাহিত করা। এই টারবাইন থেকে উৎপাদিত বিদ্যুৎ, জাতীয় গ্রীড লাইনের বাইরে স্থানীয় পলি-বিদ্যুৎ সমিতির সদস্যদের ব্যবহারের জন্য চিহ্নিত থাকবে।

আর ই বি প্রশাসনিক যোগ্যতার স্বাক্ষর রেখেছে বিধায় এই সংস্থাটি ইনডিপেন্ডেন্ট পাওয়ার প্রডিউসারদের (আই পি পি এস) পরীক্ষামূলক বিনিয়োগের একটি আদর্শ সংস্থা। এই বিনিয়োগ সরকারি পর্যায় হতে পারে এবং এর মাত্রা নির্ভর করবে আর ই বি'র সরকারি উৎসের মাধ্যমে তহবিল সংগ্রহের উপর। অন্যদিকে অধিকতর সম্পদশালী স্থানীয় সমবায় (পলি বিদ্যুৎ সমিতি) সমিতিগুলিও অর্থায়নের ব্যবস্থা করে নিজস্ব মালিকানায় ছোট ছোট গ্যাস টারবাইনে বিনিয়োগ করতে পারে। তবে এখানে উলেখ করা প্রয়োজন যে পলি এলাকায় অনেক বড় ধরনের বিদ্যুতায়ন ক্ষমতার প্রয়োজন। এতে বেসরকারি ব্যবসায়িক বিনিয়োগ প্রয়োজন হবে। আর ই বি'র গ্রাহকদেরই বিদ্যুৎ উৎপাদন, সঞ্চালন ও বিতরণের ব্যয়ভার বহন করতে হবে। বিনিময়ে উৎপাদিত বিদ্যুৎ ব্যবহারের ক্ষেত্রে তাদের অগ্রাধিকার থাকবে। স্থানীয় প্রয়োজন মিটিয়ে যদি উদ্বৃত বিদ্যুৎ থাকে, তবে তা জাতীয় গ্রীডের কাছে বিক্রি করা যেতে পারে।

সুপারিশ চার

সরকরের উচিৎ পলি-এলাকায় গৃহস্থালির রান্নার কাজে কয়লা ব্যবহারে উৎসাহিত করা। কয়লা সরবরাহের সাথে সাথে উপযুক্ত কয়লার চুলা সরবরাহেরও ব্যবস্থা করতে হবে।

এই উদ্ভাবনীমূলক পদক্ষেপে একদিকে গৃহের আভ্যন্তরীণ দূষণজনিত স্বাস্থ্য সমস্যা হ্রাস পাবে এবং অন্যদিকে বনজ সম্পদের উপরও চাপ কমবে।

সুপারিশ পাঁচ

সরকরের উচিৎ পেট্রোলিয়াম জ্বালানির বদলে সি এন জি ব্যবহারের সুযোগ চালু রাখা এবং সম্প্রসারণ করা।

ব্যক্তিগত গাড়ি ও বাণিজ্যিকভাবে ব্যবহৃত গাড়িগুলিকে সি এন জি'তে রূপান্তরে উৎসাহিত করার জন্য সরকার কিছুটা ভর্তুকি দেবার বিষয় বিবেচনা করতে পারে। যদি অধিক সংখ্যক মাত্রায় গাড়ি সি এন জি ব্যবহার করে, তবে একই সাথে সি এন জি ফিলিং ষ্টেশনের সংখ্যাও বাড়াতে হবে। নিরাপত্তাজনিত ব্যবস্থা আরো জোরদার করা প্রয়োজন হবে। যেমন জ্বালানি সংযোগ পরিমিতিকরণ, সি এন জি সরবরাহকারীদের পর্যাপ্ত প্রশিক্ষণের ব্যবস্থা করা এবং অন্যান্য (USDOE 2003) করনিয়।

A workshop in Old Dhaka. Even small amounts of electricity – enough to power a fan, a radio, and light bulbs – make work more productive and enjoyable. GEERT VAN KESTEREN PHOTO

সুপারিশ ছয়

পলি এলাকায় জৈব (বায়োমাস) জ্বালানি ব্যবহার উন্নত করার জন্য সরকারের উচিৎ হবে একটি উচ্চ মাত্রায় সামাজিক বিপনন কার্যক্রম হাতে নেওয়া।

আমাদের আলোচনায় আমরা উলেখ করেছি যে, উন্নতমানের চুলা ব্যবহার সম্প্রসারণ ও বনজ সম্পদ সম্প্রসারণের সুযোগ রয়েছে। সরকারের জনশিক্ষামূলক কার্যক্রমের মাধ্যমে কিভাবে অর্থপূর্ণ মাত্রায় জ্বালানি নীতিকে প্রভাবিত করা যায় এগুলি তারই দৃষ্টান্ত।

I. Introduction

IN MAY 2004 THE GOVERNMENT OF BANGLADESH RELEASED A DRAFT *NATIONAL Energy Policy* (NEP). The NEP refers to "the importance of energy in socio-economic development" (GOB 2004, 1). We agree. It is hard to exaggerate the importance of adequate supplies of energy for the future prosperity of Bangladesh. The government deserves credit for acknowledging the gravity of problems that exist in the energy sector – and the need for good policy to overcome the identified shortcomings. (See *Shortcomings* sidebar on the next page.)

For at least 60 percent of its energy needs, Bangladesh relies on traditional biomass fuels (Islam 2003). Reliance on direct solar energy for activities such as drying fish and on wind power for powering sailboats are additional examples of traditional renewable energy sources. Important as these sources are – and we make recommendations to improve efficiency of biomass fuel utilisation – the future prosperity of the country requires the efficient extraction, processing, and distribution of commercial energy at levels far greater than at present.

At any given level of energy supply, some countries achieve higher per capita incomes than others, but the level of commercial energy supply inevitably constrains the feasible level of prosperity that a country can achieve. We illustrate this proposition by examining the South and East Asian countries included in Table 1 and Figures 1 – 3.[1]

Among these 12 countries, Bangladesh was the most efficient, in terms of per capita income realised per unit of commercial energy. (See Table 1, column 5). This efficiency however is due primarily to the high reliance on traditional biomass fuels.

In Bangladesh and three other countries, the World Bank estimated 1998 per capita consumption of commercial fuels to be below 400 Kilograms of oil equivalent (Kgoe). The average per capita income for these four countries was $1,500. Bangladesh per capita income was close to the average for this first group.

The second energy consumption interval, 400 – 800 Kgoe per capita, includes five countries. No country with energy consumption in this interval was as prosperous as Sri Lanka, the second most efficient user of commercial energy after Bangladesh. Overall, the average per capita income among this second group was $2,800, nearly twice that for the first. The third interval, 800 – 1200 Kgoe per capita, includes two countries, with average per capita income of $5,200. Finally, the most prosperous country among the 12 was Malaysia. With per capita energy consumption of nearly 2000 Kgoe, it realised a per capita income of $8,800.

A trend line among these 12 countries is a useful way to think about the link between energy and incomes. Based on the trend, every $1000 increase in per capita income requires an increase in per capita commercial energy consumption of 230 Kgoe. While individual countries deviate from the trend, none deviate very far. And, as shown in Figure 1, the averages for countries in each of the first three energy consumption intervals lie very close to the trend.

"Shortcomings" identified by the National Energy Plan

These are the "shortcomings of past energy development programmes and management practices" as summarised in the draft *National Energy Plan* (GOB 2004, 1-2):

Due to shortage of capital it has not been possible to undertake systematic survey, exploration and exploitation of energy resources throughout the country. As a result, it has not been possible to ensure balanced development of energy resources of different zones of the country and balanced development of different sub-sectors of the energy sector.

Due to shortage of capital it has not been possible to undertake systematic development of power generation, transmission and distribution projects and rational use of electricity in the country.

Necessary attention has not been given to formulat[ing] appropriate policies to encourage private sector participation in [the] energy sector development programme to meet the shortage of [public investment] fund[s].

Development programmes of energy consuming sectors (e.g., industrial sector) have been constrained due to shortage and unreliable supply of commercial energy.

Energy agencies have not been operated and managed efficiently.

Energy prices have not been set on a rational basis.

Effective measures have not been taken to ensure rational use of energy.

Unplanned and inefficient use of fuels [is] contributing to environmental degradation.

Adequate attention has not been given to meet the total energy needs of rural areas.

Adequate attention has not been given to undertake systematic research programmes to develop indigenous technological capabilities.

Adequate attention has not been given to develop trained manpower for the efficient management of the sector.

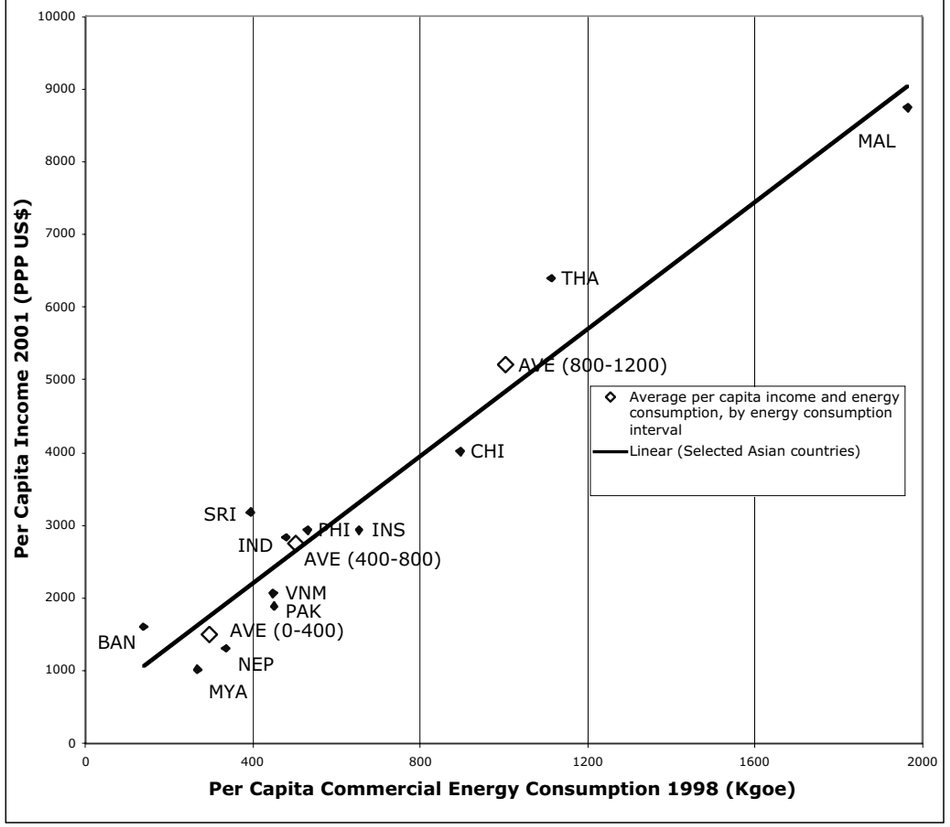
A woman washes clothes in the Buriganga River near Dhaka. GEERT VAN KESTEREN PHOTO

