ENERGY AND ENVIRONMENTAL SECURITY

A Cooperative Approach In South Asia

Editors
D. Suba Chandran
J. Jeganaathan

CONSORTIUM OF SOUTH ASIAN THINK TANKS
COSATT
BRIDGING POLICY RESEARCH IN SOUTH ASIA

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Preface

South Asia, as a region has been facing multiple security challenges from traditional conflicts between states - such as territorial disputes, cross-border terrorism and nuclear standoff, and non-traditional issues - including environmental degradation and energy crisis. The new challenges posed by environmental and energy security issues – do not emanate from a single source or a particular country. There are multiple reasons – natural and manmade, which have resulted in complicating the environmental and energy security issues. While some issues are global, and could be seen in other regions as well, others are peculiar to South Asia.

In most of the South Asian countries, the energy sources are scattered across the borders and not a single country in this region has been able to fully harness it due to scarcity of technology and expertise, and lack of inter-state cooperation among themselves as well.

The Consortium of South Asian Think-Tanks (COSATT), an informal organisation, convened by the Institute of Peace and Conflict Studies (IPCS), has been working since 2008, on a single issue every year. The primary objective of the COSATT is to create awareness among the countries of South Asia with a view to find out means to work together as a region in addressing the challenges. Last year, the COSATT worked on "Countering Terrorism: Building a Common Approach in Asia," and the year before on "SAARC: Towards a Greater Connectivity." Details of these earlier projects could be downloaded from the COSATT home page at: http://www.ipcs.org/COSATT-Regional-Dialogue-52.php.

In 2011, the COSATT embarked on a study titled " Energy and Environmental Security in South Asia" in order to reach a common understanding and foster regional cooperation. As a part of this study, the COSATT convened a preliminary meeting in Kathmandu in January 2011 to identity major themes and to prepare a

framework. At the second meeting held in Colombo, participants from individual South Asian countries elaborately discussed the issues, from a country perspective and later towards reaching a common understanding to secure energy and environmental security of South Asia.

This book is based on these discussions. Part-I of the book deals with country perspectives and part-II looks into select issues and explore how South Asia could work together to reach a common understanding on critical issues, especially water, energy and environment. The objective of the book is three-fold: to identity problems and issues concerning energy and environmental security of the region; to enhance common understanding of the issues at hand along with the emphasis on shared responsibility; and to provide concrete recommendations to respective governments on various issues concerning energy and environmental security in South Asia.

Convened by the IPCS, this project is undertaken by the COSATT in collaboration with the Regional Programm SAARC of the Konrad-Adenauer-Stiftung (KAS). As editors, we would like to thank the KAS staff and IPCS researchers for their valuable assistance. In particular, the editors would like to thank and recognize the pioneering contributions of Maj. Gen. Dipankar Banerjee, Mr. Jorg Wolff and Dr. Beatrice Gorawantschy, for their support to the earlier COSATT dialogues.

D. Suba Chandran
J. Jeganaathan

List of Abbreviations

ABC- Asian Brown Cloud

ABC- Atmospheric Brown Cloud

ADB- Asian Development Bank

AEDB- Alternative Energy Development Board

ANP- Awami National Party

APERC- Asia Pacific Energy Research Centre

B2B- Business to Business

BCCRF- Bangladesh Climate Change Resilience Fund

BCCSAP- Bangladesh Climate Change Strategy and Action Plan

BCF- Billion Cubic Feet

BCFD- billion cubic feet per day

BCM- Billion Cubic Meters

BDFC- Bhutan Development Finance Cooperation

BEA- Bhutan Electricity Authority

BIISS- Bangladesh Institute of International & Strategic Studies

BOI- Board of Investment

BPC- Bhutan Power Corporation

BRIC- Brazil, Russia, India & China

CDM- Clean Development Mechanism

CDMP- Comprehensive Disaster Management Programme

CEB- Ceylon Electricity Board

CER- Certified Emission Reduction

CEYPETCO- Ceylon Petroleum Corporation

CNG- Compressed Natural Gas

COP- Conference of the Parties to the United Nations Climate Change Conference

COSATT- Consortium of South Asian Think Tanks

CPD-UNFPA- Centre for Policy Dialogue-United Nations Fund for Population Activities

CPM-Communist Party of India (MArxist)

CPN (UML)- Communist Party of Nepal (Unified Marxist Leninist)

CPR- Common Property Resource

CPSTL- Ceylon Petroleum Terminals Ltd

CSAS- Centre for South Asian Studies

DGM- Department of Geology and Mines

DGPC- Druk Green Power Corporation

DOE- Department of Energy

DOL- Department of Livestock

DOT- Department of Trade

DPR - detailed project report

DPT- Druk Phuensum Tshogpa

EDP- Economic Development Policy

EIA- Energy Information Administration

EKC- Environmental Kuznets Curve

EPA- Environment Protection Agency

ESCAF- Economic and Social Commission for the Asia and Pacific

EU- European Union

FAO- Food and Agriculture Organization

FAOSTAT- FAO Online Statistical Database

FDI- Foreign Direct Investment

FNCCI- Federation of Nepalese Chambers of Commerce and Industry

FOP- Friends of Pakistan

FY- Fiscal Year

G2G- Government to Government

GBM- Ganges-Brahmaputra-Meghna

GCA- Greater Central Asia

GCC- Gulf Coopeartion Council

GDP- Gross Domestic Product

GHG- Green House Gas

GIIP- Gas Initially in Place

GLOF- Glacier Lake Outburst Flood

GNH- Gross National Happiness

GOB- Government of Bangladesh

GOP- Government of Pakistan

GWh- Gigawatt Hour

HDIP- Hydrocarbon Development Institute of Pakistan

HDR- Human Development Reports

HKH- Hindu Kush- Himalayan region

HOV - High Occupancy Vehicle

HVDC- High Voltage Direct Current

ICIMOD- International Centre for Integrated Mountain Development

ICREAR- Indian Council for Research on International Economic Relations

IDSA- Institute of Defence Studies and Analyses

IEA- International Energy Agency

IG- Inter-Governmental

INCCA- The Indian Network for Climate Change Assessment

IPAs- Investment Promotion Agencies

IPCC- Intergovernmental Panel on Climate Change

IPI- Iran-Pakistan-India

IPPs- Independent Power Producers

IRSA- Indus River System Authority

ISRO- Indian Space Research Organistaion

KAS- Konrad Adenauer Stiftung

KPK- Khyber- Pakhtunkhwa province

kWh- kilowatt-hour

LaoPDR- LaoPeople's Democratic Republic

LAPAs- Local Adaptation Plans of Action

LDC- Least Developed Country

LECO- Lanka Electricity Company (Pvt) Ltd

LIOC- Lanka Indian Oil Company

LKR- Sri Lankan Rupee

LNG- Liquefied Natural Gas

LPG- Liquid Petroleum Gas

LTTE - Liberation Tigers of Tamil Eelam

MCCICC- multi-stakeholder Climate Change Initiatives Coordination Committee

mmcf- million cubic feet

MNCs- Multi-national Corporations

MOA- Ministry of Agriculture

MoE- Ministry of Environment

MOEA- Ministry of Economic Affairs (Bhutan)

MOPE- Ministry of Power and Energy

MOU - memorandum of understanding

MOWP- Ministry of Water and Power

MQM- Muttahida Qaumi Movement

MT- Metric Ton

Mtoe- metric tonne of oil equivalent

MU- Million Units

MW- Megawatt

NAPA- National Adaptation Programme of Action

Natcom- National Communication

NATO- North Atlantic Treaty Organization

NCRE - Non- Conventional Renewable Energy

NDMA- National Disaster Management Authority

NDRRM - Natural Disaster Rapid Response Mechanism

NEA - Nepal Electricity Authority

NEC- National Environment Commission

NEC- Northeastern Council

NEP- National Energy Policy

NGOs- Non-Governmental Organization

NICCI- Nepal- India Chamber of Commerce and Industry

NIGC- National Iranian Gas Company

NIS - National Information System

NOC - Nepal Oil Corporation

NSAPR- National Strategy for Accelerated Poverty Reduction

NTS- Non Traditional security

NWFP- Northwest Frontier Province

NWP- National Water Policy

OECD- Organisation for Economic Co-operation and Development

PCRET - Pakistan Council for Renewable Energy Technology

PML-F- Pakistan Muslim League (Functional)

PML-N- Pakistan Muslim League (Nawaz)

PML-Q- Pakistan Muslim League (Quaid-e-Azam)

PPP- Pakistan Peoples Party

PPP- Purchasing Power Parity

PRIO- International Peace Research Institute

PTC - Power Trading Corporation

PUCSL- Public Utilities Commission

PV- photovoltaic

REDD- Reducing Emissions from Deforestation and Forest Degradation

RGoB- Royal Government of Bhutan

RMA- Royal Monetary Authority

RPPs- Rental Power Plants

RSIS- S.Rajaratnam School of International Studies

SAARC- South Asian Association for Regional Cooperation

SACEP- South Asia Co-operative Environment Programme

SAEO- South Asia Environment Outlook

SAME- SAARC market for electricity

SARI- South Asian Regional Initiative

SAU- South Asian University

SLSEA- Sri Lanka Sustainable Energy Authority

SLSEF- Sri Lanka Sustainable Energy Fund

SNV- Netherlands Development Organization

SPPs- Small Power Producers

SWERA- Solar and Wind Energy Resource Assessment

TAPI- Turkmenistan-Afghanistan-Pakistan-India Gas Pipeline

tcf- trillion cubic feet

TEEB- The Economics of Ecosystems and Biodiversity

TEK- traditional ecological knowledge

THED- traditional Theory of Himalayan Degradation

Tk- Taka (Currency of Bangladesh)

TNCs- Transnational Corporations

ToE- tonnes of oil equivalent

TPES- Total Primary Energy Supply

TWh- Trillion Watt Hours

UAE- United Arab Emirates

UNCCD- United Nations Convention to Combat Desertification

UNCTAD- United Nations Conference on Trade and Development

UNDP-GEF- United Nations Development Program- Global Environment Facility

UNEP- United Nations Environment Programme

USD- United States Dollar

VAT- Value Added Tax

WAPDA- Water and Power Development Authority

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PART- I

ENERGY AND ENVIRONMENTAL SECURITY: COUNTRY PERSPECTIVES

Chapter 1

Bangladesh: Mitigating Energy Insecurity and Environmental Vulnerability

Col. A K M Nazrul Islam

Introduction

Energy and environmental security are the most soaring problems in the world today. The accessibility and affordability of energy have been significantly impacted in recent times due to increasing instability in the supply and also the fluctuating prices. Since 1980, the global consumption of primary energy has doubled[1] and in future, consumption is projected to rise rapidly. According to an estimate, world energy consumption would increase 53 per cent from 2008 to 2035 in a business-as-usual scenario, if no additional policy actions are taken to address energy and environmental issues[2]. Under such a precarious situation of an energy deficient world, the process of deforestation precipitated by the pressure of ever increasing population and poverty are disrupting the natural equilibrium of the South Asian regional environment with devastating consequences. The increasingly unpredictable impact of climate change to most of the states makes this situation more volatile. So, amongst several security challenges, today energy and environmental security have appeared to be the most difficult ones to many countries of the South Asian region.

Bangladesh as developing state in this region has been gradually falling short of its economic growth potential because of inadequate infrastructure, particularly in the energy sector. It is trying to meet ambitious poverty reduction goals while its growing industrial, commercial, transport sectors and urban and middle-income consumers are using energy at unprecedented rates. There is a strong need for sufficient supply of energy in order to achieve the goals of poverty reduction and social development through accelerated economic growth as stipulated in the National Strategy for Accelerated Poverty Reduction (NSAPR-II)[3]. Therefore, the

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[1] See, Economic and Social Commission for the Asia and Pacific (ESCAF), *Energy Security and Sustainable Development in Asia and the Pacific*, Bangkok: United Nations, 2008, available at http.www.unescaf.org/publications/ detail.asp?id=1286 accessed on 14 May 2011.

[2] Kensuke Kanekiyo, "Energy Outlook of East Asia and Challenges for Sustainable Development", Paper presented in the Regional Workshop on *Dealing with Energy Vulnerabilities: Case Studies of Cooperation and Collaboration in East Asia* organized by the RSIS Centre for Non-Traditional Security (NTS) Studies on 09-10 December 2010 at Singapore.

[3] General Economics Division (2009), *Steps Towards Change: National Strategy for Accelerated Poverty Reduction (II) Revised: FY 2009-11*, Planning Commission, Government of Bangladesh. The key thrust of macroeconomic policy is to ensure higher economic growth and generate employment (p. xv).

assurance of huge amount of energy and electricity is urgently important for accelerating the process of its economic growth, poverty reduction, improving quality of life and also for the national security of the country.

Due to its geographical location Bangladesh is a disaster prone country and has been the victim of natural disasters since time immemorial. Besides the growing environmental concerns along its own boundary, as a lower riparian country it has also been impacted by the transnational environmental issues severely. Climate change as an environmental issue adds a new dimension to community risk and vulnerability in Bangladesh. It is one of the most populous country of the world with relatively small land mass. With over 160 million population the country is faced with a situation of aggravating poverty and currently, a huge proportion of its population live below the poverty line. There is a close link between the population and environment and as such, the rapid population growth has worsened the mutually reinforcing effects of poverty and environmental degradation in Bangladesh.

Against the preceding backdrop, the objective of this paper is to study the state of energy and environmental security of Bangladesh with a focus on the efforts undertaken by the government and the regional initiatives that may be explored to meet the challenges of energy and environmental security. The study has been divided into six sections including the introductory one. Section Two discusses the concept of energy and environmental security. Section Three looks at the existing energy situation in Bangladesh and the efforts undertaken to contest the challenges of energy security. Section Four discusses the environmental situation in Bangladesh and various steps taken to address the environmental issues. Section Five looks at the aspects of cooperation and the initiatives that may be explored at the regional level to meet the challenges of energy and environmental security. Section Six is the conclusion.

Concept of Energy and Environmental Security

Security is something instinctively desirable even though people have differing understanding of it. One of the simplest definitions of security is "the assurance people have that they will continue to enjoy those things that are most important to their survival and well-being"[4]. Since the end of the Cold War, the concept of security has undergone radical change and has been broadened considerably and continuously, to incorporate military, political, economic, societal and

[4] M. Soroos, *The Endangered Atmosphere: Preserving a Global Commons*, Columbia: University of South Carolina Press, 1997.

environmental dimensions, and the many linkages between them. Amongst a broad category of traditional and non-traditional security (NTS) in the present day, energy and environmental security falls into which encompasses "issues and factors that impinge on the security/stability of the state or individual and has become more noticeable after the demise of the Cold War"[5].

By and large, energy security is an association between national security and the availability of natural resources for energy consumption. Before 1990s, the concept of 'energy security' was based on the consensus of "enjoying sufficient supplies at an acceptable cost"[6]. Over the years, energy analysts have provided different definitions of energy security highlighting different aspects of the concept. Barry Barton, Catherine Redgwell, Anita Ronne, and Donald Zillman define it as a condition in which "a nation and all, or most of its citizens and businesses have access to sufficient energy resources at reasonable prices for the foreseeable future free from serious risk or major disruption of service"[7]. According to International Energy Agency (IEA), energy security can be described as "the uninterrupted physical availability at a price which is affordable, while respecting environment concerns"[8]. So, in the present day context, it is a common understanding that energy security is the non-interruption of supply of energy at a reasonable price and without polluting the environment. Energy security has many aspects: long-term energy security is mainly linked to timely investments to supply energy in line with economic developments and environmental needs. On the other hand, short-term energy security is the ability of the energy system to react promptly to sudden changes in supply and demand[9]. Global energy security is viewed by various stakeholders in different ways, depending on their interests and objectives. The concept and definition of energy security have different dimensions from producing and consuming countries. Consuming countries have tried to diversify the energy mix to be less dependent on oil. Producing countries have always been interested in reducing their dependency on oil money. Energy Security for them is finding a buyer for their

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[5] C. Uday Bhaskar, "Post Cold War Security", *Strategic Analysis, Monthly Journal of the IDSA*, Vol. XXI, No. 8, 1997, New Delhi, p. 1143.

[6] Perveiz Iqbal Cheema and Maqsudul Hasan Nuri, (ed.), *Quest for Energy Security in Asia*, Islamabad: Islamabad Policy Research Institute, 2007, p. i.

[7] Barton, B. et al. (eds) *Energy Security: Managing Risk in a Dynamic Legal and Regulatory Environment*, London: Oxford University Press, 2004, p. 4, cited in Gawdat Bahgat, *Energy Security: An Interdisciplinary Approach*, John Wiley & Sons, Ltd, 2011, p.1.

[8] See, http://www.iea.org/subjectqueries/keyresult.asp?KEYWORD_ID=4103 accessed on 20 April 2010.

[9] *Ibid.*

main source of income. Each side has created their own international organization to keep their interests. Access to cheap energy has become essential to the functioning of modern economies but the uneven distribution of fossil fuel supplies among countries, and the critical need to widely access energy resources, has led to significant vulnerabilities. From the perspective of consumers, increase in energy price is a leading threat to energy security.

Today, environmental security is treated as a component of national security.[10] Environmentalists around the world have tried to focus the attention of world leaders on pressing environmental matters for a long time. Though the linkage between environmental issues and national security came to the attention of the policy planners in the 1990s, it is only in recent times that environmental change is increasingly being understood as a security issue. The concept of eenvironmental security stems mainly from an understanding of security, and more particularly national security, developed within the discipline of international relations.[11] Environmental security examines the threat posed by environmental events and trends to national power, as well as the impact of human conflict and international relations on the environment.[12] In the academic sphere environmental security is defined as the relationship between security concerns such as armed conflict and the natural environment.[13] At present, the existence of life on earth is threatened, amongst other things, by climate change as a result of continuous environment pollution. Environmental security strives to protect humankind from both short and long-term ravages of nature, man-made threats in nature, as well as the deterioration of the natural environment.[14] The relation between environment and security of humans and nature has been the object of much research and the subject of many publications in recent decades. There are now substantial indications which point out clear linkages between environmental security and human security in the developing countries where the basic right to life, food, clothing, and shelter is affected due to sudden natural and man-made disasters. These turn out to be the potential triggers for social unrest as well as inter-state conflicts. Thus, it is quite comprehensible that when the foundation of a country's

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[10] Mizan R Khan, "Environmental Security in the Context of Bangladesh", *BIISS Journal*, Vol. 26, No. 2, April 2005.

[11] Jon Barnett, *The Meaning of Environmental Security: Ecological Politics and Policy in the New Security Era*, London, UK: Zed Books Limited, 2001, p.23.

[12] http://en.wikipedia.org/wiki/Environmental_security, accessed on 12 January 2011.

[13] *Ibid.*

[14] http://www.envirosecurity.org/activities/What_is_Environmental_Security.pdf, accessed on 10 January 2011.

environment is threatened or worn out, it is likely to face the emergence of a conflict in terms of disorder and insurrection within the nation or tension and hostilities with other nations due to transnational character of the environmental issues.

Energy Security in Bangladesh

Present Energy Situation

Bangladesh has limited indigenous energy resources. The principal indigenous energy resources of the country are natural gas, coal, renewable energy including traditional biomass. It has two distinct energy sectors - the urban/industrial/commercial sector and the rural/household/ noncommercial sector, each with different primary energy sources. The former relies on so-called modern marketed energy sources, mainly natural gas for electricity generation while the later is mostly dependent on traditional biomass fuels such as wood, animal wastes, and crop residues though there is an increasing trend of using electricity for the agriculture. Noncommercial energy sources are estimated to account for over half of the country's energy consumption. Electricity and gas supply utilize a centralized distribution system reaching to a limited population while traditional fuels rely on a distributed supply system impacting over 80 per cent of the people. The per capita availability of energy infrastructures and resources are very low in Bangladesh. Only 45 per cent of the population has access to electricity and such access in the rural area is only 25 per cent.[15] Per capita electricity consumption in Bangladesh is 148.048 kWh which is the lowest among the South Asian countries.[16] Approximately four to five per cent households of the country have natural gas supply.[17] Although, the demand for power has been rising by ten per cent every year, efforts of successive governments in the past for the development of this sector have been highly inadequate. As a result, today the country suffers from chronic deficit and unreliable supply of electricity which is the natural consequence of years of negligence.

Over 80 per cent of Bangladesh's power plants are now running by natural gas and the remaining 20 per cent by hydro, coal and liquid fuel. The country has a generation capacity of maximum 4,000 MW of power against a demand for 6,000

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[15] Ijaz Hossain, "Present and Future of the Bangladesh Energy Policy and Possible Areas of Cooperation between Korea and Bangladesh", Paper presented in the Roundtable on *Energy – Future of Korea-Bangladesh Energy and Power*, December 2009, p. 4.

[16] http://www.nationmaster.com/graph/ene_ele_con_percap-energy-electricity-consumption-per-capita, accessed on 14 February 2011.

[17] Ijaz Hossain, *op. cit.*

MW.[18] Out of the total electricity 69 per cent is produced by Power Development Board and rest 31 per cent by Independent Power Producers. Currently, per day about 2000 million cubic feet (mmcf) of gas is produced in the country against a demand of 2500 mmcf.[19] As a result, up to 500 mmcf supply shortfall of gas is experienced that naturally affects the electricity generations by the existing gas based power plants. Bangladesh has good potential of natural gas reserves. So far about 69 exploration wells (13 are in the offshore and 56 are onshore) have been drilled, which resulted in discovery of 23 gas fields. The Gas Initially in Place (GIIP) has been estimated as 28.856 trillion cubic feet (tcf) out of which estimated proven recoverable reserve is estimated as15.037 tcf. Upto June 2009, as much as 8.376 tcf gas has been produced, leaving only 6.661 tcf of recoverable gas.[20] Against the estimates of gas reserves in Bangladesh, and based on the projected gas demand, mentioned in the Bangladesh Gas Sector Master Plan,[21] a shortfall would commence in 2011 against proved reserves.

Petroleum products constitute approximately 23 per cent of the commercial energy used in the country.[22] Bangladesh has insignificant domestic production of petroleum products. It is dependent on imported oil for energy and such dependency made the country highly vulnerable to increases in oil price. Though the country has limited reserves of natural gas liquids with some potential for finding oil deposits, the exploratory activities done so far have not resulted in any significant oil discoveries. Thus, virtually all-liquid fuels are imported. Currently, Bangladesh imports about 1.2 million tonnes of crude and 2.5 million tonnes of refined oil each year. Total imports, including lubricants, vary from 3.2 to 3.7 million metric tonnes per annum.[23] The transport sector accounts for about 50 per cent of the consumption of oil, while irrigation makes about 16 per cent.

The total coal reserves in five coal fields of Bangladesh are estimated to be 2.9 billion metric tonnes.[24] This energy is equivalent to 67 TCF of gas. Some experts say that if properly mined, this can be enough for ensuring energy security of

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[18] *The New Age*, 06 April 2010, p 15.
[19] Petrobangla Annual Report 2009.
[20] *Ibid.*
[21] Saleque Sufi, "All About Gas Sector Master Plan", *Energy and Power*, 15-31 January 2006.
[22] Nazmul Ahsan Kalimullah *et al.* ,"Bangladesh-India Energy Security Cooperation: Prospects and Challenges", *BIISS Journal*, Vol. 31, No. 3, July 2010.
[23] *Ibid.*
[24] *Ibid.*

Bangladesh for 30 years.[25] However, the substantial coal reserve that exists will be difficult to extract and use with current technology without adverse environmental and societal impact. Presently, 230 MW of hydropower is being produced at the Kaptai Hydropower Plant. The potential of any large-scale hydro site is non-existent in Bangladesh. However, some sites with potentiality of very small scale generation could be explored in the south-eastern hilly districts of the country.

Amongst the renewable energy resources the potential of solar energy is quite high though the current utilization is relatively low. The clean and renewable energy technologies are yet to be developed for large-scale commercial applications as the investment cost involved is generally higher as compared to fossil fuel alternatives. Solar energy is cleaner and Bangladesh receives plenty of sunlight throughout the year. Solar energy is thus, a potential renewable energy resource for remote and rural areas for domestic purposes where the other cheaper energy sources do not have the access. In Bangladesh, wind energy potential is mainly limited to coastal areas, and offshore islands with strong wind regimes. Presently, there are 2 MW of installed wind turbines at Feni and Kutubdia but not in commercial operation.[26] Renewable energy in the form of traditional biomass such as fuel wood, farm waste, cow dung, rice husk, leaves and twigs, etc. is the main source of primary energy in the country. This over dependence on biomass is causing reduction in forest areas in Bangladesh that subsequently result in environment change brought along by enhanced desertification and deforestation process.

Based on the past energy and power sector development strategy, the country's energy and power sector is currently relying heavily on indigenous natural gas. But the supply of this resource is not enough to meet ever-growing energy demand of the country. Furthermore, without new discovery, the current gas supply will start declining after 2011 and as such the country needs to formulate a strategy for keeping a significant reserve of natural gas in order to develop energy and power sectors with diversified fuels. In the near future, coal could be one of the main sources of energy for power generation considering the substantial quantity

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[25] Khondkar Abdus Saleque, "Coal Mining Challenges in Bangladesh [Part -1]", available at www.energybangla. com/index.php?mod=article&cat=CoalSector&article=1789, accessed on 10 March 2011.

[26] Mohammad Shawkat Akbar, "Implementation of the Nuclear Power Project in Bangladesh – Issues, options and opportunities" Paper presented in the National Seminar on *Energy: Issues, Challenges and Options for Bangladesh,* organised by Bangladesh Institute of International and Strategic Studies (BIISS) on 25 June 2009 at Dhaka.

of coal reserves in the country. However, this will require a huge additional cost for infrastructure development for transporting of coal reserve existed in the country to the plant site and also for importing coal from outside, if so opted. On the other hand, coal is identified as one of the main sources of green house gases emission and the associated environmental degradation thereafter. Consumption of wood for fuel is already contributing to deforestation and other environmental problems in Bangladesh. To reduce deforestation and the desertification process and tackle environment degradation, alternative sources of energy will have to be made available to the rural people.

Mitigating Energy Insecurity of Bangladesh

In Bangladesh, there is a remarkable consensus on energy and electricity issues by all concerned due to the unpredicted changes in global energy situation and the experiences that have been witnessed by the country in the recent times regarding domestic conditions of energy and power generation. The major political parties of Bangladesh had laid out power sector planning strategy in their Election Manifestos of 2008. The present ruling party had outlined targets and milestones for enhancing generation capacity to 5000 MW by 2011 and 7000 MW by 2013.[27] It had also committed to implement the Rooppur Nuclear Power Plant and promised for universal electrification by 2021. Accordingly, the incumbent government has adopted a massive plan to increase power generation in the country and the target is to raise the electricity generation to 14,720 MW by 2016. The year wise generation plan is as follows:

Table 1.1. Year-wise Electricity Generation Plan

Type of Project	Year-wise Electricity Generation in MW							Total
	2010	2011	2012	2013	2014	2015	2016	
Government	255	851	838	1040	1270	450	1500	6204
Non-Government	270	105	1072	1311	1123	1900	1300	7081
Quick Rental	250	1185	-	-	-	-	-	1435
Total	775	2141	1910	2351	2393	2350	2800	14720

Source: *The Daily Star*, 11 January 2011.

[27] Election Manifesto of Bangladesh Awami League -2008.

The electricity generation of most of these projects will depend largely on imported fuel which presupposes a smooth and uniterrupted supply of fuel from the fuel exporting countries to the generation sites. This generation plan also include the coal-fired power plant of 1320 MW to be set up at Khulna jointly by Bangladesh and India. Meanwhile, the present government has started the process of importing 500 MW of electricity from India to meet the current power deficit which is expected to be materialized by 2012. The Government has also stressed on the rapid growth in solar electricity with the objective of reaching 50 MW by 2012.

Revised Draft National Energy Policy (NEP), 2008 has encouraged the use of optimal energy options, including nuclear energy for the effective planning and successful execution of a nuclear power project to enhance energy security in Bangladesh. Accordingly, the nuclear power programme will connect two medium sized nuclear power plants to national grid by 2020 and additional two units of 1000 MW each by 2025 in order to meet at least 10 per cent of demand by 2025 and 25 per cent of total electricity generation beyond 2025. Hence, the Bangladesh Government is working on its first nuclear power project to be launched by 2016 which was conceived in the early 1960s. Bangladesh has had fruitful discussions with Russia that expressed a keen interest in assisting Bangladesh in installation of two nuclear power plants. In May 2009, Bangladesh signed a memorandum of understanding with Russia to exchange nuclear technology and set up nuclear power plants in Bangladesh. Due to the trend of increasing global oil price, Bangladesh government has been considering new initiatives to diversify its sources of Compressed Natural Gas (CNG) and other renewable resources. Furthermore, government is also encouraging energy saving measures to achieve sustainable development.

Diversification of energy supply sources is the starting point for energy security.[28] The steps undertaken by the government to enhance electricity generation highlights the continuing dependence of the country on oil and natural gas though the search for coal and other alternative technologies including nuclear are also manifested to some extent. In the energy security set-up of Bangladesh it is now quite visible that there are not enough supplies of gas to fulfill the needs of the country in the short term future. The country's vulnerability will also further increase due to increase in oil price in the international market as the dependency on imported oil has been further enhanced in the electricity generation plan that

[28] World Economic Forum, *The New Energy Security Paradigm,* Spring 2006, p. 5.

has been undertaken. Implementation of the projects like nuclear power plant is time consuming. Furthermore, current nuclear plants, though they offer the promise of low carbon footprint, can be expensive and risky to introduce in a densely populated country with a limited safety culture. Under these circumstances, installing new coal-fired power plants, exploring the potentiality of solar electricity and importing electricity from neighboring countries namely India and Bhutan (as part of regional cooperation) are among the prime options of the present government.

Environmental Security in Bangladesh

Present Environmental Situation

Bangladesh faces many environmental problems both, naturally occurring and man-made. The major environmental issues that significantly affect Bangladesh, include: (i) Natural disasters; (ii) Depleting Water Source; (iii) Deforestation; (iv) Land Degradation; (v) Salinity; (vi) Unplanned Urbanization; and (vii) Climate Change. There are several dimensions of such issues, which are briefly discussed.

Natural Disasters

Bangladesh is highly vulnerable to natural disasters like frequent floods, flash floods, tidal surges, cyclones, storms, tornados and droughts, etc. Flood is the most common national disaster for Bangladesh and has been causing sufferings for millions for decades in Bangladesh. The rise of sea-level, the shallow sea-bed, sedimentation in the river beds, deforestation, unplanned constructions of dams are the main reasons behind frequent flooding in the country. Global warming has also been identified for the increase of violent storms, tropical cyclones, tornados. Tropical cyclones usually form on the southern part of the Bay of Bengal during April-December and causes devastating tidal surges. Though Bangladesh is a land of river and rain, it faces the problem of drought during dry season in the western part of the country due to high temperature as well as for the impacts of the Farakka Barrage. The country is also exposed to the risk of earthquakes. In Bangladesh, the number of deaths, economic loss, and infrastructural damages due to natural disasters is immense. Government's efforts to build infrastructures are also sometimes fruitless as it has been frequently damaged by these disasters. Loss of lives, decrease in agricultural production, displacement of people, losses of property, and damages of the state's property results of these disasters.

Depleting Water Source

In Bangladesh, lives, livelihood and economy depend completely on the rivers of the country. About 90 per cent of the total annual runoff of Bangladesh is

originator from sources outside the country's territory.[29] As a result, it largely depends on the upper riparian neighbours for water resources. Surface water sources e.g. rivers, lakes, marshes etc. are becoming polluted, dry and losing navigability in many cases due to over extraction of water. About 250 rivers that once crisscrossed the country are now facing the crisis of existence.[30] Many rivers are virtually becoming extinct and turning Bangladesh to a water-scarce country. There is a critical need for minimum flow of water in the rivers to ward off intrusion of salinity in the coastal areas; it is important for habitants in those areas for agriculture, forestry and biodiversity, and also for availability of drinking water. Water flow is also required for averting siltation of rivers all over the country especially in the dry season, which thereby affects navigability, and increases incidences of floods. The most widely used groundwater source is also depleting very fast due to over exploitation. In reality during the lean period there remains always a gap between the need and availability. Bangladesh faces dual problems of shortage of water in the dry season and abundance in the wet season. Water shortages are a very serious problem in many parts of Bangladesh during the dry season (January-May), particularly in north-west and south-west Bangladesh. The most critical period is March-April. The main reason for this is low flows of water coming from India into Bangladesh through the transboundary rivers.[31] Being a lower riparian country, Bangladesh faces a disastrous situation if any unilateral intervention in the upstream happens. Deforestation, burning of fossil fuel, unplanned dam building over rivers have also created water scarcity in the country. The major problems faced by Bangladesh due to water includes loss of navigation and transportation, loss of irrigation water for agriculture, degradation of ecological qualities, hampering industrial activities, arsenic contamination in the underground water, excessive sedimentation and river bank erosion, etc.