Table 1
Per Capita Energy Statistics and Measures of Development, Selected Asian Countries

	Annual Per Capita Consumption		Development Measures		Efficiency of Commercial Energy Utilisation (3./1.) (PPP US$ / Kgoe)
	Commercial Energy 1998 a. (Kgoe)	Electricity 1998 a. (KWH)	Per Capita Income 2001 b. (PPP US$)	Human Development Index 2001 b.	
	1	2	3	4	5
Bangladesh (BAN)	138.5	80.4	1610	0.502	11.6
Myanmar (MYA)	266.9	58.3	1027	0.549	3.8
Nepal (NEP)	333.7	48.1	1310	0.499	3.9
Sri Lanka (SRI)	394.7	255.0	3180	0.730	8.1
Vietnam (VNM)	447.7	231.6	2070	0.688	4.6
Pakistan (PAK)	450.6	329.0	1890	0.499	4.2
India (IND)	479.1	357.3	2840	0.590	5.9
Philippines (PHI)	530.2	466.5	2940	0.682	5.5
Indonesia (INS)	653.5	324.9	2940	0.682	4.5
China (CHI)	895.8	721.6	4020	0.721	4.5
Thailand (THA)	1112.1	1345.2	6400	0.768	5.8
Malaysia (MAL)	1965.2	2554.0	8750	0.790	4.5

Sources:
a. World Bank (2004)
b. United Nations (2004)

Figure 1
Per Capita Commercial Energy Consumption and Income, Selected Asian Countries



For many purposes, the most useful form of energy is electricity, and its availability is often the best way to think about the energy supply constraint on development. Among the shortcomings listed by the NEP are the unmet energy needs of the four fifths of Bangladeshis who live in rural areas, where electricity is available only to a small minority. Villagers work during daylight, but are obliged to stop most activities when the sun sets. Were reliable electricity widely available, they could do many things that contribute to economic development. They could attend night school; their children could more easily study at home; they could undertake home-based activities using electric appliances such as sewing machines. Electricity also has many benefits related to relief of poverty. Table 2 provides a summary.

A gas field. A major source of energy in the country.

Figure 2
Per Capita Electricity Consumption and Income, Selected Asian Countries

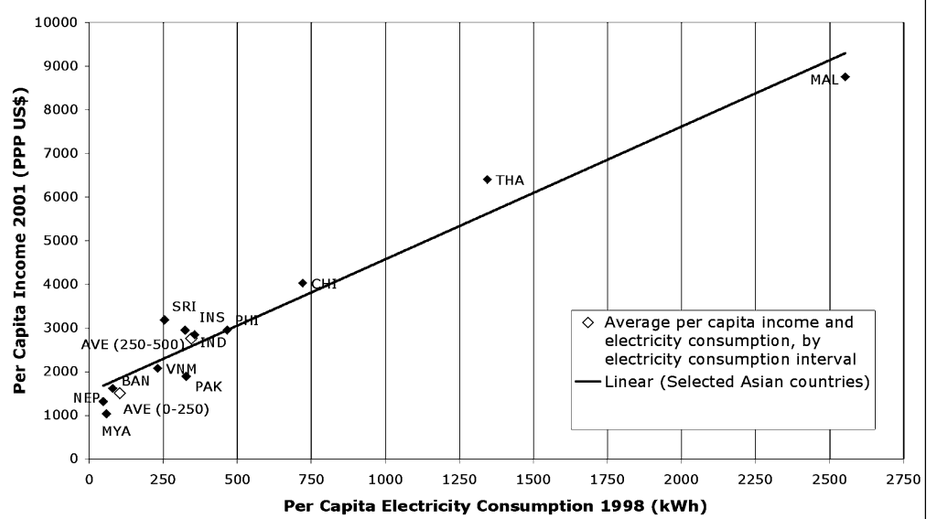
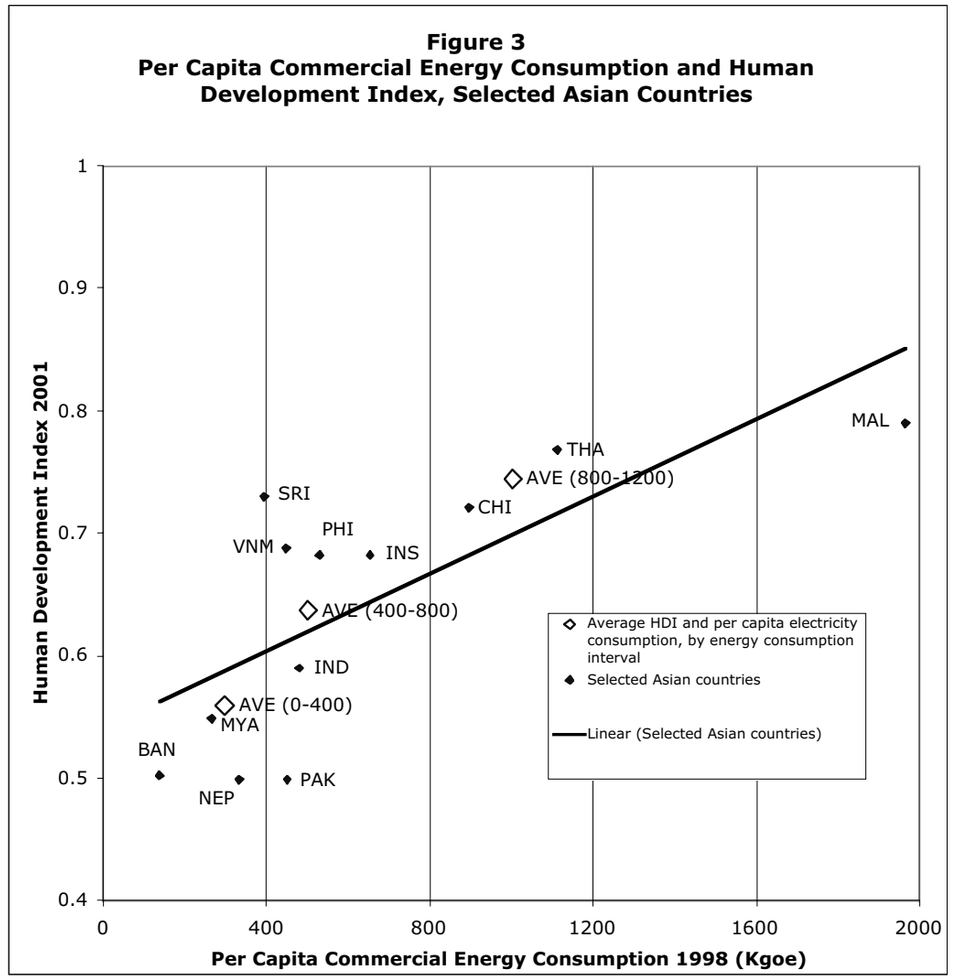


Figure 3
Per Capita Commercial Energy Consumption and Human Development Index, Selected Asian Countries



Bangladesh is the third lowest country in terms of per capita electrical consumption. Based on the trend line for Figure 2, a $1000 increase in per capita income requires an increase in per capita electricity consumption of 330 kilowatt hour (kWh).

Some consider the *Human Development Index*[2] (HDI) to be a better means for comparing development among countries than per capita income. The HDI is constructed from three measures of a country's performance: its per capita income, literacy rate, and average life expectancy. The HDI measures the effectiveness of government education and health policies, as well as the productivity of a country's economy. Since improvements in education and health care do not require much additional use of energy, the

link between higher energy consumption and higher HDI values is, not surprisingly, less precise than in the case of energy and incomes. Nonetheless, as the trend line in Figure 3 illustrates, higher HDI scores require in general more per capita energy.

In 1980, the world's primary energy consumption was about 7,300 million tonnes of oil equivalent (Mtoe). Of that total, petroleum accounted for 43 percent, coal 31 percent, natural gas 17 percent, hydropower 7 percent, and nuclear power 3 percent. By 1996, world primary energy consumption increased to 9,600 Mtoe. The shares of the various energy sources were as follows: petroleum 37 percent, coal 29 percent, natural gas 21 percent, hydropower 7 percent, and nuclear 6 percent (Islam 2001). It is worth noting that, over these 16 years, the share of petroleum and coal declined, whereas the share of natural gas increased.

The projection is for further increases in the relative importance of natural gas as energy source. Just as the 19th century was the age of coal, and the 20th was the age of oil, it may well be that the 21st century will be the age of gaseous fuels, among which natural gas is the most important (*Economist* 2001).

Table 2: Potential Effects of Improved Energy Services in Alleviating Poverty

Direct effects on well-being	Direct effects on health	Direct effects on education	Direct effects on economic opportunities for the poor	Trickle-down effect of increased productivity	Effects on government budgets and services
Improved access to lighting, heat and refrigeration ❖ Savings in time and effort (due to reduced need to gather biomass and other fuels) ❖ Improved access to information (through radio, television, and telecommunications)	Improved indoor air quality through cleaner fuel ❖ Reduced fire hazard ❖ Improved quality of health services (through better lighting, equipment, and refrigeration) ❖ Easier establishment of health centres	Improved access to lighting, allowing more time to study ❖ Savings in time and effort, releasing time and energy to channel to education	Easier establishment and greater productivity of businesses that employ the poor ❖ Creation of employment in infrastructure service delivery ❖ Improved health and education and savings in time and effort, increasing individual productivity	Easier establishment and greater productivity of businesses in general (including through positive impact on the environment)	Smaller fiscal burden and higher fiscal returns from more efficient services ❖ More benefits to the poor if government spending is effectively channelled to welfare-enhancing services ❖ Higher fiscal returns associated with higher growth, coupled with pro-poor policies

Source: adapted from Price (2000,27)

These children are attending an informal school outdoors. One benefit from better access to electric power is to enable children to study at home, after dark. GEERT VAN KESTEREN PHOTO

To sum up this introduction, higher commercial per capita energy consumption is essential for Bangladesh to achieve healthy development, whether development is measured in terms of per capita income or the more comprehensive Human Development Index.

In outline, the rest of this study proceeds as follows. Chapter II summarises what is known about reserves of alternate primary energy sources in Bangladesh, and the technologies available for exploiting them. Chapter III discusses energy demand projections for Bangladesh. Chapter IV is concerned with the need for efficient management of the energy sector. Chapter V offers a conclusion and also our recommendations.

II. Energy Resources of Bangladesh

IN THIS CHAPTER, WE ASSESS NUMEROUS ESTIMATES OF THE MAGNITUDE OF reserves of energy sources in Bangladesh, and estimates of the economic feasibility of the technologies for exploiting them.