Deforestation

Deforestation is taking place in Bangladesh at an alarming rate. It has been occurring through illegal felling, unplanned settlement and encroachment. Many rural people living adjacent to forest areas maintain their livelihood on forest

[29] Muhammad Mizanur Rahman, "Bangladesh – from a country of flood to a country of water scarcity – sustainable perspectives for solution", paper presented on a *seminar on Environment and Development,* Hamburg, Germany, 9-10 December 2005, available at http://users.tkk.fi/~mizanur/Rahaman_Hamburg.pdf, accessed on 22 March 2010.

[30] Md. Asadullah Khan, "Water Security Hampers Development", *The Daily Star*, 26 September 2010.

[31] Qazi Kholiquzzaman Ahmad, "India-Bangladesh Cooperation in Transboundary Rivers", *The Daily Star*, 03 April 2004.

resources, particularly on the daily collection, consumption, processing and selling of non-timber forest products. Because of lack of resources and technology, land hungry farmers resort to cultivating erosion prone hillsides and moving into tropical forest areas. This results in rapid loss of forestry to the detriment of environment as a whole. The largely forested areas of Madhupur and Bhawal near Dhaka are continuously shrinking. The forest areas of Sundarbans and Chittagong Hill Tracts have a no different story. Presently, the coastal forest areas are increasingly being pushed to near extinction due to natural disasters and rising human settlement into them. The country had 15 to 20 per cent of forest cover a few decades ago; this has now shrunk to about 6 per cent.[32]

Land Degradations

Bangladesh is facing a severe problems of land degradation severely. Because of overpopulation, per capita share of land in the country is already very low and with the growth of population, pressure on land is ever increasing. At about 0.08 hectare per capita, cropland is already scarce and population growth will cut in half the amount of cropland available per capita by 2025 as all the country's agricultural land has already been exploited.[33] Degradation of soil is caused by damage to the land's productive capacity because of poor agricultural practices such as the excessive use of pesticides or fertilizers, soil compaction from heavy equipment, or erosion of topsoil, eventually resulting in a reduced ability to produce agricultural products. It is also caused by reclamation of land for agriculture, over grazing and expansion of irrigation.

Salinity

Rising salinity in water is a growing problem in Bangladesh, especially in the country's coastal areas. The main cause for the salinity is the reduced flow of the rivers which lost their navigability over the years due to withdrawal of water during dry season at the upstream of the Ganges. This has been further aggravated by the introduction of shrimp cultivation in the 1970s. According to the Government's Soil Resource Development Institute, salinity caused by growing shrimp cultivation over the last three and half decadeshas damaged the soil fertility of more than one million hectares of coastal arable land that could yield 2.5 million tones of rice.[34] Large areas are converted into shrimp enclosures which

[32] http://www.fao.org/docrep/007/ad511e/ad511e0g.htm, accessed on 25 May 2011.
[33] Dilara Choudhury, "Environmental Degradation and Security", *The Daily Star*, 24 February 2010.
[34] Shrimp Farming Deals Major Blow to South, *The Daily Star*, 26 May 2011.

are obviously saltwater ponds. To lessen their expenses, farmers create channels from the estuaries to drain saltwater into their respective ponds. Once entered, the saltwater destroys the fundamental element of the soil by gradual salt sedimentation in the land. In the process, it destroys water (surface ones), ground water and the dependent flora and fauna. Shrimp cultivation is also blamed for salinity in ground water pumped out by deep tube wells and withering of trees, several aquatic plants, weeds and local fish species.

Unplanned Urbanization

Bangladesh, a predominantly a rural country experienced rapid urbanization after independence in 1971. According to Islam, "urbanization in the developing countries took place not because of industrialization, but because of the growth of tertiary and informal manufacturing sectors and a positive correlation between development and urbanization was quite obvious in Bangladesh".[35] These development sectors attract people living in the rural areas to migrate to the urban areas. The issues like land scarcity, unequal distribution of land, and high proportion of agricultural labourer act as the push factors for the villagers to migrate to the urban areas of the country. The majority of the urban areas in Bangladesh are unplanned and nearly 50 per cent of the national urban population is concentrated in the metropolitan cities and divisional headquarters. The capital city Dhaka is the main centre of urban agglomeration and being the administrative and economic centre, it attracts people from all over the country. According to a report, more than 28,000 people live in per square kilometre area of Dhaka.[36] According to United Nation's Population Projections, the size of the urban population in Bangladesh will exceed 50 million by the year 2025.[37] Country Environmental Analysis of Bangladesh indicates that, rapidly growing urban areas in Bangladesh is facing: (i) very bad ambient air and water quality; (ii) high incidence (more than 27 per cent) of the population living in extreme poverty; (iii) substandard housing conditions resulting from high land prices, insecurity of tenure, and lack of loan finance; and (iv) non-availability of piped water in more than 80 per cent of the households.[38] Thus, unplanned urbanization in Bangladesh

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[35] Nazrul Islam, Urbanisation, Migration and Development in Bangladesh: recent Trends and Emerging Issues, CPD-UNFPA Programme on Population and Sustainable Development, Paper 1, Centre For Policy Dialogue, Bangladesh

[36] *The Daily Ittefaq*, 16 March 2010.

[37] United Nation's Population Projections 1998, cited in, M. Mazharul Islam and Kazi Md. Abul Kalam Azad, Rural-Urban Migration, Poverty and Child Survival in Urban Bangladesh, available at , accessed on 04 April 2010.

[38] Asian Development Bank, *Country Environmental Analysis Bangladesh*, July 2004.

is emerging as one of the major environmental insecurity issue.

Climate Change

Bangladesh is regarded as one of the most vulnerable countries to climate change. Climate change is affecting the frequency and intensity of the natural disasters in Bangladesh. The topography of Bangladesh makes it vulnerable to the effects of global climate change. The Intergovernmental Panel on Climate Change (IPCC) Working Group II Report (2007) noted that Bangladesh has been experiencing rising temperature as a result of climate change and it has experienced a rise in the seriousness and frequency of floods through2002, 2003 and 2004 as a result of climate change.[39] The Report has identified Bangladesh as one of the country's most affected by climate change induced sea-level rise.[40] The sea-level around Bangladesh has risen considerably by about 12 cm since 2000.[41] A study conducted by Climate Change Cell of the Department of Environment of the Government of Bangladesh (GOB) found that, a sea-level rise of 0.5 metres over the last 100 years has already eroded 65 percent landmass of 250 square kilometres of Kutubdia, 227 square Kilometres of Bhola and 180 square kilometres of Sandwip islands.[42] Climate change is also projected to increase levels of salinity, monsoon rainfall, sea surface temperature, frequency and intensity of cyclones, and also droughts. Because of poor economy, lack of infrastructure and resource constraints, and inability to face calamities such as flood, storms, tidal surge, drought etc.Bangladesh's vulnerability is increased even more.. Moreover, the apprehended rise of sea level due to green house effect adds a greater and unmanageable dimension of threat to Bangladesh. As forecasted, 17 per cent of Bangladesh's total land is likely to be submerged affecting millions of people by the middle of this century. The various negative impacts are being felt severely due to increased food insecurity, hunger, poverty and inequality within the society. It displaces people in many affected ecosystems (coastal zone, river basin and drought prone areas) and enhances rural to urban migration.

Mitigating Environmental Insecurity of Bangladesh

Bangladesh has achieved several milestones in the environment sector despite facing the adversities due to poverty and overpopulation, which are very closely

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[39] IPCC, Working Group II, *Climate Change 2007: Impacts Adaptation and Vulnerability* (2007).
[40] *Ibid.*
[41] German Advisory Council on Global Change, *World in Transition: Climate Change as a Security Risk* (2007)
[42] The Climate Change Cell, *Climate Change and Bangladesh* (2007)

linked with the environmental insecurity prevailing in the country. Achievements ranged from incorporation of environmental concerns in sectoral policy formulation to benchmarking success at the field level. The government in 1992 adopted the National Environmental Policy, appended with an implementation programme. This policy embraces 15 development sectors including agriculture, Industry, health and sanitation, energy, water, land, forest, fisheries and livestock, coastal and marine environment and others. The Ground Water Management Ordinance of 1985 was endorsed by the Government to manage the ground water resources for agricultural production. In 1999, the National Water Policy (NWP) was adopted. One of the most important goals of the National Water Policy is to address issues related to the harnessing and development of all forms of surface water and groundwater and management of these resources in an efficient and equitable manner.

The GOB framed the first Forest Policy in 1979. Forestry Master Plan - a twenty-year master plan was prepared during 1991-93 for the period 1993-2013 which provides the framework to optimize the forestry sector's contribution in stabilizing environmental conditions and assisting economic and social development. The Forestry Department of Bangladesh in collaboration with the Food and Agriculture Organization (FAO) of the United Nations has set up a long term monitoring system of the country's forest and tree resources. Realizing the paramount importance of increasing the coverage of coastal mangroves, the government initiated several programmes e.g. Mangrove Afforestation Project, Second Forestry Project, Forest Resources Management Project, Extended Forest Resources Management Project and Coastal Green Belt project. The GOB signed the United Nations Convention to Combat Desertification (UNCCD) in 1994 and ratified in January 1996. To combat land degradation and to attain sustainable land management and development, current government programmes have focused on field oriented activities in conjunction with the institutional capacity building.

Bangladesh has an elaborate, established and experienced disaster management system from national down to the union[43] level to mitigate the effects of disaster. Bangladesh government's Comprehensive Disaster Management Programme (CDMP) helps ensure that communities and individuals throughout the country are better protected from events like floods and cyclones, and that Bangladesh is better able to manage the impacts of such disasters when they occur. CDMP II (2010-2014) is a vertical and horizontal expansion of its Phase I activities

[43] Union is the lowest level of administrative tier in Bangladesh.

designed based on the achievements and lessons learned. The strong foundation laid during CDMP I by continuing the processes initiated, deriving actions from the lessons learned, utilizing knowledge resources generated and knowledge products published. The approach of CDMP II is to channel support through government and development partners, civil society and NGOs into a people-oriented disaster management and risk reduction partnership. That partnership will promote cooperation, provide coordination, rank priority programmes and projects, and allocate resources to disaster management activities, risk reduction activities and climate change adaptation activities in Bangladesh.

GOB has developed and enacted Bangladesh Climate Change Strategy and Action Plan (BCCSAP) 2009. The BCCSAP sums up Bangladesh's current thinking on desirable activities to build climate resilience into the economy and society of Bangladesh through adaptation to climate change as well as mitigation for a low carbon development path. BCCSAP provides the context, outline the implications and likely impacts of climate change in Bangladesh, an overview of different adaptation strategies and briefly outline mitigation issues. It also describes a ten-year programme to build the capacity and resilience of the country to meet the challenge of climate change over the next 20-25 years. The government created Bangladesh Climate Change Resilience Fund (BCCRF), a multi-donor fund that supports the implementation of the government's own Climate Change Strategy and Action Plan.

As the issues of poverty and overpopulation greatly impact all other social, economic and developmental issues in the country it is imperative that these are given adequate attention while dealing with related other issues. Successive governments in Bangladesh have been consistently working on these two issues. With regard to population, it has achieved a brilliant record of bringing the growth rate from 2.5 per cent in 1980 to 1.41 percent in 2008.[44] Concerning poverty, the government currently runs a total of 84 schemes under social safety net programmes by allocating Tk 19,497 crore, which is nearly 15 per cent of the national budget and about 2.5 per cent of gross domestic product.[45] The enlarged size and coverage of the safety net programmes over the years have impacted positively in poverty reduction. Bangladesh's poverty reduced to 31.5 per cent in

[44] Iftekharuzzaman, "Corruption & Human Security in Bangladesh: Primacy of Transparency and Accountability" in *Seminar on Good Governance: A National Security Priority in Bangladesh* organized by BIISS at Dhaka on 03 March 2010.

[45] Sajjadur Rahman, "Call for Safety Net Strategy", *The Daily Star,* 29 May 2011.

2010 from 40 per cent in 2005 and 49 per cent in 2000.[46]

Regional Level Cooperation and Initiatives to Meet the Challenges of Energy and Environmental Security

Energy Security

At the regional level, there had been important initiatives undertaken that included the finalization of the concept of the South Asian Energy Ring in November 2008 in an expert group meeting.[47] The meeting also decided that the member states would develop common regional highways of energy within and across the region for movement of energy commodities and services in a market-based environment. The other issues discussed in the same meeting were the possibilities of harnessing hydro-potential in Bhutan and Nepal; getting natural gas from West, Central and East Asia; sharing expertise of India in wind and solar energy and of Nepal in micro-hydro and the successful experience of CNG technology in Bangladesh, India and Pakistan.[48] Deliberations have also been underway in different forums regarding the aspects of electricity grid interconnections among Bangladesh-Bhutan-Nepal and other SAARC member countries. Nepal and Bhutan have substantial untapped hydroelectricity potential. Bulk of power generated at Hydro Electric Projects in Bhutan has been implemented with technical and financial assistance of India. After meeting the internal demand of Bhutan electricity is exported to India and India also exports power to Bhutan during winter period when there is reduced hydro generation in Bhutan. This cooperation between Bhutan and India in hydropower is recognized as a successful model of energy trading in the region. Therefore, Bangladesh's effort in this regard may be further extended to explore the possibility of connecting it's electric grids with those of India and Bhutan. The power trading in South Asia is yet to emerge with its full potential. However, a proposal submitted by India on preparing a roadmap for SAARC market for electricity (SAME) on a regional basis has been a significant step forward.

Notwithstanding the fact that some of the South Asian countries possess a relatively larger potential in renewable energy sources, such as hydropower, wind, biofuels and geothermal energy, much of such renewable energy potential of the

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[46] *Ibid.*

[47] Available at http://www.newstoday.com.bd/index.php?option=details&news_id=15594&date=2010-12-24, accessed on 31 March 2011.

[48] *Ibid.*

region remain at a low level of utilization. Among the various reasons for the low utilization level of renewable energy is the lack of political consensus, insufficient funds for developing such energy and lack of proper technology required to realize the potentials. Effective energy cooperation in the region would therefore require an integrated energy market which will ensure cooperative competition among the various sectors within the energy market. An integrated market would need to first ensure that national electricity grids have the capacity to accommodate grids for renewable energy sources and that these would be able to reach all consumers.[49] Cross-border energy trade involving renewable energy resources would reduce power generation from fossil fuels such as coal or oil. This would improve the environment, as renewable energy emits smaller amounts of greenhouse gases and pollutants than fossil fuels.[50]

Establishment of the transnational physical connectivity is a prerequisite in the South Asian countries so as to build up effective regional energy infrastructure. Such infrastructures may perhaps be positioned along cross-border economic corridors which are expected to generate significant benefits to the investors. It is very important to strengthen cooperation among the regional states in order to develop advanced technology to enhance energy efficiency and conservation which may also contribute to reduction in carbon emissions.

Environmental Security

It is understood that a majority of the environmental challenges are transnational in nature with regard to their origin, conception and effects. In the present day international order no nation is expected to face such transnational challenges all alone. Cooperation on such challenges and common concerns in the region is an important objective and a regional public good that will support growth and peace for the member countries.

One of the regional level landmark undertakings on the issues of cooperation is the *SAARC Comprehensive Disaster Management: A Framework for Action 2006-2015* which was formulated by an expert group of member countries in Dhaka on 7-9 February 2006 and adopted by SAARC Heads of States and Governments at the 14th Summit in New Delhi in April 2007. It was in response to the Dhaka

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[49] Chang Youngho and Yao Lixia, "Energy in a Seamless Asia", Paper presented in the Regional Workshop on *Dealing with Energy Vulnerabilities: Case Studies of Cooperation and Collaboration in East Asia* organized by The RSIS Centre for Non-Traditional Security (NTS) Studies on 09-10 December 2010 at Singapore.

[50] *Ibid.*

Declaration and earlier Declaration of the SAARC Environment Ministers which met at Male on 25 June 2005 after the devastating Indian Ocean Tsunami. The framework envisaged five priority areas of action for the SAARC countries. In that, each member country has the primary responsibility for the implementation of the priorities for action within each country, involving all the relevant sectors-government, civil society, community-based organizations, scientific community, private sector, media and also other stakeholders. The framework further envisaged that an enabling regional environment that shall be created to stimulate and contribute to the sharing of the knowledge, capacities and motivation needed to build disaster resilient nations and communities.

Similarly, an integrated water policy for South Asia, a region characterized by numerous international river basins, many of which are shared with countries beyond the region is imperative for equitable and sustainable use of river water. Conflicting demands on these international waters, and consequent tensions, already exist – both within and between countries, and as the populations and economies of countries grow, they will undoubtedly intensify.[51] The potential benefits of closer integration in water management and development are strongly related to creating opportunities for improving the prospects for growth and prosperity across the South Asian region. Cooperation can enable better environmental management, providing benefits to the river, and underpinning all other benefits that can be derived.[52] Bi-laterally, Bangladesh and India have signed the historic Ganges Water Sharing Treaty which has opened up newer avenues for offsetting the negative impacts of Farakka Barrage in Bangladesh and tapping the potentials of water resources in both the countries. The implementation of the treaty has the prospect of allowing Bangladesh to receive a fairly good flow of water into the Ganges-Kobadak Irrigation Project in greater Kushtia and into the Gorai river that drains the south-western districts, thereby saving agriculture, aquaculture, industries and the world's largest mangrove forests in the Sundarbans by preventing salinity from the Bay of Bengal.[53] Opportunities have also opened up for regional, sub-regional and basin-wise development and management of water for mutual benefit.

Climate change is another issue on which South Asia as a region has to do a lot as most of its countries are affected by it. There are many more environmental issues

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[51] See, http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/SOUTHASIAEXT/0,,contentMDK:21272391 pagePK:146736 piPK:146830 theSitePK:223547,00.html accessed on 23 March 2011.

[52] *Ibid.*

[53] Ganges Water Sharing, *Banglapedia*.

on which regional approach is a need of the hour. Bangladesh due to its geographic, demographic and socio-economic reality and the consequent vulnerability with regards to environmental challenges will benefit quality from the bi-lateral, regional as well as global efforts or initiatives undertaken so far.

Conclusions

The reserved traditional source of energy, fossil fuel, is depleting at a faster rate than before globally while trying to keep up with the rising demand for energy. But a viable alternative to this traditional source is yet to emerge. Given the fact that the existing supply of natural gas in the pipelines is tapering off fast and the country is yet to command the technology and financial resources to access the untapped reserves of gas in the offshore areas, it is obvious that Bangladesh has to depend on the oil-exporting countries for the supply of its fuel to keep its wheel of economy moving. Taking into account the present reserves of gas and coal, and the future energy demand scenario of Bangladesh, there is an urgent need to evolve an appropriate energy supply mix diversifying available indigenous commercial energy resources as well as due consideration of competitive imported fuels. The goal should be to extend a reliable energy package to all citizens and to use energy to promote economic and social welfare with the least impact on the environment. Alternative sources of energy and technologies will also be needed in the future to complement conventional energy sources, as demand continues to grow. However, the new and renewable technologies like solar, wind, fuel cell etc. is unlikely to meet a large part of energy demands until they become cost-competitive.

Due to its geographical proximity, Bangladesh can benefit from the regional cooperation and initiatives on energy issues and meet the challenges of its acute electricity deficit. Following are a few of the recommendations that Bangladesh may pursue in the appropriate regional forums in order to mark its interest as a regional stakeholder and benefit from the regional cooperation:

a. A regional energy cooperation framework, based on respecting and complying with international law, should be institutionalized in South Asia.

b. Energy conservation and alternatives should be promoted. In that, efforts should be directed towards improving existing energy resources and exploring alternatives including renewable sources.

c. An integrated energy market should be set up in South Asia. It must have the required energy infrastructure facilities with the goal of exploring the most power trading potentials of the region.

d. A mechanism should be devised in order to facilitate sharing of information, technology and know-how on the use of both fossil and non-fossil fuels.

Since there is no one-stop solution to the energy problem, the pragmatic path for Bangladesh will be to conserve fossil energy as much as possible and at the same time fulfill the energy requirement with a mix of the traditional and the alternatives at hand including the nuclear, solar as well as other options like importing electricity from neighboring countries namely India and Bhutan as part of regional cooperation.

Bangladesh with its disaster prone geographical setting, rising population growth, poverty and ever-increasing trend of environmental degradation is already in hazardous condition. Under the circumstances, achieving an environmentally sound development has emerged as the greatest challenge for Bangladesh. Accordingly for theimplication of future development of Bangladesh, a country laden with too much population and too much vulnerability to natural disasters should be carefully examined to take environmental concerns into account. The growth of the country must be based on the principle of sustainable development and the economic growth and environmental sustainability should be treated as mutually dependent in order to improve the well-being of the nation. Despite many phenomenal achievements in the environment sector, challenges appearing every day seem to be unending for Bangladesh. Most environmental problems are global issues, and as such, these are to be faced in a concerted manner with other global partners. Therefore, the efforts undertaken by the government and other stakeholders/partners should be well-concerted, comprehensive and farsighted.

Chapter 2

Bhutan: Behavioral Switch in an Age of Fragile Abundance

Tashi Choden

Introduction

Climate change and energy security are intertwined issues at the forefront of the global challenges today. Despite declining stocks and rising prices of fossil fuels, there is no indication of slow down on use of energy from these sources. If anything, the demand for energy continues to grow with developing countries requiring more of it to feed growth and advanced economies continue with business as usual to maintain the standards of living they've become accustomed to. However, with more awareness over increasing risks posed by climate change to the energy sector and vice versa; greater attention is now being paid to renewable and cleaner sources of energy. Against this backdrop, Bhutan at first glance appears to be in an enviable position due its well-preserved watersheds and abundant hydropower potential, which it is increasingly tapping to fuel its development goals. With its stringent environmental laws and a minimal rate of environmental degradation, Bhutan has indeed lived up to its reputation as a leader in conservation. Its national development policy that of Gross National Happiness or GNH, highlights the belief that economic growth must not be pursued at the cost of ecological, cultural, spiritual and social wellbeing. However, Bhutan is a country like any other wishing to reap the benefits of economic development as noble policies are often more easily adopted on paper than in practice. On the path to so-called modernization, its people are increasingly seeking more comfortable lifestyles oriented towards amassing material wealth. This calls for more intensive use of energy of all sorts in the domestic, transport, commercial and industrial sectors.

Bhutan's per capita energy consumption for 2005 was 0.62 tonnes of oil equivalent (TOE) which was 65.7% below the world's average of 1.81 TOE in 2005.[1] However, it has one of the highest per capita consumption of fuel wood in the world, as this continues to be the main source of primary energy comprising over 57% of its total energy supply. With a hydropower potential of 30,000 MW and

[1] *Overview of Energy Policies of Bhutan.* Dept. of Energy, MOEA, RGOB. March 2009.

efforts to accelerate its development underway, electricity generated from hydropower is the main source of conventional energy as well as top contributor to the economy. On the flip side, the abundance and cost advantage of hydropower has meant that the development of other renewable sources such as solar and wind has been negligible. Moreover, this overdependence on hydropower for its energy needs and revenue generation is a major concern since Bhutan's hydro resources, which are fed by glacial lakes, are extremely vulnerable to variations in temperature patterns. Ironically, electricity shortage is experienced during lean seasons when river flows subside, requiring re-imports of electricity from India. Bhutan is also completely dependent on imported petroleum products such as diesel and petrol to fuel its transportation sector, on which all of its industrial and commercial activities rely. Therefore, the entire country itself is vulnerable to the effects of climate change, given its mountainous ecosystem coupled with limited coping capacity as a least developed country. Given these realities, it is in Bhutan's best interest to not only increase supply to meet the growing demand, but more importantly give due importance to diversifying renewable energy sources while at the same time promoting the judicious use of available energy in the country. To this end, following a brief run through of basic facts on the country, this paper covers Bhutan's energy and environmental security issues. These include:a broad outlook on the state of environment including policies and main issues; an overview of the energy sector including its management, energy demand across various sectors, and energy supply options; the core (inter-related) energy and environmental issues for Bhutan; a long-term view on what is required to address these issues; and conclusions and recommendations.

Bhutan Basic Facts

The Kingdom of Bhutan is located in the Eastern Himalayas, landlocked by the Tibetan Autonomous Region of China to its north; and the Indian states of Sikkim, West Bengal and Assam, and Arunachal Pradesh to its west, south and east respectively. Its land area of 38,394 square kilometers is spread roughly over 170 km north to south, and approximately 300 km east to west.[2] Altitude varies from below 200 meters in the southern tropical region to over 7500 meters above sea level in the northern alpine region.[3] The Population and Housing Census carried out in 2005 recorded the country's population at 634,982. With an expected population growth rate of 1.4%, the National Statistical Bureau projected 2010

[2] *Bhutan at a Glance 2006. National Statistics Bureau, RGOB.*
[3] *Ibid.*

population at 695,822. After more than a hundred years of monarchy, Bhutan finally transited to a constitutional democracy in 2008. This was initiated and guided by the fourth and fifth kings of Bhutan, ultimately culminating into the 2008 party elections during which the Druk Phuensum Tshogpa (DPT) party was voted in by the people. The country's constitution was also adopted that year.

Since the initiation of planned development in the early 1960s, Bhutan has now reached a stage where its economy is less dominated by the primary sector, with major contribution to GDP coming in from the tertiary sector followed by the secondary sector. Bhutan's GDP in 2009 stood at 61,223 million Ngultrums[4] (which is approximately USD 1,360 million). Although majority of the Bhutanese continue to earn their livelihoods as subsistence farmers, the share of agriculture to the economy has seen gradual decline in relation to other sectors such as hydropower and construction over the past decade.

In 2009, the electricity and water sector constituted 19.3% of GDP, while agriculture (including livestock and forestry) constituted 18.2%, and construction accounted for 12.2% of GDP. In contrast in 2000, agriculture accounted for 26.8% of GDP, while construction accounted for 13.98% followed by electricity with 11.42% of GDP.[5]

Environmental Outlook

Bhutan is blessed with extensive tracts of natural forest, and is recognized by the United Nations as one of the ten biodiversity-hotspots in the world. It is one of the few countries that is a net sequester of carbon, and has experienced relatively less recurrent and widespread natural disasters compared to many other countries in the region. To this day, Bhutan's positive state of environment can be attributed to several main factors including: strong political commitment and far-sighted leadership; traditional values and way of life that conserves nature; its relatively late entry into modern development; and its small population size.[6] Internationally, Bhutan has committed to environmental sustainability through the Millennium Development Goals; all three Rio Conventions (the Convention on Biological Diversity, UN Framework on Climate Change, and UN Convention to combat Desertification); and some nine other international environmental agreements.[7] Nationally, in terms of development policies and strategies,

[4] *Bhutan at a Glance 2010*. National Statistics Bureau.
[5] *Annual Report 2009/10*. Royal Monetary Authority of Bhutan. 2011.
[6] *Bhutan Environment Outlook*. National Environment Commission, RGOB. 2008.
[7] Ibid.

environmental conservation has always been a priority for Bhutan, and forms one of the main dimensions of the country's development philosophy of Gross National Happiness (GNH). In particular, the country's vision document *Bhutan 2020* stresses that, "development must be pursued within the limits of environmental sustainability, and carried out without impairing the biological productivity and diversity of the natural environment." Moreover, environmental conservation is a constitutional mandate, with one of the provisions being that a minimum of 60% of Bhutan's total land area is to be maintained under forest cover for all time.

In terms of formal institution, the National Environment Commission (NEC) has the mandate to look after all environmental related issues. It is a high-level autonomous agency of the government that monitors the impact of development on the environment and aims to put in place the necessary controls, regulations and incentives to the private/public sectors to achieve sustainable development through the judicious use of natural resources. It coordinates inter-sectoral programmes, and implements policies and legislation with regard to the environment.[8] The National Environmental Protection Act 2007 is an umbrella legislation, with which all other laws and regulations pertaining to the use of land, water, forests, minerals and other natural resources are required to be consistent. It provides principles and directives for protection of environmental quality, and the maintenance of forest, biodiversity and ecosystem integrity.[9]

Although Bhutan has overall maintained a positive state of environment, issues and challenges are on the rise as increasing developmental activities take place. At the same time, with about 70% of its population subsisting on an integrated farming system of crop production, livestock rearing and a wide array of forest-based goods and services, the pressure on the forests are immense. Various instances of unsustainable agricultural practices have also led to land degradation in some areas. In view of these situations, the key environmental concerns for Bhutan include localized deforestation, overgrazing, forest fires, and conversion of natural habitats to accommodate urbanizing and infrastructure development. Newer trends such as pollution, waste and climate change are also becoming more apparent. These are particularly significant within the context of a fast-growing modernizing population and their increasing demand for energy. In Bhutan, agriculture and hydropower are most vulnerable to climate change and variability.

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[8] Website of the National Environment Commission, RGOB: www.nec.gov.bt

[9] *Review of Mainstreaming of Sustainable Land Management in Government Policies and Plans in Bhutan.* NEC, RGOB, 2008.

These sectors are heavily dependent on monsoon and temperature change patterns. With more than 70% of the people dependent on subsistence farming, communities in rural areas are especially vulnerable to high possibility of resultant crop failure and stress on livestock rearing.[10]

The main cash crops grown locally like rice, potatoes, chilies, apples and oranges are extremely sensitive to water and temperature variations. With its rugged, mountainous terrain and scattered settlements, the costs of providing social services and developing infrastructure are extremely high for Bhutan. In addition, Bhutanis situated in one of the most seismically active zones of the world with continual threat of earthquakes, and Bhutan is extremely vulnerable to climate change impacts.[11] Unlike in the past, landslides and flashfloods have now become an annual occurrence in the country. In order to mitigate such natural disasters, it is necessary that Bhutan works extra hard to conserve its inherently fragile geologic conditions, rugged mountain terrain and high precipitation-levels. With rising temperatures causing glaciers in the Himalayas to recede, increased glacier lake outburst flood (GLOF) events and flooding are the most likely climatic events expected to occur in Bhutan. Recent studies by ICIMOD suggest that several lakes in Bhutan and neighboring Nepal have high risks for outbursts due to global warming.[12] In fact Bhutan suffered a major glacial lake outburst in 1994 in the northwest part of the country. This resulted in a flash flood causing extensive damage to farm and other lands, as well as loss of several human lives and livestock along the valley below. Of the 2674 glacial lakes in the country, 24 have been classified as potentially dangerous lakes.[13]

Besides the obvious and immediate threats of destruction, such events can have other detrimental impacts. This includes disruption of river flows and changes in sediment yield, thereby impacting hydropower generation and water supply; destruction of settlements, infrastructure and agricultural land; loss of biodiversity and adverse impacts on human lives downstream.[14]

While climate change impacts on Bhutan's natural environment have not been thoroughly assessed, the experience in recent years of a number of incidents indicates the dangers of this issue. For instance, the winter of 1998/1999 saw a

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[10] *Bhutan Biodiversity Action Plan 2009*. Ministry of Agriculture, RGOB.
[11] *Bhutan National Adaptation Programme of Action 2006*. NEC, RGOB.
[12] *Biodiversity Action Plan 2009*. Ministry of Agriculture, RGOB.
[13] Ibid.
[14] Ibid.

prolonged spell of dry, snowless weather. This exacerbated forest fire incidents that winter, with such fires occurring even in places where they were earlier not known. The summer of 2000 witnessed the worst ever monsoon rains in the country's recent history. This triggered off unprecedented number of floods and landslides, causing loss of human lives and damage to infrastructure and natural resources. Ultimately, such events ripple into impacts on the economy. With Bhutan's main economic activities being heavily nature-dependent, the agriculture, hydropower and tourism sectors can only be sustained if natural resources are managed and used with care. The new political scenario in the country also presents new concerns. While Bhutan's recent transition to democracy is a positive development, the concern is that there is now greater risk of short-term economic development needs of the public taking precedence over the long-term benefits of conservation and sustainability, something that had been ensured by the monarchy to date. The current government of course has pledged itself to the overarching philosophy of GNH and the commitment to environmental conservation that comes with it, but it already faces the pressure of fulfilling its many promises of economic development activities including increasing networks of national highways, rural access roads and accelerated 'electricity for all' – all of which have substantial impacts on the fragile ecology.