Natural gas

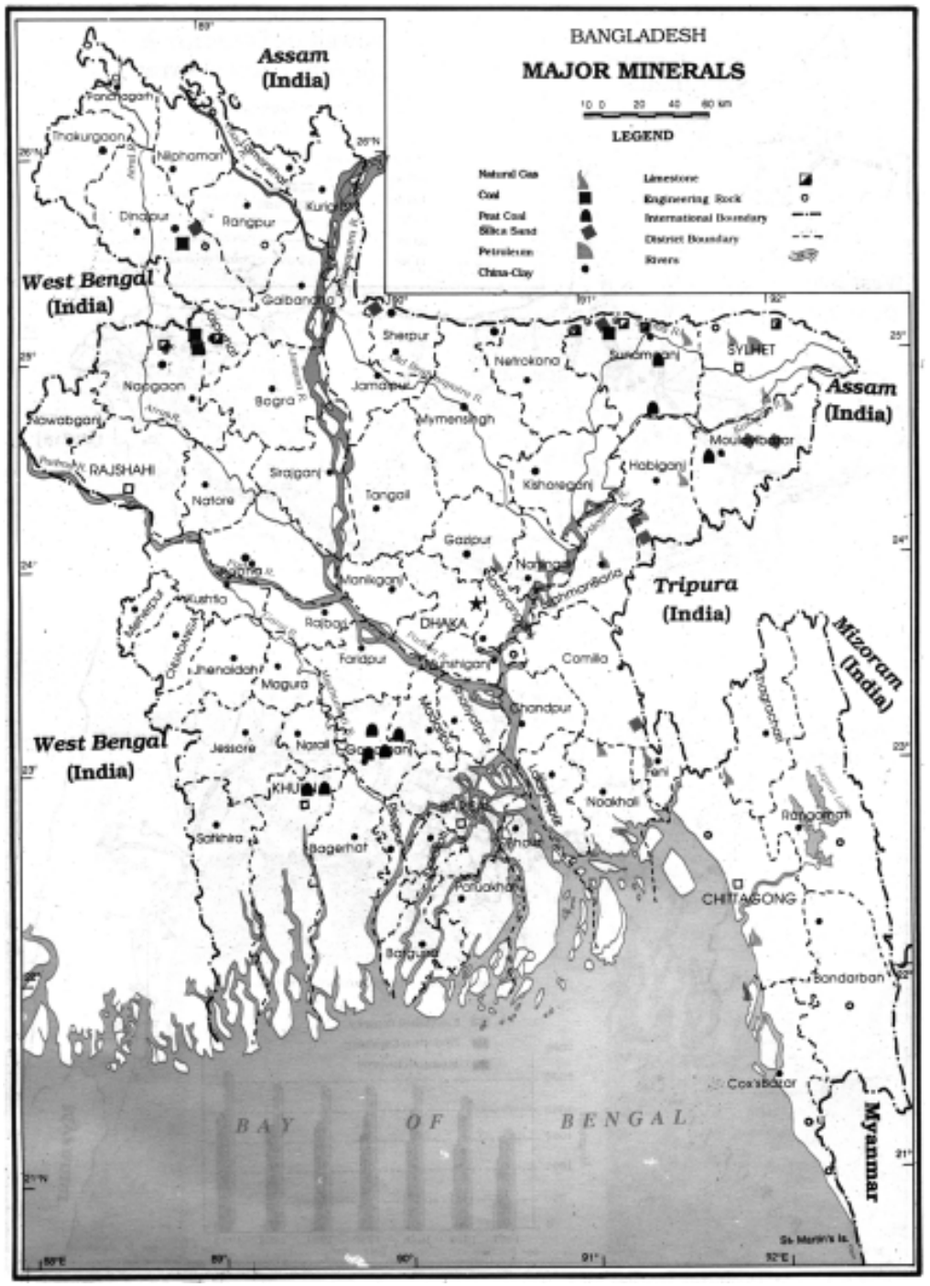
The most important commercial energy source in Bangladesh is natural gas. Estimating gas reserves has been subject to much controversy in recent years. First, it is important to distinguish among different concepts used in discussions about reserves:

Recoverable reserves are the volume of natural gas deposits recoverable with reasonable certainty under existing economic conditions and technology. Recoverable reserves may be classified as either proved or probable.

Proved recoverable reserves have more certainty because of more detailed exploratory work on the actual size of the reserve (e.g., seismic activity, greater number of wells drilled in area of reserve).

Probable recoverable reserves have less certainty, being based on information from perhaps a few wells and general geological knowledge of a promising area.

Undiscovered reserves are speculative estimates of reserves yet to be discovered in unexplored areas. These estimates rely on statistical extrapolations and are subject to great uncertainty. They should not be confused with recoverable reserves.



To date, 22 natural gas fields have been discovered in Bangladesh. Table 3 summarises recoverable reserve estimates from four assessments in recent years. The estimates of remaining recoverable gas range from 11 to 16 trillion cubic feet (TCF). For example, the Nagorik (Citizens) Committee estimated proved reserves of 10.8 TCF and probable reserves of another 5.8 TCF, for a total recoverable reserve estimate of 16.6 TCF. To date, 4.6 TCF have been consumed. Hence, remaining recoverable reserves, according to the Nagorik Committee, are 12.0 TCF (12.0 TCF = 16.6 TCF – 4.6 TCF). Table 4 summarises results from two recent assessments of undiscovered reserves.

Table 3: Estimates of Proved Plus Probable Bangladesh Remaining Recoverable Natural Gas Reserves

	Remaining Recoverable Reserves [a] (TCF)
Nagorik [Citizens] Committee Report (Bangladesh Geological Society & Bangladesh Economic Association 2002)	12.02
Natural Gas Demand Supply Forecast: Bangladesh (FY 2001-2050). Petrobangla. (Khan 2001)	10.91
Petroleum Potential and Resource Assessment 2001. Government of Bangladesh (GOB) & Norwegian Petroleum Directorate (NPD) (GOB & NPD 2001)	15.80
Report of the Committee for Gas Demand Projection and Determination of Recoverable Reserves and Gas Resource Potential in Bangladesh. Ministry of Energy and Mineral Resources (GOB 2002b)	12.04 – 15.55

Note: [a]Cumulative consumption to April 2002 is estimated to be 4.6 TCF. Remaining reserves are estimates as of May 2002.

Table 4: Estimates of Bangladesh Undiscovered Natural Gas Reserves

	Probability that undiscovered reserves exceed specified volume (TCF) ...				
	95%	90%	50%	10%	5%
US Geological Survey – Petrobangla Cooperative Assessment of Undiscovered Natural Gas Resources of Bangladesh. (USGS & Petrobangla 2001)	9	-	31	-	66
Petroleum Potential and Resource Assessment 2001. Government of Bangladesh (GOB) & Norwegian Petroleum Directorate (NPD) (GOB & NPD 2001)	-	19	42	64	-

Adequate supplies of water are crucial to the country's farmers. And crucial to successful irrigation is adequate power for water pumping. GEERT VAN KESTEREN PHOTO

Some analysts have added together recoverable and undiscovered reserve estimates, and calculated very large *reserve life* estimates. Using estimates from the Ministry of Energy and Mineral Resources and Norwegian Petroleum Directorate (GOB/NPD 2001), one can generate a total reserves figure as high as 79.8 TCF (79.8 TCF = 15.8 TCF remaining recoverable reserves + 64 TCF undiscovered reserves). Static reserve life estimates can then be calculated by dividing total reserves by present annual consumption. Based on total consumption in 2003 of 0.421 TCF, the reserve life of Bangladesh reserves can be calculated as high as 190 years (190 years = 79.8 TCF / 0.421 TCF per year).

At times, the motivation to generate large reserve life estimates has been to persuade decision makers and the public to favour gas exports. There are two reasons to be sceptical. The first is the speculative nature of undiscovered reserve estimates. The second is that reserve life estimates often ignore future growth in domestic demand, or extrapolate unreasonably low growth rates. The most important domestic use of natural gas is for power generation. A universally agreed priority for Bangladesh energy policy is that natural gas-based power capacity expand sufficiently to put an end to the problem of load shedding and assure better power availability throughout the country. To be consistent with this goal, re-

serve life estimates must be reduced dramatically.

Table 5 illustrates the reserve life of Bangladesh natural gas, under alternate assumptions about the total of recoverable plus undiscovered reserves, and alternate rates of growth in annual domestic demand within Bangladesh. If, as an example, the total of recoverable plus undiscovered reserves turns out to be 40 TCF, the reserve life is 95 years – provided annual consumption does not rise above the 2003 level. However, over the last two decades the Bangladesh annual GDP growth rate averaged 4.55 percent. If natural gas demand grows at that rate, a conservative assumption, the reserve life falls to 38 years. If Bangladesh is to overcome its acute power shortage, the rate of increase in power capacity must increase faster than 4.55 percent. Over the 1990s, gas consumption grew at an average annual rate of 7.1 percent (GOB 2002b, 16). If we extrapolate this growth rate, 40 TCF of natural gas would last 30 years. In the last few years, the annual growth rate in gas consumption has approached 10 percent (Kamal 2004). At that rate of growth, 40 TCF would last only 25 years.

In terms of ability to generate heat, we demonstrate below that coal reserves are equivalent to additional natural gas reserves of 8 – 13 TCF. Hence, the availability of coal deposits does a little, but not much, to relax the energy resource supply constraint. If recoverable plus undiscovered reserves of gas and coal are equivalent to, say, 60 TCF, and consumption grows at 7.1 percent annually, the combined gas plus coal reserve life remains less than four decades.

Table 5: Reserve life of Bangladesh Natural Gas Reserves by Volume of Reserves and Annual Rate of Increase in Utilisation

Annual rate of increase in natural gas utilization[a]	Recoverble and undiscovered reserves (TCF)				
	10	20	40	60	80
(per cent)			(years)		
0.00	24	48	95	143	190
4.55	16	26	38	45	51
7.10	14	22	30	35	39
10.00	13	18	25	29	31

Note: [a]Gas utilization rate in initial year is 0.421 TCF, the actual volume consumed in the year 2003.

Most cooking is done on stoves using biomass fuels. The woman tending this outdoor stove is fortunate inasmuch as she is less likely to suffer bronchial problems than women who undertake the family cooking on indoor stoves. Long-term exposure to smoke arising from inefficient stoves is a serious health problem. With the newly developed Barapukuria coal mine, Bangladesh has the potential to expand use of more efficient coal-burning stoves. GEERT VAN KESTEREN PHOTO

Coal

A coal mine is under development at Barapukuria. It is expected to produce 1 million tonnes of coal annually, starting in late 2004. Total recoverable coal reserves at this field are estimated at 64 million tonnes. The NEP (GOB 2004, 9) estimates the country's total coal deposits in place to be 2527 million tonnes. This includes estimates of deposits at four fields – Barapukuria, Khalaspir, Phulbari, and Jamalganj. Of this total, 492 million tonnes are estimated to be recoverable.