Energy Outlook

The energy needs of the Bhutanese economy fall into three main categories as identified by the *Integrated Energy Master Plan for Bhutan* (2010). These encompass resources for generating electricity; fuels and resources for the transport sector; fuels to meet heat and mechanical energy demand of the industrial, commercial and residential sectors, excluding electricity. In Bhutan, the energy sector comes under the administration of two ministries. The Ministry of Economic Affairs (MOEA) formulates policy; plans, coordinates and implements conventional energy generation, consumption and exports, and fossil fuel imports. The Ministry of Agriculture (MOA) is responsible for biomass management.

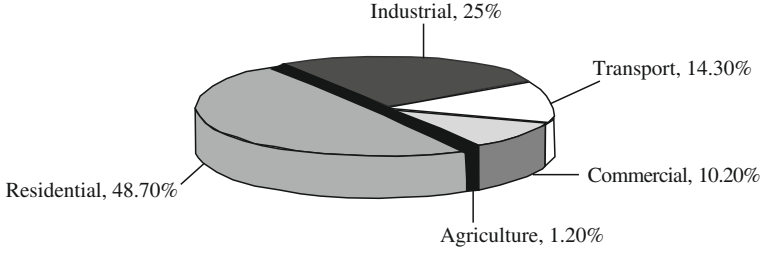
Within the Economic Affairs Ministry, the Department of Energy (DOE) is responsible for formulation of policies, plans, projects and programmes, and other initiatives related to hydropower and alternative forms of energy in the country. Import of fossil fuels for domestic consumption is overseen by the Department of Trade (DOT), and local coal mining falls under the purview of the Department of Geology and Mines (DGM). The electricity sector is regulated by the Bhutan Electricity Authority (BEA), an autonomous regulatory agency. The government

owned Bhutan Power Corporation (BPC) is a public utility responsible for distributing electricity throughout the country; it provides transmission access for generating stations of domestic supply as well as export; and also owns and operates small and micro power plants. The government owned Druk Green Power Corporation (DGCP) is responsible for operating and managing the country's main hydropower projects, towards implementing the government's policy of accelerating hydropower development. Bhutan does not have a national energy policy, and relies on guidelines such as the Power Sector Master Plan and the Rural Energy Master Plan. These are both primarily hydropower-oriented, following the basic principle of developing and enhancing access to clean energy for socio-economic development at national and local levels.[15] Similarly, under the umbrella of the current government's Economic Development Policy (EDP) 2010, the policy with regard to energy is to accelerate growth in the hydropower sector. This is in the context of harnessing renewable and sustainable energy that can boost sustainable and equitable socio-economic development, and contribute towards environmental conservation.

Energy demand by sector[16]

The total consumption of energy in 2005 was 392,467 tonnes of oil equivalent (TOE) where most energy was consumed by residential and industrial sectors. The per capita energy consumption for the same year was 0.62 TOE which was 65.7% below the world's average of 1.81 TOE in 2005. The electricity consumption increased rapidly from no electricity to 1,084 kWh per capita since 1961.The following chart gives an overview of total energy consumption in the country by different sectors.

Figure 2.1. Energy consumption by sector



[15] *Existing Good Practices of Sustainable Consumption and Production in Bhutan*. 2009-2010. National Environment Commission, RGOB.

[16] Information in this sub-section has been drawn from the *Integrated Energy Management Master Plan for Bhutan*, DOE, MOEA, RGOB, 2010, unless otherwise indicated

The residential sector uses energy mainly for cooking, lighting, space heating, and for fodder cooking in rural areas, consuming 48.7% of the country's total energy consumption. Of its total energy demand, 91% is met from biomass i.e. mainly fuel wood; and the rest is met by electricity and fuels like kerosene and Liquid Petroleum Gas (LPG). The residential sector consumed 89 MU of electricity in 2005 i.e. 14.5% of total consumption in the country, for cooking, lighting and heating. As the third most preferred fuel in this sector, about 50% of the total supply or 12,545 kilolitres was consumed, used mainly for lighting, cooking and in urban areas for heating. Total LPG consumption by this sector was 3,522 tonnes, used mainly for cooking, especially in urban areas. In all, about 68% of total fuel wood consumption comes from the residential sector, with per capita consumption about 0.78 tonnes annually. This high dependence on fuel wood is due to the fact 69% of the population lives in rural areas, where government policy allows fuel wood to be collected free of royalty. At the same time, only about 40% of rural households had been electrified as of 2005, giving little other alternative to unreached households.[17] Rural households use wood for cooking and heating. Many urban households also use wood for space and water heating in the winter, although briquettes are now increasingly being used in local heating stoves called *bukhari*. Solar photovoltaic (PV) systems are set up in some remote areas for lighting.

The industrial sector consumes 25.5% of the total energy supply and is the largest consumer of electricity in the country, accounting for 410 MU or 64.7% of the total electricity consumed in the country. Other fuels used in the sector include coal, furnace oil, kerosene, light diesel oil, and fuel wood.

The transport sector accounted for 13.7% of the total energy consumption. Oil is the dominant source of energy for this sector. This is broken down into 94.64% or 48,703 kilolitres of diesel consumption; 100% or 13,879 kilolitres of petrol consumption; and 100% or 1145 kilolitres of aviation turbine fuel consumption.

The commercial and institutional sector (comprising commercial establishments such as shops and hotels, and institutional establishments such as monasteries, government offices, schools, hospitals, etc) accounted for 10.2% of the total energy consumption. This sector consumed about 18.75% or 119 MU of total electricity consumption in the country. It also used fuel wood, LPG and kerosene.

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[17] It is, however, the government's intention to provide electricity for all by the year 2013, and recent reports indicate that rural household coverage may have reached about 60%.

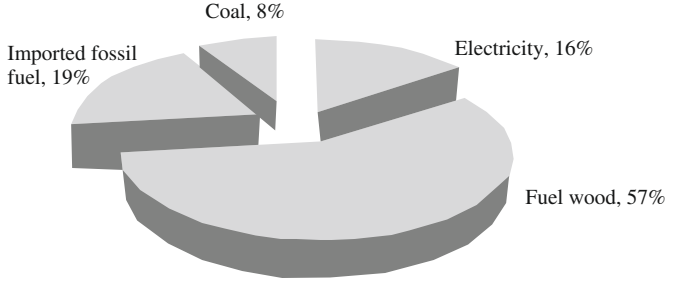
The agriculture sector which is the mainstay of the Bhutanese economy involving about 79% of the population, primarily meets its energy needs from human and animal power. It accounted for only 1.2% of total energy consumption in 2005, as the sector does not find much use for commercial and modern energy resources due to constraints by natural factors. For instance, given the mountainous terrain only 7% of land is under cultivation while demand for land for other uses such as industries and urban settlements are on the rise.

Electricity, of which the agriculture sector uses about 0.8 MU or 0.13% of total consumption, is mainly used for pumping. Diesel is also used for power tillers (about 544 kilolitres) in a few places. Cardamom drying, oil extraction and rice milling are some other activities that use energy for post-harvesting processing.

Energy Supply by Type

As the previous section indicates, Bhutan's energy supply is dominated by renewable energy sources. Fuel wood continues to be the main source of primary energy while electricity generation from hydropower is the major source of conventional energy. 99% of electricity generated in the country is from hydro resource with the rest from diesel generating plants. Without any of its own (known) reserves, all fossil fuels are imported from India. In 2005, Bhutan's total energy supply was 554,752 TOE. The per capita supply was 0.87 TOE, which was 51% below the world's average supply for the same year.[18] The following chart gives an overview of the total energy supply according to energy source.

Figure 2.2. Energy supply mix (2005)



[18] *Overview of Energy Policies of Bhutan.* DOE, MOEA, RGOB. 2009.

Biomass

The main source of primary energy in Bhutan is fuel wood. With rich forest cover and a predominantly agrarian population, it is reported as one of the highest per capita consumer of fuel wood in the world, with firewood comprising over 57% of total energy supply mix in the country. This amounted to approximately 725,000 tonnes of fuel wood in 2005.[19] In addition, other biomass fuels such as briquettes made from saw dust and agriculture residue have also been used in small quantities for some time now.

Some reports estimate that the total growing stock of forests in the country is about 527.529 million cubic meters, while the total sustainable annual yield that can be harvested in the country is estimated at 849,437 cubic meters or 3,913,850 tonnes. Accounting for inaccessible and protected areas, estimated at 40% of the total, the sustainable extraction rate is estimated at 1,565,540 tonnes although a more conservative estimate puts the figure at 1.18 MT.[20]

The potential for utilizing other forms of biomass energy is being explored. A feasibility study was conducted in 2008 by the Netherlands Development Organization (SNV), and an in-depth market study conducted in 2009 by SNV on contract for the Asian Development Bank (ADB) framework for 'Energy for All Partnership Programme'. These studies indicate that Bhutan has a technical potential of 20,000 biogas plants in these regions. Further, the effective potential of the country to install biogas plants was found to be 16,879 households or 68% of the technical potential (i.e. after considering required favorable conditions such as technical feasibility, socio-economic conditions, farming practices, use and availability of conventional fuel sources and poverty level). At the national level then, 19% of total households in Bhutan are found to have all the conditions favorable to install biogas plants.[21]

Based on the studies, the Ministry of Agriculture (MOA) commissioned two pilot biogas plants in Thimphu and Paro in 2009, which were being operated and used for cooking. Additionally, two pilot plants were initiated in Samtse and Thimphu by the Renewable Energy Division under the Department of Energy. With a funding of US$ 1.28 million from ADB, the project is being implemented by the Department of Livestock (DOL) under a Memorandum of Understanding with the

[19] Ibid.
[20] Report on *Biogas Market Study in Bhutan.* SNV/ADB, December 2009.
[21] Ibid

Department of Energy (DOE), SNV and Bhutan Development Finance Cooperation (BDFC). Project activities are coordinated by the DOE, while microcredit services are provided by BDFC; capacity building, training, quality control, management support and monitoring activities are provided by SNG. Implementation rests with the DOL.[22] At the same time, the UNDP GEF small grants programme is covering some other communities, with about 16 of 25 plants funded by this programme already completed since November 2010.[23]

Hydropower

Bhutan's positive state of environment with well-preserved watersheds and high precipitation has meant that it is endowed with rich hydropower resources. It receives rainfall varying from 500 mm in the north to 5000 mm in the south. It has 667 glaciers and 2674 glacier lakes, which feed four major rivers and their tributaries.[24] Its hydropower potential is estimated at 30,000 MW of which 23,760 MW is assumed technically exploitable.[25] Currently, the installed capacity in the country is close to 1500 megawatts.

Table 2.1. Installed capacity of 1,484 MW as of 2006

Project	Installed capacity	Development model	Year of commission	Percent exported
Chhukha	336 MW	Govt. of India	1986-88	82%
Kurichhu	60 MW	Govt. of India	2001	85.4%
Basochhu Stage-I	24 MW	Austrian Govt.	2002	Consumed internally
Basochhu Stage-II	40 MW	Austrian Govt.	2004	Consumed internally
Tata	1020 MW	Govt. of India	2006	100%
Micro/Mini	4 MW			Consumed internally

Table adapted from: *Overview of Energy Policies of Bhutan*, DOE, MOEA, 2009

Electricity contributes to about 16% of total energy supply in the country. Since domestic demand is relatively small, Bhutan exports most of the hydroelectricity generated to India. For instance in 2005, 71% or 1793.76 MU of total power generated was exported to India, while only 21% or 745.88 MU was consumed domestically.[26] At the same time, about 18.39 MU of electricity was imported

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[22] *From Dung to Clean Energy.* Bhutan Observer. August 31, 2010.
[23] *The Biogas Capital of Bhutan.* Kuensel. March 25, 2011.
[24] *Biodiversity Action Plan 2009.* Ministry of Agriculture, RGOB.
[25] *Integrated Energy Management Master Plan for Bhutan*, DOE, MOEA, RGOB, 2010
[26] *Integrated Energy Management Master Plan for Bhutan*. DOE, MOEA, RGOB. 2010.

from India to fill in shortages experienced in some areas and during the lean season. Overall, hydropower exports to India constitute the most important export, accounting for 39% of total exports during the 2009/2010 fiscal year.[27]

The accelerated development of hydropower is underway with the 10,000 MW Plan to develop a total of ten hydropower projects within 2020. These projects are to be developed through inter-governmental (IG) undertaking with the Indian government, and through joint venture undertakings with Indian public sector companies. Under the IG model, RGOB and GOI establish an authority that gets 100% financing from India to undertake the construction of projects (except for the composition of grants and loans). These projects are to be handed over to DGPC after completion; under the joint venture mode, the Indian public sector partner is allowed 51% equity stake, while DGPC's share of the equity will be provided by India as grant. In principle a debt-to-equity ratio of 70:30 has been agreed to, and the Indian partners will leverage the loans needed for construction.[28]

Table 2.2. 10,000 MW Planned Projects by 2020

Project	Installed capacity	DPR Schedule	Construction schedule	Development Model
Punatsangchhu-1	1200 MW	Completed	2008-2015	IG
Punatsangchhu-2	990 MW	Completed	2010-2016	IG
Mangdechu	720 MW	Completed	2010-2016	IG
Sankosh Reservior	4060 MW	2010 (Dec)	2011-2020	IG
Kuri-Gongri	1800 MW	2011 (Dec)	2012-2019	IG
Amochhu Reservior	620 MW	2011 (Sept)	2012-2018	IG
Wangchhu Reservior	600 MW	2011 (Dec)	2012-2020	JV with Indian PSU
Bunakha Reservior	180 MW	2011 (Mar)	2012-2018	JV with Indian PSU
Kholongchu	650 MW	2011 (Jun)	2012-2018	JV with Indian PSU
Chamkharchhu-1	670 MW	2011 (Dec)	2012-2018	JV with Indian PSU

IG: Inter-governmental undertaking with GOI; JV: joint venture undertakings
Table adapted from: *RMA Annual Report 2009/10.*

In addition to the above, the DGPC is also investing towards its goal of an additional 500 MW of power by 2020. These comprise the Dagachhu (114 MW),

[27] *RMA Annual Report 2009/10*. Royal Monetary Authority of Bhutan.
[28] Ibid.

Nikachhu (208), and Gamri (100MW) projects. The DPR for the latter two are underway, while that of Dagachhu has been completed and its construction is also underway.[29]

The Dagachhu Project has been registered as a Clean Development Mechanism (CDM) project, with the crediting period defined from 1st January 2012 to 31st December 2018 on a renewable basis. With an estimated annual generation of 500 GWh of electricity, it is expected to provide 500,000 Certified Emission Reduction (CER) certificates for trading.[30]

Solar

The share of solar energy to total energy supply mix is negligible, with the total installed capacity only about 0.239 MW. Nevertheless, it has been crucial in providing lighting in some far-flung and isolated communities including schools, monasteries and telecommunication centers where the extension of grid electricity has been impossible due to prohibitive costs and unfavorable climatic and environmental conditions.[31] While detailed data is not yet available on solar potential, it is generally agreed that Bhutan has reasonable good solar energy potential. A resource potential of 4.5-5 kWh/m2 in various locations has been mapped under the Solar and Wind Energy Resource Assessment (SWERA) project of the United Nations Environment Programme (UNEP). According to the Integrated Energy Management Master plan for Bhutan, solar energy in Bhutan can be exploited in two major ways i.e. solar systems including solar thermal systems such as water heating systems and solar photovoltaic systems; and solar passive systems for building heating.

Fossil fuel

As for fossil fuels, Bhutan has no known reserves of this class of fuels (except minimal deposits of coal), all of which it has to import from neighboring India. Imported fossil fuels constitute about 19% of the total energy supply, exceeding the share of hydroelectricity to total domestic energy consumption. In 2005, 51,460 kilolitres of diesel; 13,879 kilolitres of petrol; 12,545 kilolitres of kerosene; 1145 kilolitres of aviation turbine fuel; and 4472 million tones of LPG were imported.[32]

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[29] Ibid.
[30] Drug Green Power Corporation Website: www.drukgreen.bt
[31] Overview of Energy Policies of Bhutan, DOE, MOEA, RGOB, 2009.
[32] *Integrated Energy Management Master Plan for Bhutan*. DOE, MOEA, RGOB. 2010.

Coal

Coal is mined in the country, which in combination with additional imports from India contributes in small part to the total energy supply mix i.e. 8%. Total coal consumption in 2005 was 97,509 tonnes. Total coal mined from local mines was 85,279 tonnes while 60,607 tonnes of coal was imported in the same year. Bhutan also exported 48,377 tonnes of coal the same year.[33]

Core Energy and Environmental Security Issues for Bhutan

As is true for any other country, Bhutan's energy security is inextricably linked with its environmental security. The two cannot be considered apart as separate entities. Additionally, the country's socioeconomic development is increasingly dependent on these two areas as electricity generation from hydropower is the main driver of the economy.

The robustness of Bhutan's hydropower industry is entirely dependent on the health of its ecosystem, which in turn is vulnerable to climate change. Such a challenge is not one that Bhutan alone can control, but one that the entire world must address collectively. For example, whether Bhutan is a net sequester of carbon and whether it follows stringent environmental policies within its boundaries or not, the Himalayan glaciers will continue to melt at an accelerated pace if the top emitters fail to cut carbon emissions drastically. This fact has direct bearing on Bhutan's very existence, where majority of its people rely on climate-sensitive activities like agriculture for their livelihood. The threat of glacial lake outbursts, floods and water scarcity are not to be taken lightly, especially for a mountainous least developed country (LDC) with limited coping capacity for such disasters.

Climate change will also have direct bearing on the Bhutanese economy, which is heading more and more towards overdependence on hydropower, with even the construction sector largely driven by the works on developing major hydro projects. Given the delicate state of the Himalayan ecology, electricity generation from hydropower is highly vulnerable to water supply, as indicated by the variability in its contribution to the economy. For instance, the real growth of the electricity and water sectors saw significant decline from 13% in 2008 to -2.4% in 2009, resulting in the decline in the real value of this sector from Nu. 9.1 billion in 2008 to Nu. 8.9 billion in 2009. The share of this sector to nominal GDP was 19.3% in 2009 as compared to 21.1% in 2008. Its contribution to national revenue however increased from Nu. 2.8 billion in 2008 to Nu. 3.5 billion in 2009.[34]

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[33] Ibid.

[34] *RMA Annual Report 2010*. Royal Monetary Authority of Bhutan.

While hydroelectricity generation is plentiful and far exceeds domestic needs on the whole, a taste of scarcity is experienced each time during the lean season when river flows subside. In a typical year, production is near or at capacity in only about 5 months from June to October. Since all hydropower plants in the country are currently run-of-the river schemes without reservoirs to store water during winter for electricity production, hydropower generation is highly seasonal. Moreover, the risk of hydropower plants being forced to shut down during the summer months also cannot be ruled out. There is every possibility of rivers swelling as snow and ice melt in early summer months, accompanied by threat of overflow and flash floods due to heavy monsoon rains. Bhutan faces such seasonal shortage of electricity especially in meeting the needs of a growing industry. Some places in the east and southwestern parts of the country also face shortage during the rest of the year, because of insufficient coverage of transmission lines linking western, central and eastern grids. This is basically attributed to lack of skilled manpower, insufficient revenues and budget, coupled with formidable terrain making it difficult to expand coverage.[35]

Electricity then has to be imported from India during the lean season and also to reach some of these deficit areas inside the country from various points in India. In 2005, about 18.39 MU of electricity was imported from India.[36] While domestic demand for electricity during the winter has already reached 237 MW and is expected to rise further to 308 MW during 2011, the total winter generation in the country is only about 288 MW.[37] Therefore, a shortfall of about 20 MW is expected in the winter months of 2011, and such power shortages are expected to continue until the commissioning of the Punatsangchhu I hydro project in 2016 or so. Until then, the DGPC projects a winter import requirement of approximately 718 MU over the next six years at a cost of Nu. 1.3 billion.[38]

The concern over dependence on this one source is further compounded by the fact that there is currently little choice of other renewable energy resources that's been developed. Since hydropower is relatively cheaper and in abundance, other potential sources are not considered financially attractive or feasible. Currently, more than 99% of total electricity generated in Bhutan is from hydropower. Even though solar energy has potential in the country, especially for remote areas not connected to the national grid, there is marginal use of this source. Since solar PVs

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[35] Ibid.
[36] *Integrated Energy Management Master Plan for Bhutan*, DOE, MOEA, RGOB, 2010.
[37] *RMA Annual Report 2010*. Royal Monetary Authority of Bhutan.
[38] Ibid.

are relatively expensive especially within context of abundant hydropower, there has been very little attention given to tapping solar energy for basic purposes like heating of space and water in homes. Besides the lack of adequate financing, there has been inadequate documentation and evaluation of the many solar projects that have been undertaken; spilling over into lack of skills in operating and maintaining the few projects that have been initiated.

Similarly, the exploration of wind energy has been overshadowed by hydropower. Although a pilot site for wind power generation has been identified (in Tsimilakha in Chhukha), so far no concrete studies on wind resources or measures to pursue its development have taken place. The inadequate infrastructure such as wide-enough roads required for transporting large and heavy materials for developing wind machines; and reservations of government officials and policymakers over aesthetic impact of large wind machines are also factors affecting further exploration of wind energy potential in the country. Looking at things more holistically, the latter is a weak argument because if there really was concern about aesthetics, the unpalatable building constructions quickly filling up our poorly planned urban areas would not be allowed. Basically there is a gap between what is said and what is actually done. Such discrepancy in the long run is harmful as it prevents the real issues as hand from being properly addressed, such as the need to explore alternative renewable energy sources.

The small scale domestic production of biogas at least has received some renewed attention in recent times. The government had once attempted to introduce biogas technology in the late 1980s with the installation of about 50 plants in the southern subtropical regions. However this attempt had failed overall due to lack of follow-up, inadequate training of masons and users and poor after-sales service.[39] However, current media reports indicate that so far, the recent initiatives are well-received by the stakeholders and proceeding well. While a large proportion of rural households in Bhutan have enough livestock to make for a successful biogas programme, there are still challenges to overcome.

The lure of traditional fuel sources from the easily accessible forests, people's relatively low awareness of biogas technology, and low affordability of rural farmers limit the scope significantly. Current effective market for biogas plants are limited to the southern belt and some inner valleys in the country, spread out over only seven of twenty districts in the country. Temperate and higher altitude

[39] Report on *Biogas Market Study in Bhutan*. SNV/ADB, December 2009.

areas generally do not have favorable conditions required for biogas production due to low ambient temperatures especially at night. Other potential sources of renewable energy such as municipal solid waste and geothermal energy also remain unexploited mainly owing to lack of budget and technical expertise. Bhutan's high dependence on fuel wood as a primary source of energy is also a serious concern. With demand for wood far exceeding supply, there is a lot of pressure on the forests. The risk of extraction by ad hoc means that are not under a sustainable management system is further increased. These are factors that could lead to excessive extraction causing forest degradation, thus making the land vulnerable to soil and water erosion.

In light of this situation, rural electrification and the goal to provide 'electricity for all by 2013' has even more significance. With about 78.6% of electrified households in the country using electricity for cooking, lighting and heating, it is clear that electricity is the preferred source for such purposes. A 25% reduction in fuel wood consumption was recorded in electrified households in rural areas. However, the issues associated with accelerating hydropower development and drawing transmission lines to connect all households (mentioned earlier) still have to be handled with caution. Meanwhile, the country's complete dependence on imported petroleum products is a major concern. The transportation sector in the country is particularly vulnerable to the supply and price fluctuations in India, which in turn is effected by global supply and prices. Any fluctuation in India can have a ripple effect throughout the Bhutanese economy, given its landlocked condition which ensures that transportation costs are always high. Besides having to transport goods in diesel and petrol-fueled trucks from sea ports in India, transport within the country is also expensive with long and winding roads traversing the mountainous terrain.

As the country continues to develop, the dependence on imported fuels is quickly growing with more and more Bhutanese purchasing vehicles whether they can genuinely afford to or not. There has been significant growth in the number of vehicles at about 11% to 12% annually, which is close to 6,000 vehicles in a year. As of February 2011, the total number of registered vehicles in the country was 54,469. Just a decade ago, the figure was less than half at 22,527 vehicles in the country.[40]

As a result, air pollution and carbon emissions are heading for an increase, not to mention overcrowding on the limited road space in major towns in the country. At

[40] *Vehicles Contribution to Air Pollution Unknown* in Bhutan Times, April 3 2011.

the same time, road networks throughout the country are continually being increased, cutting through mountainous topography, and making larger number of areas more vulnerable to landslides caused by loose soil. It is clear that fossil fuel dependence will only increase going by these developments, all the while adding to and increasing the country's energy and environmental security issues.

Finally, the use of coal in industries in the country is also a deviation from the country's stated commitment to remaining a net carbon sink for all times. One of the biggest contributors to climate change in the world is coal, and for Bhutan to be mining, using and exporting this contradicts the very principles of environmental conservation and GNH which it proclaims. The share of coal to total energy use is about 8%, with locally produced coal used mainly for reduction processes in industries. While this may seem a small portion to some, the potential impact must be viewed within the context of a country that has limited usable land, an inherently fragile ecosystem, and the abundant generation of hydroelectricity which should be used more efficiently to take care of domestic demands.

In general, the mining industry has direct impact on the landscape. Soil erosion, increased run-off, and exposure to potentially reactive natural materials are some of the inherent risks that come with cutting slopes and excavation works, which are required for mining. Artificial slopes of potentially hazardous materials develop due to dumping or piling of overburden materials; and if not properly rehabilitated, abandoned mines leave the landscape degraded and pose immense environmental risks. [41]

A report prepared by the Royal Audit Authority in 2007 found that almost all mines in the country lacked proper system for environmental management of mined areas and their surroundings; as a result of which air pollution, water sedimentation and land degradation, among others, have been occurring in and around most of these places.[42]

Basically, policy implementation has not been able to keep pace with policy formulation in the environmental sector, especially in the mining industry. There is weak enforcement of environmental standards and norms owing to constraints in financial and human resources, as well as weak inter-agency coordination. Information and data are not very robust, making assessments of environmental conditions and trends difficult.

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[41] *Bhutan Environment Outlook 2008*. NEC, RGOB.

[42] *Report on the Mining Operations in Bhutan.* Royal Audit Authority, 2007.

A long-Term View on What is Required to Address the Core Issues

As laid out in the previous section, the core issues for Bhutan in terms of its energy and environmental security include: climate change impacts and the vulnerability of hydropower; electricity shortage during lean seasons along with electricity-deficit areas requiring re-imports from India; high dependence on hydropower and little choice of other sources of renewable energy; high per capita consumption of fuel wood and consequent pressure on forests; complete (and increasing) dependence on petroleum imports from India; compounded by relatively weak implementation of environmental policy in certain crucial aspects. Given these realities, Bhutan's energy and environmental security will depend very much on the holistic and long-term thinking, planning and execution of appropriate measures that can be sustained and have least impact on the environment. Some of these measures are suggested below.

Diversifying renewable sources of energy

There is no argument that Bhutan must make the best use of its hydropower potential, not just for domestic energy needs but also for export through which to earn revenue. However, the danger lies in becoming over reliant on this one source because of its comparative advantage. While it might make economic sense to focus on hydropower, doing so at the expense of exploring other renewable sources, because they are more expensive, is rather shortsighted.

Given that there is potential for tapping energy from alternative sources like wind, solar and various biomass materials, the opportunity to diversify energy sources must be seized while the conditions are favorable i.e. while electricity from hydropower is generally quite reliable and provides fallback through any teething issues that may be encountered in utilizing other sources of electricity.

More effort is required in this area whether it is to be initiated by government-owned entities, or to be encouraged among the private sector. We must not be resigned to an outlook that abundance and comparative advantage of hydropower makes other alternatives non-viable. If energy and environmental security is to be ensured beyond mere rhetoric, conscious efforts have to be made on the ground even for less profitable ventures.

The current government has indicated in its EDP 2010 that it aims to ensure national energy security through development of solar, wind and other renewable energy sources, among others; and that while hydropower development shall be the main focus, it will also consider “an integrated approach to meet different

energy needs in the most efficient manner", with a National Renewable Energy Policy to be adopted before the end of 2013.[43]

The potential benefits of filling in the energy supply gap in the country, particularly in isolated communities without access to grid electricity, by tapping solar power is already quite apparent. As mentioned earlier, solar energy has been crucial for lighting purposes in some such places, even though its overall contribution to total energy use in the country has been minimal. Besides lighting, solar can also be utilized for water heating purposes. The use of appropriate devices such as solar water heaters not only in remote areas but also more generally, should be encouraged with tax incentives for local suppliers and users. Considering that solar heating and lighting systems may not be cost-effective due to high transportation and installation costs compounded by difficult terrain and small market, subsidies, special soft loans and other incentives will have to be seriously considered as part of promotion strategy.

Likewise, the pilot domestic biogas production initiatives that have recently taken off should be further strengthened in areas with the required atmospheric and social conditions. Those households in appropriate locations but without adequate capital could be assisted with subsidies, grants or other appropriate support. This way, dependence on fuel wood as well as LPG could be reduced.

In more concentrated town areas, waste products could also be utilized for generating bio-fuels. This must be explored because it serves two useful purposes. Even if the amount of energy generated is not substantial, it could be appropriate for small scale purposes and will add to diversification of energy sources. Also, it is a useful way of addressing the solid waste problem which Bhutan especially in the urban centres, is increasingly grappling with.

However, the downside of using bio-fuels must be fully considered. The purpose should be clear i.e. that in a limited way, it is an avenue for addressing the waste problem while at the same time contributing to diversifying the energy mix in the country.

The lessons of ethanol production in the U.S and its negative impact on world food prices must be heeded. From the very beginning, the possible diversion from growing crops for food, to growing crops for fuel must be discouraged. In promoting the use of waste products from agriculture, we should ensure that monocultures are not promoted.

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[43] *Economic Development Policy of the Kingdom of Bhutan, 2010.* Royal Government of Bhutan.

Greater consideration of ecological and social impacts of hydropower development

Given the importance of hydropower for Bhutan's energy and economic needs, we can only expect that its development will become more intense in the future. We are witnessing this trend already with the accelerated 10,000 MW plan of the present government. Given this reality, what now has to be ensured is that the environmental and social impacts associated with developing hydropower projects is fully taken into consideration.

However, we cannot be complacently comfortable with this fact any longer, since several reservoir types are slated to come up under the 10,000 MW plan to help address lean season shortages. At the outset we need to be clearheaded about the differences between run-off the river scheme and reservoir type hydro projects, and understand the potential negative consequences.

While generally considered a clean source of energy, adverse impacts can occur including possible diversion of forest lands towards constructing energy infrastructure, and ecological impacts of large hydro projects. Up to now, hydro projects in Bhutan have been run-off the river schemes, and the impact has not been as detrimental in some other parts of the world.

An example of how such projects cannot be taken at face value as an economic boon can be seen from the controversy surrounding the proposed Mekong River hydroelectric dam. In addition to displacing over 2000 people to make room for the dam and reservoir, conservationists point out that the project could result in trapping river sediments, blocking fish migration, devastating biodiversity and reducing seasonal flooding that sustains floodplain farming. There is also fear of the reservoir bursting due to risks of destabilization posed to its foundation by heavy rainfall, landslides and floods.[44]

Within the accelerated 10,000 MW plan of the Bhutanese government, four planned projects are reservoir types, including the 4060 MW Sankosh project. It is therefore crucial that our decision makers and project implementers are fully cognizant of, and prepared to address, all the possible controversies. That there will be some displacement of local population from their habitat along with disturbances in the ecosystem is a given, although for now we cannot be sure of the degree to which these could occur.

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[44] Mekong river hydroelectric dam threatens livelihoods and endangered species in landlocked Laos. March 2009. www.guardian.co.uk.

In addition, hydropower development in Bhutan entails not just the construction of dams but also considerable works on increasing or improving road networks. The same is true for drawing power transmission and distribution lines, which at the same time require large areas of land and special efforts to keep these areas safe from forest fires. Such activities ultimately translate into significant impact on the landscape and soil stability.