Natural gas and coal are, respectively, the first and second most important sources of commercial energy in Bangladesh. A useful way to compare their relative importance is to compare the heat derived from a unit of coal to that from a unit of natural gas.[3] The recoverable reserves from the Barapukuria field are equivalent to approximately 1.7 TCF of natural gas. The above estimate of 492 million tonnes is equivalent to 13.4 TCF of gas.[4]

The coal at Jalmalganj lies at depths of 1000 meters, and its extraction is probably not economically viable at present energy prices (Islam 2003; GOB 2004, 9). Jalmalganj deposits are at least 1000 million tonnes. If these are excluded from consideration, recoverable coal reserves are below 300 million tonnes, equivalent to 8.1 TCF of natural gas.[5] This figure can be set against estimates of remaining recoverable

gas reserves: a range from 11 – 16 TCF. (See Table 3.)

Inevitably, reserve estimates are subject to uncertainty. The NEP emphasises the need for additional exploration to establish the magnitude of mineral deposits – a recommendation with which we agree. And technology may evolve: either increasing the recovery rate from known deposits, or rendering economically viable the exploitation of certain deposits previously excluded from reserve calculations. Most assessments, including that of the NEP, conclude that exploitation of the deep deposit at Jamalganj is not commercially viable at present energy prices.[6] Technical advances may make it commercially attractive. Alternatively, the Jamalganj field may be a good test case for application of new drilling technology that permits extraction of methane gas embedded in coal deposits (Imam 2003).

There are employment advantages to coal as energy source: it generates more employment per unit of energy than do many other sources, such as natural gas. However, mining is a dangerous occupation; coal mines are subject to natural hazards, such as flooding and explosion from methane gas.

Coal also poses a range of environmental problems. Burning coal generates more greenhouse gases per unit of energy obtained than does natural gas. However, Bangladesh coal consumption will inevitably be a trivial fraction of total world coal consumption. Of immediate concern is the problem of local air pollution. Those living in the vicinity of major coal-fired thermal power plants face higher incidence of long-term respiratory diseases due to particulates. To minimise the problem of local air pollution requires installation of expensive anti-pollution technology.

Peat

Peat is partially decomposed plant matter, submerged in water. Exploitation of peat as an energy source is usually not efficient, given availability of other lower-cost sources. Furthermore, large-scale peat extraction can produce complex ecological damage (International Peat Society 2004).

The total peat deposits of Bangladesh have been estimated at 170 million tonnes (LGED 2004a). Petrobangla initiated a pilot project to attempt commercial exploitation of peat at Madaripur. It was not a success due to technical and economic reasons, including negative impact on agricultural land. The Bangladesh Council of Scientific and Industrial Research (BCSIR) should nonetheless undertake more thorough research on the potential to exploit peat.

Hydropower

There is some potential for small-scale hydroelectric power, particularly from "run of the river" turbines that do not require reservoir dams. To generate significant quantities of hydropower requires dams to create a high fall for the water powering the turbines. Such dams entail large construction costs and often displace human settlements. They may also impose unacceptable environmental costs – due to the flooding of land under reservoirs behind the dams, and to the disruption of soil fertilisation from seasonal flooding.

Islam (2003, 6) estimates the total potential of the country at 755 Megawatts (MW), in three locations (Kaptai, Sangu, and Matamuhuri). Of this, about 230 MW has been harnessed at Kaptai. The Bangladesh Power Development Board (BPDB) plans to install two additional hydropower units, each of 50 MW capacity.

Further expansion of hydropower may occur, but its impact on total energy supply will be minor.

Crude oil

Traces of oil have been discovered in various exploratory wells, but Bangladesh oil reserves are insignificant (LGED 2004a).

Imported commercial energy

Some have suggested Bangladesh will in the future be able to import abundant hydropower from future projects likely to be developed in Nepal. However, even if such projects are built and the power is offered to Bangladesh at an attractive price, there are significant geological and political risks in relying extensively on Nepal.

Nepal is on the active boundary between the Eurasian and Indian tectonic plates, and is accordingly an unstable zone subject to earthquakes. If Bangladesh becomes reliant on Nepalese hydropower and a major earthquake destroys a dam, it would be calamitous for the Bangladesh economy.

In addition to geological risks, power from Nepal poses other risks of a political and economic nature. India has a voracious appetite for additional energy, and Nepal might be pressured at some point to divert power from Bangladesh to India. If it did not divert power, Nepal might insist that Bangladesh pay a price much higher than originally negotiated. And the political instability in Nepal could interrupt power delivery.

If Bangladesh relies on imported energy, it must use foreign currency. In a context of scarce foreign reserves, importing energy requires a tradeoff with other pressing import requirements. Bangladesh currently imports all petroleum fuels (3.4 million tonnes in 2000) and a small amount of coal (used primarily for brick-making).

Compressed natural gas (CNG) provides attractive prospects for limiting the need for petroleum imports, and for reducing air pollution due to combustion of petroleum by vehicles. Reducing air pollution is a high priority in large urban centres, in Dhaka in particular. Use of CNG to power vehicles requires investment in a dense network of distribution outlets. In the last two years, considerable expansion of this network has taken place. The government has enabled this expansion in various ways: making available suitable sites for filling stations, and so on.

Indigenous biomass fuels and animal power

At present, indigenous biomass fuels have been estimated to provide at least 60 percent, if not more, of the energy used in Bangladesh. Provided they are exploited below the – often hard to establish – sustainable limits of biological regeneration, use of renewable biomass fuels is desirable.

The NEP estimates the total draught animal population of Bangladesh to be about 10 million (GOB 2 004, 4). During peak agricultural periods, mechanised tilling devices (e.g., tractors, power tillers) supplement the shortage of draught animal power.

Nuclear, solar photovoltaic, and wind power

Since the 1960s, the government has been trying to establish a nuclear power plant at Rooppur.[7] Several feasibility studies have been conducted. In the present geopolitical context, it is exceedingly difficult for any developing country to mobilise the necessary finance plus administrative and technical expertise to establish a nuclear power plant. Were it feasible to organise such a venture, the cost of the power generated would probably exceed that from gas-based generators.

Over the last two decades, various government agencies and NGOs have installed small solar photovoltaic (PV) power systems, essentially for lighting and pumping in isolated regions. The total installed capacity is 0.42 MW, less than 0.01 percent of total installed power capacity in Bangladesh. Even in India, a country known throughout the world for the use and manufacture of solar PV modules, installed solar power is only 58 MW, about 0.06 percent of that country's installed power capacity. Total installed solar PV capacity in the world is about 1,200 MW, less than one quarter of Bangladesh's total capacity.

The reason for the small share of solar PV power is its high cost relative to electricity generated by other means. The cost per kWh of PV power depends essentially on three variables: the initial capital cost of the equipment, the discount rate used to calculate per kWh costs over the lifetime of the equipment, and the average hours of sun per day. Admittedly, costs of PV power have declined dramatically over the last two decades. But, even using state-of-the-art PV technology, calculating cost with a low discount rate, and employing the PV systems in a climate like that of Bangladesh with high average hours of sun per day, the cost per kWh is at least US30¢ per kWh (Solarbuzz 2004).[8] This is about five times the BPDB's cost per kWh using thermal power plants. Solar PV power is suitable for use in isolated regions where transmission costs are prohibitively high, but overall it has a very limited potential to satisfy Bangladesh energy needs.

Islam (2003,10) has reported the total installed wind power generation capacity in Bangladesh as 50 kW. This represents about 0.001 percent of Bangladesh power capacity, an order of magnitude smaller than solar PV power. Throughout the world, total installed wind power in 2002 was about 30,000 MW, 40 percent of it in Germany. Like solar PV power, wind power is expensive. The NEP (2004, 5-6) discusses the possibility of wind power along the coast in small wind/diesel combined operations, but cautions that such projects are expensive because they must be constructed to withstand the forces associated with cyclones.[9]

Summary on availability of resources

Many observers have attempted to persuade Bangladesh that there exist multiple energy sources available at reasonable cost and that, accordingly, the government should approve the export of natural gas. That is not our conclusion. We are more cautious, and recommend against gas exports at this point of Bangladesh development. In summary, here are the conclusions we draw from our survey of energy sources:

Transportation requires energy – human energy for rickshaws; combustion of hydrocarbon fuels for motor-powered vehicles. Bangladesh relies on imports for all petroleum products, except natural gas. Use of CNG-powered baby taxis in recent years has reduced Dhaka's air pollution and saved scarce foreign exchange. GEERT VAN KESTEREN PHOTO

- There is only a limited prospect for increasing the sustainable supply of biomass fuels. For certain biomass sources, it is crucial to reduce present exploitation rates, in order to reduce environmental degradation.
- The most important commercial source of energy in Bangladesh is natural gas. Estimates of remaining recoverable reserves are in the range of 11 – 16 TCF. Estimates of undiscovered reserves are necessarily speculative. Even if optimistic undiscovered reserve estimates become justified, projected domestic needs for natural gas – primarily in power generation – are very large.
- Domestic coal deposits can play a role in supplying energy needs, primarily in power generation. Excluding the Jamalganj field, recoverable coal reserves are equivalent to about 8 TCF of natural gas.
- There is a small potential to expand domestic hydropower. Reliance on imported hydropower from Nepal poses serious risks, both political and geological.
- For geopolitical reasons and lack of available financing, there is no prospect for development of nuclear power.
- New renewable energy sources, such as PV power and wind power, have very limited potential.
- Consumption of imported petroleum will increase. However, use of CNG for transport has considerable potential and can limit the need for imported petroleum.

III. Future Energy Demand

THE PRESENT DISTRIBUTION OF BANGLADESH ENERGY CONSUMPTION ACROSS the various primary fuel categories is given in Table 6.

Over the two decades, 1981-2000, Bangladesh annual GDP growth averaged 4.55 percent. Estimation of future GDP growth and energy demand is subject to much uncertainty. The Gas Demand and Reserve Committee (GDRC) of the Bangladesh government (GOB 2002b) estimated commercial energy demand using a range of four different GDP growth rates (3.0 percent, 4.55 percent, 6.0 percent, and 7.0 percent). Two energy scenarios were estimated for each GDP growth rate. If Bangladesh is to escape poverty, it requires several decades of growth at the upper end of this range. Table 7 shows total commercial energy demand in selected years under the "business as usual" 4.55 percent GDP growth rate.

The GDRC (GOB 2002b) and Petrobangla (Khan 2001) have both estimated cumulative natural gas demand over the next half-century. The GDRC cumulative estimates range from 40 TCF with a 3.0 percent GDP growth rate to 141 TCF with a 7.0 percent growth rate. Table 8 shows cumulative demand by selected years for four GDRC scenarios and one for Petrobangla.

Comparing the projections of Table 8 with estimates of Table 3 is a sobering exercise. Present recoverable reserves will probably suffice to meet domestic demand for the next two decades. Nonetheless, the government's Gas Utilisation Committee (GOB 2002a) has stated that gas shortages may occur as early as 2015. If the median undiscovered reserves (31 – 42 TCF of Table 4) are actually discovered, Bangladesh will probably have enough natural gas to meet cumulative domestic requirements for the next four decades.