Some of the major impacts that are likely to arise as indicated in the Environmental Assessment Act in context of hydropower projects include: possibility of being affected by GLOFs, erosion rates and sediment yield; impact on land use, vegetation, protected areas, wildlife, fish species and wetlands, social aspects such as families affected, loss of house and infrastructure, cultural and heritage sites, water use conflicts (presence of water users in dewatered areas), and aesthetics.[45]

Although stringent guidelines and requirements have been set for environmental clearance of any project, these have turned into mere formality and the ground realities are not in sync with what's on paper. With contractors, site engineers and machine operators going about with their business as they see fit, these laws are not being enforced adequately by those responsible for ensuring their enforcement.

Moreover in absence of competent domestic technical capacity, Bhutan has to rely (in large part) on expertise from India for almost every stage of developing a hydropower project - right from conducting the feasibility study, to writing up the detailed project report (DPR), to construction and implementation.

Ensuring that foreign companies adhere to national guidelines and concerns becomes even more challenging than trying to ensure that local companies do the same. Therefore, the concerned agencies need to be extra diligent in the overall development, management and execution phases.

These concerns become even more significant within the context of the accelerated 10,000 MW Plan, and the revised policy of achieving 'electricity for all' by 2013 instead of 2020. Intensive works have been underway towards this accelerated target of 100% rural electrification under the present government. As of 2005, about 40% of rural households were electrified, while more recent figures indicate that about 60% of rural households now have access to electricity. This figure is expected to reach over 84% by 2012, though a mix of both on-grid and off-grid power supplies.[46]

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[45] *Environmental Assessment Act, 2000*. National Environment Commission, RGOB.

[46] *ADB to help Bhutan complete electrification of rural households.* ADB news release, November 2010.

In Bhutan's case, another issue associated with hydropower development is its reliance on labor-intensive technology, and the resultant mass influx of non-native construction workers. This means that additional population pressure is exerted on the surrounding natural resources, especially forests and water.

At the peak of its construction, the Kurichhu Hydropower Project was employing more than 6000 laborers for direct project-related works and another 4500 for the construction of transmission lines. Tala project is estimated to have employed more than 15,000 laborers at the peak of its construction.[47]

These are significant numbers when taken in the context of the country's small population and limited inhabitable space. In view of all of these environmental and social concerns associated with hydropower development in Bhutan, extreme caution and diligence as we move forward in this area cannot be overemphasized.

Finally, at some point in time, it will be necessary for the government to allow greater roles to be played by the domestic private sector in developing our hydropower potential. This will be important not only in terms of giving local firms the opportunity to develop their technical capacity in the long run, but also in terms of diversifying the country's partnership options.

While Indian assistance to date has been instrumental for Bhutan, exploring partnerships with other actors, including other governments and companies from third countries should be very much on the table. Bhutan must not limit itself to partnerships with Indian institutions because it needs to tap into a wider array of technologies and expertise, and also exercise greater autonomy in general.

Encouraging behavioral change for energy demand management

The move towards ensuring energy security will also require public education towards reducing demand for energy, and not just measures to increase supply options. Any long-term strategy should incorporate measures to encourage behavioral change such as using various sources of energy responsibly without wastage; and choosing less environmentally damaging types of fuels for cooking, heating, transport, industrial use, among others.

Currently, awareness on energy conservation and renewable energy choices is very limited in Bhutan. This will have to be addressed through concerted awareness-raising efforts, as well as subsidies or other financial support to

[47] *Biodiversity Action Plan 2009*. Ministry of Agriculture, RGOB.

encourage households, institutions and industries to move towards overall energy efficiency.

Basically, across all energy consuming sectors, the use of sector appropriate energy-efficient appliances, renewable energy sources, and energy efficient buildings can be promoted to help reduce overall energy consumption.

For instance in the residential sector, rural households could be supplied with improved stoves for cooking and heating to reduce fuel wood consumption. In electrified areas, energy efficient lighting systems can be promoted. As a way to replace use of firewood, briquetting plants could be installed in other parts of the country besides Thimphu to produce more briquettes and pellets from sawdust and forest waste.

It would also be worthwhile to introduce energy-efficient housing, especially now as Bhutan is experiencing a construction boom in housing. If done properly, energy consumption for lighting and heating can be reduced. Currently, Bhutanese buildings are generally difficult to heat up during the cold winters, owing to choice of materials as well as poor design. Expertise for developing such buildings can be sought from abroad, while providing training to local builders and architects at the same time.

Similarly, use of energy efficient equipment and technologies can be promoted in the industrial sector with soft loan/tax credit to help cover additional expenses incurred. Its use can also be made mandatory, along with annul energy auditing to help identify under or over utilization of machineries.

At the same time, the government should seriously consider phasing out the use of coal in local industries, thereby eliminating the need to import coal from India. While it will be a much bigger battle to completely stop coal mining operations in the country, given that some of it is exported to India, such difficult choices must ultimately be made if the government is serious about its stated policies of promoting the country's ecological resilience and GNH, and if it is to adhere to its pledge to remain carbon neutral.

In general, subsidizing electricity in the domestic market is necessary for the state to fulfill its social responsibility to the Bhutanese people, especially given its strength in generating hydroelectricity. It has also been crucial to support the growth of the country's industrial base, thus far. However this has meant that inefficiencies in the sector have in part been subsidized by the prevalent low tariffs for electricity.

While the thrust of the tariff policy is to gradually phase out subsidies, the burden to the state is quite high overall. Within this context, proper studies will need to be conducted to assess increases in energy demand and corresponding supply options during the lean season, as more power-intensive industries can be expected to be set up in the country over time.

Initiating major changes in the transport sector

As a way to reduce the growing dependence on imported petroleum fuels and to improve energy efficiency, local authorities could make it mandatory for imported vehicles to be in compliance with the latest European vehicle efficiency norm. Longer term and more effective options could include promoting large-scale use of electric vehicles, and the introduction and operation of a mass transportation system that is efficient.

There is great potential for large-scale use of electric cars given the abundant generation of hydroelectricity in the country. It is apparently twelve times more economical to run such an electric car, costing between 40 to 80 chheltrums per kilometer, as compared to well over Nu. 5 to 6 per kilometer for conventional cars. When charged fully, which takes about eight hours and nine units of electricity, it can run up to 80 kilometers.[48]

Following the initial launch of an electric car by the DOE in June 2009, a few such cars are currently being used by the DOE and DGPC, the idea being to encourage its use among the Bhutanese as a way to reduce dependency on fossil fuels. However, it has not as yet been actively promoted. Also, the car itself is not built to work the steep terrains in the country. It is therefore not meant for uphill and long drives, and its use is limited to town areas.

Of course this does not mean that it cannot be adopted on a wider scale. There are several ways to do this. Starting in the capital Thimphu, where government institutions and luxury vehicles are concentrated, and where traffic is at its worst, policymakers and government offices can choose to lead by example.

At least for local, regular use within Thimphu and nearby places such as Paro where roads are generally not at steep inclines, officials can ride in electric cars. The conventional official cars can then be used only when necessary, such as for longer trips and when the need for bigger vehicles is actually there.

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[48] Some variations in figures have been reported by local media in the country. Ref.: *Electric car for Bhutan.* Kuensel, June 10, 2009; *Electric car is here*. Bhutan Observer, June 5, 2009.

Besides leading by example, the general public can only be encouraged if the proper incentives and conditions are in place. Taking the cue from India where the government offers a subsidy to encourage the use of electric cars, and from Europe where owners of such cars have access to free parking space and High Occupancy Vehicle (HOV) lanes, the Bhutanese government should work out similar measures if it is serious about reducing dependency on oil.

Side by side, if any kind of behavioral change is to be expected from the general population, other options also have to be available. Without an efficient network of public transport system within the country and within localities, it will be an uphill task to get people to forego increasing purchase of individual vehicles. Ever-rising oil prices may to an extent make people think twice, but that alone does not solve the wider concern of having a proper public transportation system in place.

Besides individual electric cars, electric trams and monorails could also be considered for mass transportation in the long run. Other options could be promoting bicycles as a regular mode of transport among the populace, especially in urban areas, as well as walking. These will then require development of exclusive lanes for cycling and pedestrians, as well as an efficient public transportation system for those without private vehicles.

Conclusions

Based on the previous sections, it is clear that climate change is one of the most important issues in terms of Bhutan's energy and environmental security, especially in light of its dependence on hydropower. Since the abundance of its hydro resources cannot always be guaranteed, it must be prepared to deal with the risks associated with GLOFs, deforestation and other environmental disasters.

Mitigation efforts are extremely important for Bhutan, and access to funds from global carbon trading mechanisms must be speeded up. Its contribution to the global environment as a carbon sink must be acknowledged not just through verbal recognition but also through practical means such as support for disaster preparedness and management, among others.

Bhutan has to continue pushing its position on this important issue on the global front. It may be a small and economically insignificant player on the world stage, but together with other developing and/or small countries it must continue to push for legally binding agreements from the major polluters to cut carbon emissions.

With the multilateral process long and drawn out as demonstrated recently by the failure of COP 15 at Copenhagen, Denmark, and only slight progress during COP 16 in Cancun, Mexico, Bhutan has to take more proactive measures because its fast melting glaciers and the variations in temperature and rainfall patterns aren't waiting for a major breakthrough in international commitments.

In the meantime on the home front, Bhutan must continue to maintain its rich forest cover. One way to ensure this is through a policy of compensatory afforestation accompanying any hydropower project development, given that there is high possibility of diverting increasing areas of forests towards creating space for large generation capacity and transmission infrastructure.

With the pursuance of accelerated hydropower development, domestic environmental and social costs must be fully considered. At the same time, there has to be more conscientious effort put into diversifying renewable sources of energy including biomass materials, wind, solar and municipal solid waste, among others.

This is important if we are to reduce our overdependence on hydropower, and also to help fill in electricity shortage in various locations and during lean seasons. Besides electricity generation, the potential of these sources for heating and motor fuel purposes to substitute where possible the use of fuel wood and imported fuels must be properly studied and explored for possible implementation.

At the same time, the available hydroelectricity generated in the country must be used more innovatively and effectively in the transport sector, such as promoting the larger-scale use of electric cars. This is not only an environmentally-friendly option in terms of reducing pollution locally and cutting back on carbon emissions in general, it also offers potential for reducing our dependence on imported petroleum.

Basically, ensuring energy and environmental security of the country requires energy systems to be planned and developed so that externalities associated with developing energy infrastructure are taken into account. It also means that national objectives such as poverty reduction and balanced regional development (both of which require taking into consideration the special needs of remote and rural communities) are adhered to.

This essentially calls for good governance and management of the energy sector. Currently Bhutan lacks not only a focal agency with all the relevant information on various energy sources, but also a focal agency that coordinates and manages all

activities associated with energy. With information scattered across various agencies owing to compartmentalized responsibilities, efficient management of the energy sector as a whole is questionable.

Addressing the many challenges associated with energy security in the country requires an integrated and holistic approach, and in this regard it makes sense to bring all energy sources making up the country's supply mix under the purview of a single agency such as the DOE. This means that the DOE, which should have potential to be upgraded to a full-fledged Ministry of Energy, would have the mandate to look after policies and activities related to hydropower and other renewable energy, as well as import of fossil fuels and general energy conservation strategies.

Ultimately energy and environmental security will depend on changing our very approach to the way we live and do things, not just in Bhutan but in the region and beyond. Behavioral change has to be vigorously encouraged through proper education, as a way to address this demand aspect of ensuring energy and environmental security.

Therefore, policies must focus not only on increasing supply to meet demand, but also give due importance to diversifying renewable energy sources, while promoting the judicious use and conservation of energy. In other words, we need to reassess the way we apply GNH principles, and ask ourselves if the theoretical and the practical really are in sync - in this case in terms of our proclaimed commitment to sustainable development, with the way that development activities are actually taking place on ground.

The less obvious ways that we contribute to rising fossil fuel demand should also be made visible to the public so that people are well informed and in a position to make practical changes in lifestyle to help address this (global) problem. While we may not consume petroleum directly in many instances, we need to increase awareness that almost everything we consume in this day and age has been produced with the intensive use of fossil fuels in industries all over the world.

Packaged food, bottled water, diapers, television sets, you name it - most of the conveniences of our modern lifestyle have been made possible with the ever increasing use of fossil fuels, spurred by the industrial revolution centuries ago. As a renewable energy specialist puts it, if we take a moment to look at the big picture, we can see that our energy problems are part of our larger resource problems,

which represents a moral dilemma that almost no one is addressing.[49]

The fundamental challenge then is to reassess our values and our lifestyles. Although Bhutan consumes far less than others, it is nevertheless well on its way to becoming a consumerist society. Judging by the way that we are importing cars and consuming imported products in the urban centers, we are not that much different from other people elsewhere. This is why the country's guiding principle of GNH becomes even more relevant.

But there has to be drastic improvement in the way that such principles are understood and implemented. Decision makers and implementers, as well as the general public all need to understand and implement the fundamental principles if any kind of long-term change is to take place.

References

1) ADB news release. *ADB to help Bhutan complete electrification of rural households.* November 2010.

2) Bhutan Observer. *Electric car is here*. June 5, 2009.

3) Bhutan Times. *Vehicles Contribution to Air Pollution Unknown.* April 3 2011.

4) Department of Energy, Ministry of Economic Affairs, RGOB. Overview of Energy Policies of Bhutan. 2009.

5) Department of Energy, Ministry of Economic Affairs, RGOB. *Integrated Energy Management Master Plan for Bhutan*. 2010

6) Kuensel. *Electric car for Bhutan.* June 10, 2009

7) Ministry of Agriculture, RGOB. *Bhutan Biodiversity Action Plan 2009*.

8) Morris, Craig. *Energy Switch: Proven Solutions for a Renewable Future.* 2006

9) National Environment Commission, RGOB/B.Tamang. *Hydropower Development in Bhutan: A Background paper for Bhutan's National Environment Strategy.* 1993.

---

[49] *Energy Switch: Proven Solutions for a Renewable Future.* Craig Morris, 2006. [1]HDIP (Hydrocarbon Development Institute of Pakistan), 2005, Pakistan Energy Yearbook 2005; Ministry of Energy & Water Islamic Republic of Afghanistan, Power Sector Strategy for the Afghanistan National Development Strategy 2007; Ministry of Power & Energy, Government of Sri Lanka (www.mope.gov.lk); Ministry of Power, Government of India (www.powermin.nic.in); Nepal Electricity Authority Fiscal Year 2006/07 – A Year in Review; Power Cell, Power Division, Ministry of Power, Energy & Mineral Resources, Government of Bangladesh (http://www.powercell.gov.bd/)

10) National Environment Commission, RGOB/Y.Sharma & C.Norbu. *Erosion due to Roads and Canals in Bhutan: A Background paper for Bhutan's National Environment Strategy.* 1993.

11) National Environment Commission, RGOB/A.P. Sharma. *Environment, Shelter and Energy: A Background paper for Bhutan's National Environment Strategy.* 1993.

12) National Environment Commission, RGOB. *Environmental Assessment Act, 2000.*

13) National Environment Commission, RGOB. *Bhutan National Adaptation Programme of Action*. 2006.

14) National Environment Commission, RGOB. *National Environment Protection Act 2007.*

15) National Environment Commission, RGOB. *Bhutan Environment Outlook 2008.*

16) National Environment Commission, RGOB. *Review of Mainstreaming of Sustainable Land Management in Government Policies and Plans in Bhutan.* October 2008.

17) National Environment Commission, RGOB. *Existing Good Practices of Sustainable Consumption and Production in Bhutan*. 2009-2010.

18) National Statistics Bureau, RGOB. Bhutan at a Glance 2006.

19) National Statistic Bureau, RGOB. Bhutan at a Glance 2010.

20) Royal Government of Bhutan. Bhutan 2020: A Vision for Peace, Prosperity and Happiness. 2000.

21) Royal Government of Bhutan. *The Constitution of the Kingdom of Bhutan*. 2008

22) Royal Government of Bhutan. *Economic Development Policy of the Kingdom of Bhutan, 2010.*

23) Royal Audit Authority, RGOB. *Report on the Mining Operations in Bhutan.* 2007.

24) Royal Monetary Authority of Bhutan. *Annual Report 2009/2010.* Published 2011.

25) SNV/ADB. Report on *Biogas Market Study in Bhutan*. December 2009.