Table 6: Distribution of Primary Energy Sources in Bangladesh, 2000

	(metric tonnes of oil equivalent)	(percent)
Natural Gas (0.331 TCF)	7.67	27.2
Petroleum (imported)	3.23	11.4
Coal (0.5 million tonnes, imported)	0.32	1.1
Hydro power (1027 GWh)	0.09	0.3
Total, commercial fuels	11.31	40.0
Biomass fuels	16.97	60.0
Total	28.28	100.0

Source: GOB (2002b)

Table 7: Projected Distribution of Primary Commercial Energy Sources in Bangladesh, 2000-2050

	2000	2010	2020	2030	2040	2050
			(Mtoe)			
Natural gas	7.7	14.2	22.9	33.6	45.6	57.1
Petroleum	3.2	5.9	8.9	12.1	15.4	20.1
Coal	0.3	0.6	1.3	3.0	4.7	5.1
Renewable fuels	0.1	0.2	0.5	0.7	1.3	1.7
Total	11.3	20.9	33.6	49.4	67.0	84.0

Source: GOB (2002b). Note: This projection assumes 4.55 percent annual GDP growth

Table 8: Projected Cumulative Natural Gas Consumption in Bangladesh, 2010-2050

	2010	2020	2030	2040	2050
			(TCF)		
Report of the Committee for Gas Demand Projection and Determination of Recoverable Reserves and Gas Resource Potential in Bangladesh. Ministry of Energy and Mineral Resources (GOB 2002b) (Adjusted-low energy intensity projections)					
3.00% annual GDP growth	4.3	10.6	18.9	29.0	40.0
4.55% annual GDP growth	4.7	12.6	24.7	41.8	64.0
6.00% annual GDP growth	5.0	14.9	32.2	60.0	101.0
7.00% annual GDP growth	5.3	16.8	38.8	77.7	141.0
Natural Gas Demand Supply Forecast: Bangladesh (FY 2001-2050). Petrobangla. (Khan 2001)	4.8	13.7	26.8	43.7	63.0

IV. Management of the Energy Sector

IN ALL COUNTRIES, MANAGING THE ENERGY SECTOR IS A COMPLEX AND DEMANDING activity for government. It entails coordinating the activities of various government agencies and of the relevant state-owned enterprises (SOEs). Most countries have concluded there is an important role for private firms in the energy sector. That, in turn, requires government to put in place competent regulatory agencies.

Managing the State-Owned Enterprises

Under British rule and in early years of East Pakistan, power generation was undertaken by small private producers. Over the last five decades, however, East Pakistan and subsequently Bangladesh have relied primarily on SOEs to produce and distribute energy. The major energy-sector SOEs are the following:

- Bangladesh Oil, Gas and Mineral Corporation (BOGMC – Petrobangla): It has many subsidiaries in different energy sectors, ranging from gas exploration to coal mining.
- Bangladesh Power Development Board (BPDB): The BPDB is a vertically integrated power company, undertaking over two thirds of Bangladesh power generation and over one third of power distribution.
- Bangladesh Petroleum Corporation (BPC): It is a holding company with shares in a refinery and in oil marketing companies.
- Dhaka Electric Supply Authority (DESA): This agency is responsible for nearly all power distribution in the Dhaka region, and accounts for about two fifths of all power distributed in the country.
- Dhaka Electric Supply Corporation (DESCO): This agency, organised as a separate state-owned corporation, is responsible for some power distribution in the Dhaka region.
- Rural Electrification Board (REB): The REB is responsible for all rural power distribution, about one quarter of the total.

Private firms have engaged in oil and gas exploration and production, and in retail petroleum distribution, but their role has been smaller than in most developing countries. Relative to the years before 1947, Bangladesh has dramatically increased utilisation of commercial energy. However, per capita energy consumption in Bangladesh remains very low and, overall, the performance of SOEs in the energy sector has been unsatisfactory in recent years. The World Bank has estimated their annual average *financial shortfall* over the years 1991 to 2002 at 2 percent of GDP. (See Table 9.) Making good on this shortfall is a significant cost to the government and to the people of Bangladesh. The shortfall is nearly as much as the government spends annually on education. Furthermore, the well-to-do have better access to energy services than the poor. Hence, the government subsidies required to accommodate the financial shortfall of the energy sector SOEs have been of primary benefit to the well-to-do – albeit, both rich and poor suffer from the low quality of many energy services.

Efficient management of the energy sector is exceedingly complex in all countries, including wealthy industrialised countries. The United States has experienced the equivalent of load shedding (for example, the power shortages in California in recent

Table 9: Overview of Energy Sector State-Owned Enterprises

	Energy Sector	Public/private Role and Market Share	Share of SOE Employment[a]	Share of SOE Assets[b]	Rate of Return on Assets[c]
Petrobangla (BOGMC)	Natural gas	BOGMC 80% IOC 20%	3.4	7.0	4.1
Bangladesh Power Development Board (BPDB)	Integrated power company	Generation: public 78%, private 22%; Public monopoly in distribution and transmission	9.6	23.2	-0.3
Dhaka Electric Supply Authority (DESA)	Power distribution in Dhaka	Public monopoly in distribution in Dhaka	1.9	5.6	-4.7
Bangladesh Petroleum Company (BPC)	Petroleum refining, import and marketing	Public monopoly; retail distribution is private	1.3	7.9	-0.5
Total / Average			16.2	43.8	-0.1

Source: adapted from World Bank (2003,79)
Notes: a. Share of all employment in SOEs in fiscal year 2001.
b. Share of all assets in SOEs in fiscal year 2001
c. Rate of return on assets, fiscal years 1991-2002, calculated before deduction of interest.

Imperatives of Energy Sector Reform

Bangladesh's energy sector remains underdeveloped, representing a major development challenge because of the importance of adequate and efficient supply of commercial energy for faster growth and poverty reduction. Low per capita availability and user coverage of commercial energy, compounded by substantial gas and power shortages, have continued to constrain growth, affecting the poor disproportionately. Inefficiencies and rent seeking in energy provision, particularly in distribution, billing and collection, low levels of commercialization and inadequate tariffs have all contributed to the poor financial performance of the energy entities. Funding available for operation and maintenance and expansion of generation capacity and transmission and distribution infrastructure in power and gas has been inadequate, especially given the limited donor funding in a business-as-usual reform scenario. Excessive Government intervention in the operation of the energy utilities and inadequate expertise within the entities have also contributed to the unsatisfactory outcome. Public provision of energy has contributed most to SOE losses and led to a massive transfer of resources. The financial liabilities of energy sector entities represent major contingent liabilities for the exchequer. While key areas of energy sector reform – including unbundling of operations, corporatization and commercialization of entities, competitive private participation in generation, production and distribution, and economic or competitive pricing – have been identified, commitment to pursue these improvements on a sustained basis has been weak, until recently.

Restructuring of vertically integrated monopolies through unbundling of operations into generation, transmission and distribution improves efficiency in power and other energy sectors. The improvement from unbundling arises from efficiency gains in a number of areas:

- *clearer delineation and distinction of functions;*
- *greater transparency of operational outcomes at each stage, which can facilitate accountability, avoidance of cross-subsidies and greater incentives for performance, and*
- *economies of more manageable operations.*

The breaking up of BPDB into DESA, by itself, did not achieve the desired results largely because the status quo in their poor governance and managements was essentially maintained.

Opening up private participation in power generation and gas exploration and production has been a welcome move but is not enough. It is imperative that deeper reforms be undertaken, particularly in order to reinforce pressures for full cost recovery for energy at the retail level. It is vital that taxpayers are not exposed to contingent liabilities linked to Government guarantees due to poor cost recovery or risks of overestimation of energy demand. A number of countries have experienced crisis because of mistakes. In view of the lessons of experience, Bangladesh, like other countries in South Asia, should reassess its energy strategy seriously, accelerate private participation in distribution and implement related structural and regulatory reforms. A recent decision to adopt an improved pricing framework for petroleum, gas and power,

years, and the major power failure in north-eastern states and adjacent Canadian provinces in 2003), and private US firms have on occasion engaged in corrupt practices (the massive criminal fraud perpetrated by Enron) (Jaccard 2002). In poor countries, SOEs face powerful pressures that render efficient management particularly difficult. Public sector unions negotiate to increase employment in SOEs above levels required for efficient performance of the tasks at hand. Politicians may also undermine efficient SOE operation. To increase political support, they may insist on patronage appointment of political supporters. Certain employees may engage in unambiguously corrupt practices, such as bribe-taking in exchange for non-collection of bills or non-reporting of energy consumption. Customers exert pressure to maintain tariff levels below cost of production. Politicians campaign for election on promises to lower tariffs which, in turn, prevents energy SOEs from covering costs.

The accompanying box reproduces the World Bank's argument for an ambitious reform agenda among energy sector SOEs. While implementation of a major reform is difficult both administratively and in terms of reconciling interest groups, the nature of required reforms can be described succinctly:

- Hire well trained managers able to make efficient decisions, and protect

continued from previous page

and the passage of the Energy Regulatory Commission Act are welcome developments. The challenge now will be to set up an energy regulatory entity with adequate independence and capacity so as to play an effective role in promoting development of the energy sectors, particularly through efficient pricing and safeguarding quality of services.

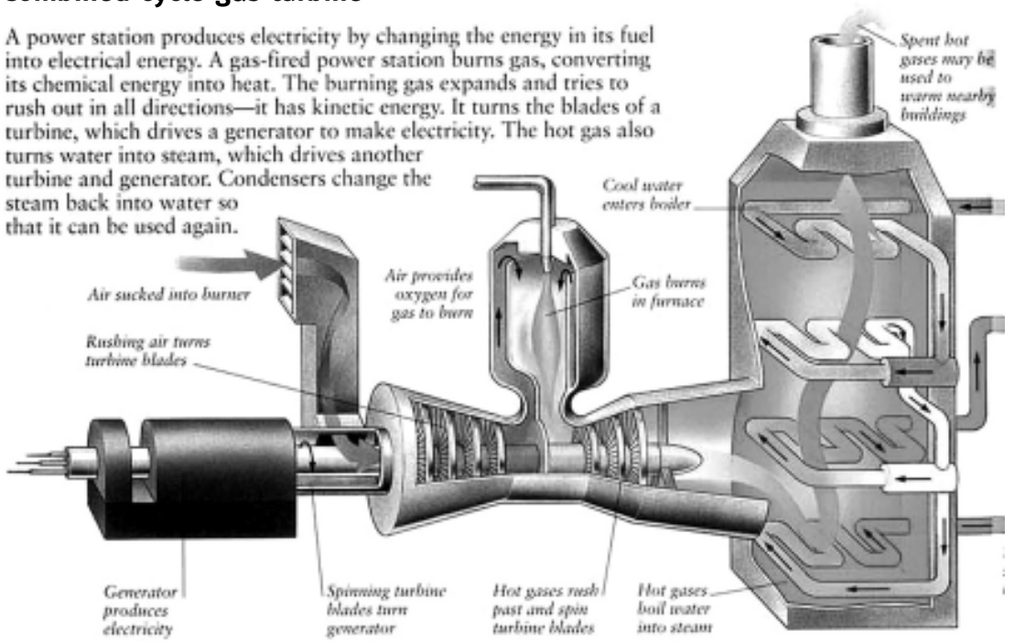
It is envisaged that one entity will be responsible for regulation in gas, power and petroleum sectors. It should be noted, however, that if there is sufficient competition, pricing in the petroleum downstream market can be left to be determined by market forces rather than through price regulation.

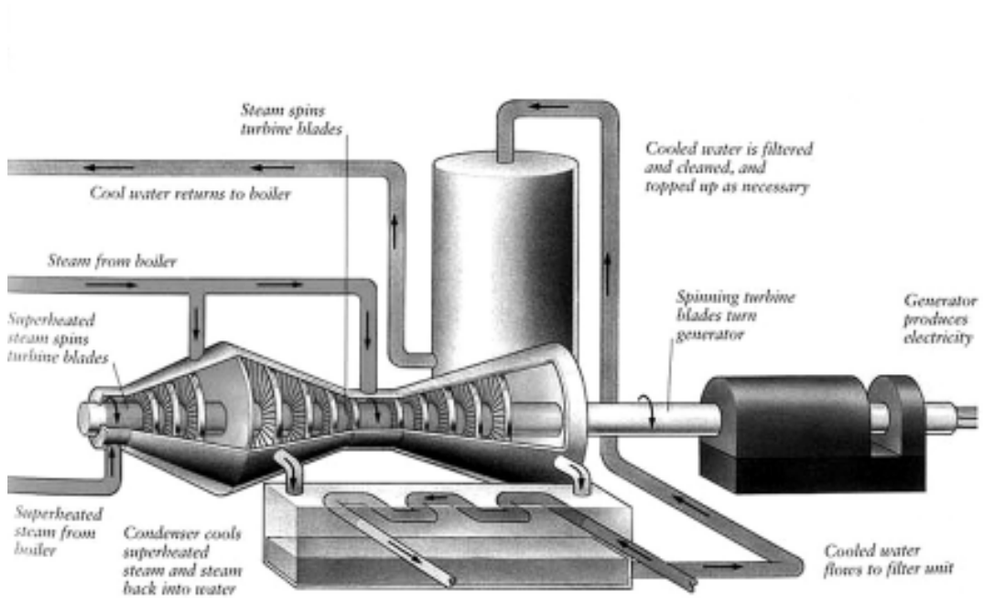
The countries that have been most successful in energy sector reforms are those that had the political will to abandon a long history of subsidised tariffs and establish regulatory frameworks that offer credible commitments to investors. Commercialisation and corporatisation, legal reforms, regulation, and restructuring are all crucial to energy sector reforms. But by themselves these steps may not bring about all the needed improvements. For these actions to be fruitful, it is essential to allow private investment and privatise existing assets. Improving the environment for private generation by strengthening cost recovery, developing local capital markets, optimizing sector capital structure and privatizing distribution services will all be vital for success in the sector.

World Bank. 2003. *Bangladesh: Review of Public EnterprisePerformance and Strategy – Key Issues and Policy Implications.* p.102.

Combined cycle gas turbine

A power station produces electricity by changing the energy in its fuel into electrical energy. A gas-fired power station burns gas, converting its chemical energy into heat. The burning gas expands and tries to rush out in all directions—it has kinetic energy. It turns the blades of a turbine, which drives a generator to make electricity. The hot gas also turns water into steam, which drives another turbine and generator. Condensers change the steam back into water so that it can be used again.





them from undue political interference. This means that SOEs engaged in production and distribution of energy should be expected to cover costs. SOEs engaged in exploring for and producing primary energy products, such as natural gas, must realise reasonable unit costs and transfer surpluses to the government.

- Invest in better safety nets for employees displaced from SOEs, and thereby lessen political pressure to maintain inefficient employment levels.
- Enable a much larger level of investment in the energy sector. To the extent the SOEs can realise reasonable efficiency and the government can obtain financing on reasonable terms, such SOEs should be encouraged to increase their investments. However, the level of investment required to achieve reasonable energy supply is too great to be financed by government or by donor agencies. Greater openness to private investment is required.
- Create a credible regulatory authority able to provide a stable, predictable legal framework for the energy sector. A regulatory authority should supervise both SOEs and private firms in the energy sector. It must assure investors that they can invest with confidence, and assure customers that both private and state-owned firms will behave responsibly with respect to prices charged and reliability of service.
- Enable the judicial system to address corrupt practices in both private and public firms in the energy sector.

Inevitably, successful reform will generate controversies. It will pose costs to some – such as reducing the number of customers with unauthorised power connections – even as it generates, overall, significant net benefits to the economy.[10]

Management of the rural electrification programme

Making reliable electricity accessible to villages can have a profound impact on the lives of people (Barkat 2003). Electrification has contributed to higher incomes among electrified relative to non-electrified households. Electrification has contributed to achieving national food self-sufficiency by enabling more efficient irrigation.

Unfortunately, many in Bangladesh have little trust in the ability of government to reform the energy sector, and are sceptical of reform strategies promising improved efficiency. Given this scepticism, it is im-

portant to build on success where it has been achieved. One of the outstanding successes in Bangladesh development over the last quarter century has been rural electrification.

In 1977, the BPDB was partially "unbundled." Responsibility for distribution of electricity in rural areas was awarded to a new agency, the Rural Electrification Board (REB). A quarter century later, the REB coordinates the activities of 67 Palli Biddyut Samitees (PBSs), rural cooperatives formally owned by the customers to whom they sell electricity. The PBSs cumulatively distribute electricity to over half of the 64,000 villages in the country. The REB is now responsible for nearly one quarter of all power distribution in the country. The REB/PBS system has achieved impressive results in terms of attracting new customers, in bill collection, and in avoidance of system loss. This is a record much superior to that of the other power distribution agencies.[11] But only a small minority of rural Bangladeshis have access to power, and the quality of that power is unsatisfactory due to the extent of load shedding and voltage variability.

A feasible strategy for future expansion of the REB is for it to integrate backward and undertake small-scale power generation using gas turbines. Presumably, this would entail contracting with independent power producers (IPPs). Surplus power could be sold to the national grid, but priority would be given to local customers. Most of the output from these small power plants would be distributed to local REB customers, independently of the national grid. These customers would receive uninterrupted power and avoid the load shedding experienced by customers relying on power distributed through the BPDB grid.

Presently, the REB enjoys the ability to buy power from the BPDB at a price slightly below the BPDB's cost of production. If the REB contracts to buy off-grid power from IPPs, the REB's price of power may well rise. However, it may not: IPPs may realise savings that the BPDB has been unable to achieve. And off-grid power will be of greater value to users than power supplied by the BPDB because it will be free from the BPDB practice of load shedding.

Management of biomass fuels and new renewable technologies

The need for more commercial energy is obvious, but that does not mean ignoring the efficient utilisation of biomass fuels. Consider first the matter of environmental degradation. As the NEP notes, some biomass sources "are now being consumed beyond their regenerative limits. Unplanned and uncontrolled use of biomass fuels is causing environmental degradation" (GOB 2004, 10). Trees are being cut down, for example, in the country's small reserve forests.

Deforestation "upstream" in India has adverse consequences "downstream" in Bangladesh. Deforestation limits the ability of soil to retain moisture, leads to excess flooding and to soil degradation. There is little that Bangladesh can, in the short run, do about deforestation beyond its borders. It can relieve the problem somewhat by community forestry programmes and more tree plantations on private lands in Bangladesh. Community forestry poses difficult management problems: programmes must provide means whereby villagers can monitor planted trees and prevent theft; villagers need good technical advice on species to plant, and so on.[12]

Kaptai Dam. Bangladesh potential hydropower is modest.

During peak agricultural periods, mechanised tilling devices (e.g., tractors, power tillers) supplement the shortage of draught animal power. It may be feasible to augment the number of draught animals available. Farmers with draught animals typically realise higher yields than those without. And they have better access to animal dung as fuel. But, in a densely populated region like Bangladesh, it is important to assess various social costs of increasing the draught animal population. More animals may, for example, exacerbate overgrazing problems (Wilson ca.2001).

About nine of ten households depend on biomass fuels for cooking. Below, we discuss the potential of using coal for domestic cooking. Whether or not coal becomes widely available for this purpose, there is a potential to reduce the demand on biomass resources by aggressive social marketing of more efficient stoves that require less fuel. (The BCSIR and other agencies have researched this subject.)

The NEP (2004, 21) notes the government's intent to establish a Renewable Energy Development Agency with responsibility to develop new technologies and accelerate their adoption by campaigns of social marketing. There is a precedent for this recommendation in the Indian Renewable Energy Development Agency. It has achieved notable success over the last 15 years in increasing adoption of renewable energy technologies. This strategy should include adoption of better ways of using traditional biomass fuels (e.g., briqueting, improved cooking stoves, biogas).

Although the impact may be modest, there is a potential to increase use of new renewable technologies – solar PV power, wind power and so on – in isolated locations where transmission costs of conventional power are very high.

Management of coal

The extraction of indigenous coal in Bangladesh is a new activity. Development of the Barapukuria mine has required Chinese technical support and has taken 10 years. (Production is scheduled to start in late 2004.) Petrobangla has established a separate subsidiary for development and management of Barapukuria coal. The primary use for this coal will be in a thermal power plant operated by the BPDB. The success of this project will depend on the simultaneous efficient operation of the mine and power plant.

A second potential use of coal is as fuel for domestic cooking purposes. This use can partially address two important environmental hazards. First, indoor air pollution arising from use of biomass fuels has been identified as a major hazard adversely affecting health. One recent report summarised as follows:

> *Indoor air pollution is a serious environmental health problem in developing*

This barge mounted power plant moored at Chittagong went into commercial operation in 1986.

erates little indoor pollution when burned in reasonable stoves.

Deforestation is a separate, equally severe, environmental problem associated with present levels of use of wood fuels for brick kilns and for cooking. If coal is to compete with biomass fuels among villagers, its cost must be similar to the implicit cost of using wood fuel. (If we ignore environmental costs, the major cost to villagers in use of wood fuel is time required for gathering leaves and branches.) To use coal for domestic cooking would require planning. It would require creation of a distribution system of coal to villages, as well as the sale of cheap and reliable coal-burning stoves.

Both China and India have undertaken large-scale programmes to provide villagers with improved cooking stoves. China has distributed stoves to two thirds of the rural population – a total of over 140 million stoves. An important feature of the Chinese programme has been the quality and durability of the stoves, which are sold on local markets with very little subsidy, at about US$10 each. By contrast, the stoves used in the Indian programme were, at least initially, less reliable and met with less acceptance by villagers (Budds et al. 2001, 28-30).

> *countries that has received relatively little attention in comparison to other issues. The most significant source of indoor air pollution is cooking smoke from low-grade fuels burnt using inefficient stoves … poor women and children are generally most exposed to indoor smoke, as women cook and simultaneously care for young children, and thus are also likely to be most at risk from the associated health effects. (Budds et al. 2001, 1)*

From the perspective of providing heat with minimum pollutants, the ideal fuels for cooking are gas and electricity. However, electricity is inherently too expensive for most people to use for this purpose. And only a small minority of households have access to either electricity or gas. While less desirable than gas or electricity, coal is superior to biomass fuels, inasmuch as it gen-

V. Recommendations

A SUCCESSFUL ENERGY POLICY MUST SATISFY MANY GOALS. LET US FIRST STATE them in general terms:

Energy policy must be concerned not only with current supply, but with the country's long term needs. For example, in assessing any surplus of natural gas available for export, it is important to consider domestic energy needs long into the future, for a period of, say, 50 years.

Energy policy must be concerned with efficiency of production and distribution, as well as quantity. The energy sector is among the most complex sectors of the economy. It raises problems of managing state-owned enterprises and regulating private sector participants in the energy sector. In general, customers should pay the cost of the energy they consume. Government subsidy to supply energy below cost is an inappropriate use of government revenue. In the past, corruption in certain energy sectors – such as meter reading – has eroded public faith in the possibility of creating an efficient energy sector, and has encouraged customers to rely on "second best" options such as captive power generation.

Energy policy must enable improvements in energy access among all Bangladesh citizens. Most government energy investments have favoured urban over rural areas. An efficiently organised energy sector can bring immense benefits to both rural and urban citizens, to the poor and those with higher incomes.

Energy policy must reduce the pressure placed on the country's physical environment. Low-income countries rely heavily on biomass fuels to meet their energy needs. The energy demand from a growing population is threatening the country's physical environment. Sustainable development requires wide distribution of commercial forms of energy that will enable the population to ease the pressure placed on over-exploited biomass energy sources. More efficient use of biomass fuels is also required.

Behind these children are two rows of carefully tended trees. Bangladesh needs to do more to sustain and increase its forest resources. This requires innovative programmes to protect forests and encourage woodlots. It requires more efficient use of biomass fuels. It requires increased access to commercial energy sources, in order to lower pressure on forest resources. GEERT VAN KESTEREN PHOTO

Realising these goals requires several clear strategic decisions by the Government of Bangladesh. We do not attempt an exhaustive list of specific recommendations. The following however we consider to be of particular importance.

RECOMMENDATION ONE

Given what is known of natural gas and other mineral reserves, the Government of Bangladesh should not approve natural gas exports. It should designate natural gas for domestic energy needs, of which electrical generation is the most important. It is important that the Government instruct Petrobangla and the Geological Survey to undertake continued exploration of potential energy resources in Bangladesh.

For many purposes, the most useful form of commercial energy is electricity, and the very low per capita supply of electricity is a major constraint on national economic development. Natural gas is the optimal fuel for electricity generation in Bangladesh, and available reserves should be designated for a programme of accelerated investment in generating capacity, not for export or for expanded fertilizer production.

In order to make rational policy decisions over the strategic use of energy resources, the government needs reliable geological information. To get this information, continued exploration is important.

RECOMMENDATION TWO

The Government of Bangladesh should place a very high priority on establishing the credibility of an energy regulatory commission.

Bangladesh's need for investment in the energy sector is acute, and neither the government nor donor agencies can provide adequate investment funds. It is crucial to establish a regulatory regime that encourages private investment, while still assuring customers that prices remain reasonable and supply remain reliable.

RECOMMENDATION THREE

The government should encourage the REB to develop a network of small-scale (10 – 100 MW capacity) gas turbine plants whose power would, on a priority basis, be distributed independently of the national grid.

The REB has a record of administrative competence that makes it an ideal agency to undertake experiments in investment by independent power producers (IPPs). To the extent the REB can obtain public financing, or the more successful local cooperatives (Palli Biddyut Samitees) can arrange financing, gas turbines may be publicly financed. However, the scale of new power capacity required in rural areas is very large. Private investment will be required. The REB customers would be expected to cover the costs of generation, transmission, and distribution. In exchange, they should have priority access to the power generated. Any power surplus to local needs would be sold to the national grid.[13]

RECOMMENDATION FOUR

The government should encourage the sale of coal for domestic cooking in rural areas. This would also require the distribution of suitable stoves.

This innovation has the potential to reduce the health problems associated with indoor pollution, and to relieve pressure on forest resources.

RECOMMENDATION FIVE

The government should continue to facilitate substitution of CNG for liquid petroleum fuels.

The government can consider modest subsidies to encourage owners of automobiles and commercial vehicles to convert to CNG. If use of CNG is to be extended to large numbers of vehicles, there is a need for further expansion of CNG filling stations. More can be done to increase safety of use: standardise fueling connections, assure adequate training among those supplying CNG, and so on (USDOE 2003).

RECOMMENDATION SIX

The government should undertake high profile social marketing activities intended to improve utilisation of biomass fuels in rural areas.

As we have discussed, there is a potential to increase adoption of more efficient stoves and expand forest plantations. These are examples where government public education activities can have a meaningful impact on energy policy.

Notes

[1] In terms of population, these are the major countries of the region. The list is limited to those with 2001 per capita incomes below US$10,000. Incomes are measured in terms of purchasing power parity (PPP), not exchange rates.

[2] Explanations for certain terms are given in the glossary. The first appearance of the term in the text is highlighted in bold type.

[3] The heat generated from 1 million tonnes of coal is equal to that from 0.0273 TCF of natural gas. Alternatively, 1 TCF of natural gas is equivalent to 36.67 million tonnes of coal in terms of heat generated.

[4] 1.7 TCF = 64 million tonnes / 36.67 million tonnes per TCF; 13.4 TCF = 492 million tonnes / 36.67 million tonnes per TCF.

[5] The NEP (GOB 2004, 9) estimates 492 million recoverable tonnes from deposits in-place of 2527 million tonnes, implying a recovery rate of 19.5 percent (0.195 = 492 / 2527). Applying this recovery rate to the deposits net of Jamalganj yields a recoverable reserve estimate of 297 million tonnes (297 = 0.195 x [2527 – 1000]). In terms of heat generated, it is equivalent to 8.1 TCF of natural gas (8.1 TCF = 297 million tonnes / 36.67 million tonnes per TCF of gas).

[6] The Local Government Engineering Department is an exception (LGED 2004a). On its web site, it refers to a report by Krupp Company. The report lists Jamalganj as commercially viable.

[7] Unless otherwise indicated, all statistics cited in this section are drawn from Islam (2003).

[8] Solarbuzz is a US consulting and research firm, specializing in solar power. The US30¢ per kWh cost is based on the following assumptions: US$8 per installed watt of capacity; an average of 5 sun-hours per day; 25-year lifetime for the installed PV system; and annualising capital costs using 5 percent cost of finance.

[9] The LGED (2004b) provides information on wind speeds in coastal regions of Bangladesh, and on several small projects producing wind-generated power.

[10] For a more detailed discussion of managing the energy sector – in particular, putting in place a credible regulatory and planning regime – see an earlier publication of the Centre for Policy Research (Jaccard, Khan & Richards 2001).

[11] The NEP estimates system losses to have ranged between 27 percent and 40 percent in the power sector over the last quarter century. Most system loss is due to pilferage and non-billing, as opposed to transmission and distribution losses (GOB 2004,12). By contrast, the analogous system losses experienced by the REB have been much lower (Murphy, Kamal & Richards 2002, 24). For further information on the REB/PBS system, see an earlier publication of the Centre for Policy Research (Murphy, Kamal & Richards 2002).

[12] Hegde (2000) provides a comprehensive survey of the successes and failures of community forestry programmes in India.

[13] This recommendation is discussed in detail in Murphy, Kamal & Richards (2002).

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Glossary

Biomass fuels. Biomass includes all organic matter produced by plants. More specifically, biomass fuels include wood fuels (tree branches and leaves), agricultural residue, and animal dung. Implicit in the definition of these fuels is that they are renewable. In other words, they should be exploited below the – often hard to define – limit of regenerative potential.

Financial shortfall. This is a measure of the net costs incurred by the government due to the activities of SOEs. The World Bank (2003) uses the concept in its recent study of Bangladesh SOEs. The concept assumes the annual cost of government-supplied assets of SOEs to be 13 percent. Pre-interest positive returns in a SOE are subtracted from the assumed cost and reduce the size of the shortfall. If pre-interest cost returns of a SOE are negative (in other words, if the SOE is incurring a deficit before deducting interest charges), the shortfall is increased by the calculated negative return. For further detail, see World Bank (2003,20-21).

Human Development Index (HDI). The HDI is a more comprehensive measure than per capita income of a country's development. The index is an equal weighting of three separate sub-indices. For each of the three sub-indices, the denominator is a predetermined range; the numerator is the distance for the particular country above the minimum. Hence, by construction, for each sub-index and the HDI itself, the minimum value is zero; the maximum is one. The first sub-index is calculated from the log of per capita income, measured in terms of purchasing power parity (PPP) US dollars. The denominator is the difference between log (40,000) and log (100). The numerator for country i is the difference between log (per capita income of country i) and log (100). The second sub-index is calculated from the country's literacy rate. The denominator is 100 percent (= 100 percent – 0 percent); the numerator is the literacy rate of country i. The third is calculated from average life expectancy at birth. The denominator is 60 years (= 85 years – 25 years); the numerator is life expectancy in country i less 25 years. Most developing countries lie between 0.500 and 0.800. Based on the 2001 calculations, the highest-ranked country was Norway, with a HDI score of 0.944. The lowest was Sierra Leone, with a score of 0.275. Bangladesh, with a score of 0.502, ranked 139 out of 175 countries.

Recoverable, probable, proved, and undiscovered reserves. These are conventional terms used by the oil and gas industry to indicate the degree of confidence in estimates of oil or natural gas reserves. *Recoverable reserves* are the volume of natural gas deposits recoverable with reasonable certainty under existing economic conditions and technology. Recoverable reserves may be classified as either proved or probable. *Proved reserves* have more certainty because of detailed exploratory work (e.g., seismic activity, wells drilled in area of reserve) on the actual size of the reserve. *Probable reserves* have less certainty, being based on perhaps a few wells and general geological knowledge of a promising area. *Undiscovered reserves* are speculative estimates of reserves yet to be discovered in unexplored areas. These estimates rely on statistical extrapolations and are subject to great uncertainty. They should not be confused with recoverable reserves.

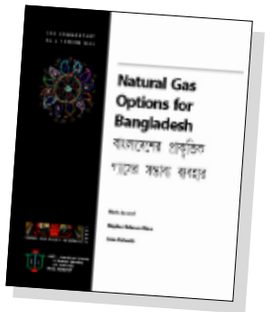
Reserve life. Estimated life of a resource deposit. Actual reserve life depends on the size of the recoverable reserve and actual rate of extraction over time. The simplest estimate projects the current extraction rate unchanged into the future. More sophisticated reserve life estimates allow for expected increases in rates of extraction.

Abbreviations

BAPEX	Bangladesh Petroleum Exploration Corporation (subsidiary of Petrobangla)
BCSIR	Bangladesh Council of Scientific and Industrial Research
BOGMC	Bangladesh Oil, Gas and Mineral Corporation (Petrobangla)
BPC	Bangladesh Petroleum Corporation
BPDB	Bangladesh Power Development Board
BUET	Bangladesh University of Engineering and Technology
CNG	Compressed natural gas
CPR	Centre for Policy Research, located at IUBAT
DESA	Dhaka Electric Supply Authority
DESCO	Dhaka Electric Supply Corporation
GDRC	Gas Demand and Reserve Committee of the Bangladesh government
GOB	Government of Bangladesh
GWh	Gigawatt hours (10E9 watt hours = 1000 MWh), a measure of electrical energy
IOC	International oil companies
IPP	Independent power producer
IUBAT	International University of Business Agriculture and Technology
Kgoe	Energy derived from a kilogram of oil, often used as a common unit for comparing the energy contained in different sources and forms of energy
kWh	Kilowatt hours (10E3 watt hours), a measure of electrical energy
Mtoe	Million tonnes of oil equivalent
MWh	Megawatt hours (10E6 watt hours = 1000 kWHs), a measure of electrical energy
NEP	*National Energy Policy*, the draft report issued by the Government of Bangladesh, Ministry of Power, Energy and Mineral Resources, May 2004
NGO	Non-government organisation
NPD	Norwegian Petroleum Directorate
PBS	Palli Biddyut Samitee
PPP US$	Purchasing power parity US dollars, a metric permitting comparison of incomes across countries based on comparable purchasing power – as opposed to comparison based on exchange rates
PV	Photovoltaic
REB	Rural Electrification Board
SOE	State-owned enterprise
TCF	Trillion cubic feet, a conventional measure of natural gas volume
USAID	United States Agency for International Development
USGS	United States Geological Survey

CPR COMMENTARY NO. 1

Natural Gas Options for Bangladesh



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বাণিজ্যিক খাতে জ্বালানি শক্তির অতিস্বল্পতা বাংলাদেশের অর্থনৈতিক উন্নয়নের পথে একটি গুরুত্বপূর্ণ অন্তরায়। সৌভাগ্যক্রমে প্রাকৃতিক গ্যাসের বড় ধরনের উৎস আবিস্কৃত হওয়ায় উন্নয়ন ক্ষেত্রে একটি উজ্জ্বল সম্ভাবনা সৃষ্টি হয়েছে। এই প্রতিবেদনে বাংলাদেশের প্রাকৃতিক গ্যাস সম্পদ ব্যবহারের তিনটি সম্ভাবনা নিয়ে পর্যালোচনা করা হয়েছে ঃ গ্যাস বিদেশে রপ্তানী করে সরকারী রাজস্বখাতে অর্থ আয় যা উন্নয়নের চাহিদা মিটাতে পারবে, দেশীয় শিল্প, কৃষি, গৃহস্থলি ও অন্যান্য সম্ভাব্য কাজে গ্যাসের ব্যবহার সম্প্রসারণ; বা দ্রুত বিদ্যুতায়নের ক্ষেত্রে প্রাকৃতিক গ্যাসের ব্যবহার কেন্দ্রীভূত করা। এই তিনটি সম্ভাবনা যাচাই করে প্রতিবেদকগণ এই সিদ্ধান্তে পৌছেন যে দ্রুত বিদ্যুতায়নই সর্বোচ্চ প্রাধান্য পাওয়া উচিৎ।

অধিকন্তু এই প্রতিবেদনে কিছু কিছু প্রাতিষ্ঠানিক সংস্কারের বিষয় আলোচনা করা হয়েছে যা বেসরকারী বিনিয়োগকে উৎসাহিত করবে এবং সরকারী প্রতিষ্ঠান, মন্ত্রণালয়সমূহ এবং এজেন্সিসমূহের কাজের স্বচ্ছতা, দক্ষতা এবং নির্ভরযোগ্যতা বৃদ্ধি করবে। পরিবেশগত এবং সামাজিক লক্ষ্যগুলি অন্তর্ভূক্ত করে সমন্বিত সম্পদ পরিকল্পানার গুরুত্বের বিষয়ও এই প্রতিবেদনে সুপারিশ করা হয়েছে।

The very low level of available commercial energy is a serious constraint on economic development in Bangladesh. Fortunately, there is one bright prospect – sizeable discoveries of natural gas.

This report explores three options for how Bangladesh might use its natural gas endowment: exporting gas to provide public revenues that could be directed to many other development needs; expanding the many possible end-uses for gas in domestic industry, agriculture and households; or concentrating natural gas use on accelerated electrification. After assessing the three options, the authors conclude that rapid electrification should have the highest priority.

In addition, the report discusses institutional reforms to foster private investment and to improve the transparency, efficiency and consistency of government corporations, ministries and agencies. There is an important case to be made for integrated resource planning that includes environmental and social objectives.

CPR COMMENTARY NO. 2

Electricity for All

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বাংলাদেশে পাঁচজনের মধ্যে মাত্র একজন বিদ্যুতের সুবিধা পান। গ্রাম বাংলায় বিদ্যুতের সুবিধা পান প্রতি সাতজনে একজন।

বাংলাদেশে বিদ্যুৎ খাতে এই সমস্যাগুলি কেন অব্যাহত থাকছে? এই সমস্যাগুলি সমাধানের জন্য কি ব্যবস্থা নেয়া যায়? এই রিপোর্টে দ্রুত বিদ্যুতায়ন, বিশেষ করে পল্লি বিদ্যুতায়নের ক্ষেত্রে বাধা সমূহের মূল্যায়ন করা হয়েছে। একই সাথে এই বাধাসমূহ দূর করার জন্য কিছু বাস্তবধর্মী সুপারিশ রাখা হয়েছে।

বর্তমানে পল্লি বিদ্যুতায়ন বোর্ড (আর ই বি) এবং তার সমবায় নেটওয়ার্ক পল্লি বিদ্যুৎ সমিতিগুলির মাধ্যমে পল্লি এলাকায় দেশে ব্যবহৃত বিদ্যুতের এক চতুর্থাংশ বিতরণ করে। এই আকর্ষণীয় সাফল্য সত্ত্বেও, বাংলাদেশে বিদ্যুতায়নের ক্ষেত্রে আরো অনেক কিছু করার বাকি আছে।

গবেষকগণ সুপারিশ করেন যে আর ই বি'কে স্বাধীনভাবে বিদ্যুৎ উৎপাদনের প্রতি অগ্রাধিকার ভিত্তিতে অধিক গুরুত্ব দিতে হবে, বিশেষ করে জাতীয় সঞ্চালন গ্রীড বহির্ভূত এলাকাসমূহে। এই সম্প্রসারণের জন্য প্রয়োজন হবে অধিকতর মাত্রায় ব্যক্তিখাতে বিনিয়োগে এবং আর ই বি গ্রাহকদের ক্ষেত্রে বর্ধিত হারে গড় ট্যারিফ।

অধিকতর হারে নতুন বিনিয়োগ আকর্ষণ এবং ট্যারিফসমূহের সংস্কার কঠিন কাজ, তবে বিদ্যুৎ ব্যবস্থার ব্যাপক সম্প্রসারণের লক্ষ্যে গুরুত্বের সাথে এই প্রয়োজনীয় সংস্কারসমূহ বাস্তবায়ন যুক্তিসঙ্গত।

Only one in five Bangladeshis has access to power; among those in rural areas the ratio is about one in seven.

What can be done to improve access? This report assesses the barriers to accelerated electrification – rural electrification in particular – and offers practical recommendations.

The Rural Electrification Board (REB) and its network of cooperatives – Palli Biddyut Samitees – now distribute nearly a quarter of electricity consumed in the country. Despite this impressive accomplishment, they need to do more.

The authors recommend that the REB place a high priority on power generation independent of the national transmission grid. This expansion will require private investment and higher average tariffs for REB customers.

Securing major new investment and revising tariffs will not be easy, but the goal of increased electrification is sufficiently important to justify the required reforms.

বাংলাদেশের ভবিষ্যৎ সমৃদ্ধির জন্য পর্যাপ্ত পরিমাণ বাণিজ্যিক জ্বালানি সরবরাহের গুরুত্ব সম্বন্ধে অতিরঞ্জনের কোন অবকাশ নেই। বাংলাদেশ সরকার ২০০৪ সালের মে মাসে একটি খসড়া জাতীয় জ্বালানি নীতি ঘোষণা করে এবং এর উপর জনসাধারণের অভিমত আহবান করে। সরকারের এই প্রতিবেদনে বর্তমান নীতির গুরুতর সমস্যার বিষয় এবং নূতন নীতি প্রণয়ন যে অতীব বিতর্কপূর্ণ তা স্বীকার করা হয়।

সেন্টার ফর পলিসি রিচার্সের এই তৃতীয় প্রতিবেদনটির মাধ্যমে খসড়া জাতীয় জ্বালানি নীতির উপর মন্তব্য এবং সুপারিশ করা হয়েছে। ড. এম আলিমউল্যা মিয়ান, উপাচার্য ও প্রতিষ্ঠাতা, আই ইউ বি এ টি - ইন্টারন্যাশনাল ইউনিভার্সিটি অব বিজনেস এগ্রিকালচর এন্ড টেকনোলজি এবং ড. জন রিচার্ডস, অধ্যাপক, সাইমন ফ্রেজার ইউনিভার্সিটি, কানাডা এবং আই ইউ বি এ টি'র ভিজিটিং অধ্যাপক এই প্রতিবেদনটি প্রণয়ন করেছেন। তাঁদের সুপারিশ মালার মধ্যে প্রাকৃতিক গ্যাসের রপ্তানি থেকে শুরু করে জৈব জ্বালানি শক্তি ব্যবহারের উন্নতি সাধনসহ গুরুত্বপূর্ণ বিষয় সমূহ অন্তর্ভূক্ত হয়েছে।

It is hard to exaggerate the importance of adequate supplies of commercial energy for the future development of Bangladesh. In May 2004, the Government of Bangladesh released a draft *National Energy Policy*, and invited public commentary. The government report acknowledges the serious shortcomings of present policy and the dilemmas in designing new policy.

In this third report of the Centre for Policy Research, Dr. Alimullah Miyan, Vice-Chancellor and Founder of IUBAT – International University of Business Agriculture and Technology, and Dr. John Richards, Professor at Simon Fraser University in Canada and Visiting Professor at IUBAT, respond to the draft *National Energy Policy* and offer a series of recommendations. The recommendations cover major issues from export of natural gas to improvements in the utilisation of biomass fuels.

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