26) Website of the National Environment Commission, RGOB: www.nec.gov.bt

27) Website of Druk Green Corporation: www.drukgreen.bt

28) Website of Bhutan Power Corporation: www.bpc.bt

29) www.guardian.co.uk. *Mekong river hydroelectric dam threatens livelihoods and endangered species in landlocked Laos.* March 2009.

Chapter 3

India: Building Energy and Environmental Linkages

Nitya Nanda

Introduction

Energy security and environmental security are both critical issues for the South Asian region. In both these areas, the countries will be able to handle challenges better if they cooperate rather than going alone. The South Asian region is poorly endowed with energy resources at least for conventional energy sources as it accounts for more than one-fifth of the world population, but its share of global oil reserves is about 0.6 percent and the share of global natural gas reserves is about 1.4 percent only. Its share in global coal reserves is relatively better with about 10 percent but still much lower compared to population. In 2008, the region accounted for about six percent of global energy consumption. In the same year the region's TPES was about 750 Mtoe of which only about 570 Mtoe (75%) was produced in the region. About 28 percent of this energy however came from non-commercial sources like wood, animal waste and other biomass which came almost entirely from within the region. Thus outside dependence of the region for commercial energy was much higher at about 35 percent.

Table 3.1. Energy Indicators in South Asia 2007

Country/ Region	TPES/Pop (toe/capita)	TPES/GDP (toe/thous 2000USD)	TPES/GDP (PPP) (toe/thous 2000USD)	Elect Cons (Kwh/capita)
South Asia	0.50	0.72	0.15	503
OECD Europe	3.35	0.17	0.14	6287
World	1.83	0.30	0.19	2782
Africa	0.67	0.75	0.26	571
Bangladesh	0.17	0.38	0.09	208
India	0.54	0.75	0.14	566
Nepal	0.34	1.34	0.23	90
Pakistan	0.50	0.74	0.21	436
Sri Lanka	0.44	0.37	0.09	409

The issue of energy cooperation in South Asia therefore has to be seen in the context of efficiency of management and use of renewable energy resources. Greater regional cooperation in South Asia in the energy sector particularly in renewable energy, will not only improve the energy security and economic

development in the region but will also reduce the carbon intensity of production and consumption which in turn will help mitigate climate change, one of the major global environmental challenges that we are facing today. Apart from climate change, other major environmental problems of the region are land degradation, deforestation and problems related to water resources. In fact all these environmental problems are related to climate change as well.

Among the environmental problems in the region, the problem of water security can pose the biggest challenge. The South Asian countries (Afghanistan; Bangladesh; Bhutan; India; Maldives; Nepal; Pakistan; Sri Lanka) are home to about one-fourth of the world's population, but only contain about 4.5 per cent (1,945 billion m^3) of the world's annual renewable water resources (43,659 billion m^3). Except for Bhutan and Nepal, the per capita water availability in the region is less than the world average. But even in Nepal, many parts of the country including the capital city of Kathmandu have serious water problems. The percentage of population with sustainable access to improved sanitation facilities in South Asia is 39 per cent (compared to the world average of 59 per cent). Water resources, due to its very nature have serious cross border implications as water passes from country to country and river basins are shared by countries.

Among the energy security issues, this paper will focus on trade of electricity and gas with particular emphasis on hydropower development and development of other renewable energy sources. As far as environmental security is concerned, the paper will focus more on cross-border cooperation and management of water resources though issues like land degradation and deforestation will also be discussed.

Trade in Electricity and Gas

The region generated about 937 trillion-watt hours (TWh) of electricity in 2007. About 86 percent of this was generated in India. However, almost all countries including India, and except Bhutan, have shortage of electric supply. Pakistan also has nominal surplus but considering that a large section of the population does not have access to electricity, such surplus is of little significance. In fact, except in Sri Lanka, access to electricity is quite poor in all countries. Since trade in electricity in the region is quite limited, the production pattern also reflects the consumption pattern across countries. In other words, production patterns and consumption patterns are the same. Consumption patterns, however, by no means are reflective of demand patterns as there could be excess demand in most countries.

Table 3.2. Electricity Generation by Different Sources - 2007 (Trillion Watt-hours)

	Coal	Oil	Gas	Hydro	Other	Total
Afghanistan				1		1
Bangladesh	2		21	1		24
Bhutan				3		3
India	549	33	67	124	30	803
Nepal				3		3
Pakistan		31	33	29		96
Sri Lanka		6		4		10
South Asia	551	70	121	165	30	937

Source: International Energy Agency (IEA) Database

Fossil fuel powers about 79 percent of electricity generation in the region, with coal providing for about 59 percent, though the fuel mix varies from country to country. India depends predominantly on coal while Bangladesh is dependent largely on gas. Pakistan also has significant contribution from gas. Nepal and Bhutan depend almost entirely on hydropower for electricity generation. Pakistan and Sri Lanka get a significant share of electricity from hydropower. Sri Lanka is however the only country in the region which has high dependency on oil as it does not have coal or gas and does not have facilities to import gas.

Table 3.3. Installed Electricity Generation Capacity-2006 (Mega Watt)

	Thermal	Hydro	Other	Total
Afghanistan	377[a]	392		769
Bangladesh	5045[b]	230		5275
Bhutan		978		978
India	88216[c]	34391	14295	136902
Nepal	53[d]	590		643
Pakistan	12423[e]	6494	425	19342
Sri Lanka	658[d]	1772	5	**2435**
Total	106772	44847	14725	166344

[a] Oil/gas-based; [b] Mainly gas-based; [c] Coal-based = 72432, gas-based = 14582 and oil-based = 1202; [d] mainly oil-based; [e] coal-based = 150 and gas/oil-based = 12273.

Source: Compiled/estimated from various sources[1]

[1] HDIP (Hydrocarbon Development Institute of Pakistan), 2005, Pakistan Energy Yearbook 2005; Ministry of Energy & Water Islamic Republic of Afghanistan, Power Sector Strategy for the Afghanistan National Development Strategy 2007; Ministry of Power & Energy, Government of Sri Lanka (www.mope.gov.lk); Ministry of Power, Government of India (www.powermin.nic.in); Nepal Electricity Authority Fiscal Year 2006/07 – A Year in Review; Power Cell, Power Division, Ministry of Power, Energy & Mineral Resources, Government of Bangladesh (http://www.powercell.gov.bd/

Since the region is not well endowed with fossil fuel reserves, harnessing of hydroelectric potential is of crucial significance. Fortunately, the region is far better endowed in terms of hydroelectric potential. Globally, the potential of hydroelectricity generation is about 13000 TWh per year, of which about 1083 TWh (about eight percent) is in South Asia. In 2007, the region utilised just about 15 percent of this potential. South Asia has, however, been able to create an installed hydroelectric capacity of 44847MW which is just about 10.3 percent of the potential capacity (Table 3.4).

Table 3.4. Potential and Actual Hydropower Generation in South Asia

	Potential Capacity '000MW	**Installed Capacity (2006) '000MW**	**Annual Generation Potential TWh/Yr**	**Actual Generation (2007) TWh/Yr**
Afghanistan	18.4	0.39	55	1
Bangladesh	0.78	0.23	2	1
Bhutan	30	0.98	70	3
India	301	34.39	660	124
Nepal	44	0.59	158	3
Pakistan	40	6.49	130	29
Sri Lanka	2	1.77	8	4
South Asia	436.175	44.85	1083	165

Source: HDIP (Hydrocarbon Development Institute of Pakistan), 2005, Pakistan Energy Yearbook 2005; SARI/Energy Program, 'Regional Energy Security For South Asia: Regional Report', Energy For South Asia, cited in Bishal Thapa, Amit Sharma and Rashika Gupta (2007) 'Prospects for energy integration', *Himal South Asian* April 2007

Among the South Asian countries, Sri Lanka has almost exhausted its potential hydroelectric capacity. The potential capacity in Bangladesh is quite low and almost exhausted. Hence, much of the additional capacity would come from other countries, with the largest share coming from India. But, tapping unutilised potential would be relatively easier in Nepal, Bhutan and Afghanistan as their current utilisation levels are very low with greater capacity of picking up the low hanging fruits. Incidentally, these are also the countries in the region that can generate surplus electricity only through hydropower. For example, the current installed capacity in Bhutan is about 1000 MW as against the potential of about 30000 MW of electricity. Yet, Bhutan is the only country in the region to have substantial surplus in capacity and generation.

India has almost half of the potential hydroelectric capacity of the region, yet the total potential cannot even satisfy the current level of demand in the country.

Pakistan is in a better situation but its potential is not enough to satisfy its demand in the long run. Thus, it appears that Afghanistan, Bhutan and Nepal can have substantial surplus electricity generated from hydropower alone that can be exported to other countries in the region.

The potential capacities in Afghanistan, Bhutan and Nepal cannot be utilised without outside support. Bhutan today has substantial surplus capacity that has been developed largely with outside support, particularly from India. Hydropower contributes more than 13 percent to GDP and about 80 percent in export earnings. It also brings almost half of the government revenue and funds critical for improvement in health and education. The Bhutanese success story can easily be replicated in Nepal though they need follow the exactly same model.

Seasonality in power supply and demand in a year as well as variations in demand within a day can also be the source of complementarity and cooperation across South Asian countries. Inability to match supply and demand can lead to major losses. This can be particularly difficult in a country where the climatic conditions remain similar in the entire country. For instance, in Bangladesh sizable generation capacities to the tune of 1200 MW remain unutilised during the off-peak hours though the country faces shortage of power during the peak hours. This available capacity can be a ready source for regional cooperation for import-export of electricity from neighbouring countries (Nanda and Goswami 2008). India, by virtue of being a large country, can manage such fluctuations better. Nevertheless, there exists clear seasonality in power generation, particularly in hydel power generation. The peak months for hydro-power generation are August-September while the lean remain from January to June.

In Nepal and Bhutan, the peak demand is usually during December-January and is minimal during the months of August and September. During the months of peak demand, generation from hydro power-plants is relatively low. The supply capacity in turn is maximum during the wet months of August and September. This seasonality mismatch in energy supply and demand is where the complementarity in cross border power trade emerges. It is during the hot summer months, the Indian system is starved of energy and capacity. Though the peak season starts in May, it continues till August and September thus overlapping with the peak generation and lean demand season in Nepal and Bhutan. Indian thermal plants generation has been mostly designed to match and balance the lean dry months created by the hydel plants in winter and the pre-monsoon season but the same can be designed to account for fluctuations in Nepal and Bhutan as well.

An integrated regional electricity grid with trading arrangements among the countries can improve efficiency in the entire region. Even if most countries in the region have excess demand in electricity, there can still be trade on it. Trade occurs even in such situation because it reduces the distance between the points of production and consumption, and thereby reduces transmission losses. This is the reason that several countries including the US, Canada, France, Germany and Switzerland are all among the top exporters as well as importers of electricity. South Asia, where transmission and distribution losses of electricity are among the highest in the world will do well to take a regional cooperation approach. Needless to say that such an approach will not only help climate change mitigation but also be of immense economic sense in an energy-starved region like South Asia.

There have been negotiations between India and Pakistan on the possibility of a gas pipeline from Iran and the Central Asian countries passing through Pakistan though the one from Iran is on hold for now. There has also been some progress on cross-border infrastructure projects – such as the memorandum of understanding (MOU) recently signed for transmission lines between India and Nepal, and the agreement for an interconnecting submarine electricity cable between Sri Lanka and India. Recently there has been an agreement between India and Bangladesh for export of electricity from India to Bangladesh. All of these point to the great potential of a regional collaboration on energy. Such collaboration can be a win-win situation for all. India, with its growing energy needs will benefit not only in terms of greater energy security in absolute sense but also get energy that will be cleaner and will help it address its climate change mitigation concerns. For exporting countries, it will mean substantial revenue that will be used for development purposes. As of now, Nepal maintains substantial trade deficits both globally and with India. Like Bhutan, development of hydroelectricity can turn it from a trade deficit country to a trade surplus country.

The region is poorly endowed with reserves of natural gas and no country in the region has any substantial surplus. Hence, trade in natural gas would be limited within the region. However, the real benefit in this sector will accrue from a region wide integrated gas pipeline network. As of now, only India imports Liquefied Natural Gas (LNG) in limited quantity. There is no other trade in natural gas within the region or with outside countries as there are no gas pipelines and no other country has LNG processing infrastructure. However, Pakistan is in the process of building up LNG import facilities, which may become operational very soon. Both India and Pakistan have been exploring the possibility of importing

natural gas through cross-border pipelines. However, no concrete progress has been made in this regard.

A region wide gas pipeline network will connect the entire region to Iran, Myanmar and even Central Asia as Afghanistan is also a member of SAARC. Import of LNG is not only more expensive, it also needs substantial investment in LNG import facilities. As of now Nepal and Bhutan are not using natural gas but they might find it difficult to ignore this option in the future. Though both have substantial hydro-electric capabilities, they might like to have gas as cleaner fuel to run vehicles and for other uses. Connecting Sri Lanka with India through gas pipelines will not be difficult. Enabling Sri Lanka to use gas for electricity generation as well as fuelling vehicles will be helpful to it both in terms of cost as well as reduction of carbon emission as it is using oil for electricity generation as well. India's difficulties as well as apprehensions in getting gas pipelines through Pakistan and Bangladesh may get mitigated to some extent if it looks for a regional network including Sri Lanka, Nepal and Bhutan rather than bilateral arrangements with them.

Biomass and Renewable Energy

Biomass based energy contributes about nine percent to global energy consumption and yet it is the primary source of energy for about 2.5 billion people across the world. In South Asia its share is about 38 percent and is the primary source of energy to a majority of the rural population. Biomass can deliver energy in all forms; solid, gas and liquid, and can be converted to electricity, heat and mechanical power. This source of energy can thus play an important role in promoting energy security, poverty reduction and can have positive environmental effects in terms of restoration of degraded land, water retention etc. However, the way such energy is used in most South Asian rural households is not only inefficient as much of the energy generated is wasted but is also hazardous to health. The problem can be taken care of to a large extent if gasification technology is used which can give advantages of fossil fuel at much lower costs.

Though this source is getting stretched due to increasing energy demand in rural areas, it will be easily available in significant quantity and may remain the most economic feasible alternative in rural and remote areas. Though once this was the major source of energy everywhere, developed countries abandoned this source in favour of fossil fuel, in the process of development. However, India has worked to make this source more efficient and cleaner. Today, India is the pioneer in the field particularly in biogas, gassifier and cook stoves. However, there is significant

scope for further improvement in technology in this area. India can share this technology with its neighbours, which will be useful for them both in terms of raising efficiency as well as reducing carbon emission. Regional cooperation can also be useful in promoting research for further development of this technology.

South Asia has a reasonably good potential in renewable energy like solar and wind power. Interestingly, Bhutan and Nepal which have relatively higher potential in hydropower, have lower potentials in solar and wind power. The potential for wind power in South Asia is estimated to be in the range of 150000-200000 MW mainly in India, Pakistan and Sri Lanka.[2] Only a fraction of this is being utilised now mostly in India. The installed wind power capacity in India is now about 7000 MW, the highest in Asia. India has also developed good manufacturing capability in wind power generators and exports these to several countries.

Similarly, South Asia has huge potential for solar energy which is estimated to be more than 300000 MW.[3] Apart from India, Pakistan, Afghanistan and Nepal have good potential. But the current utilisation is extremely low. Here also, India is much ahead of its neighbours in solar power generation, and development in solar power technology and products. It has a strong manufacturing base for modules/systems and increasingly SPV cells. India is, in fact, one of the pioneers in solar thermal products. Indian box-type solar cookers are considered to be the best in the world and solar water heaters, absorbers and coolers are also of global quality. It has also developed solar harvest processing and water pumping systems, appropriate for Indian use but suitable for other countries in the region as well. Other South Asian countries can benefit by collaborating with India on such technologies. Moreover, development of these technologies, and their use in the country has been greatly facilitated by appropriate policy measures. This is another area where countries in the region can benefit by sharing experiences with each other.

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[2] Alternative Energy Development Board, Government of Pakistan (http://www.aedb.org/currentstat_solarthermal.php); Asia Cleantech (http://asiacleantech.wordpress.com); Ministry of New and Renewable Energy of India (http://mnes.nic.in); Schillings, Christoph, Richard Meyer and Franz Trieb (2004), Solar and Wind Energy Resource Assessment (SWERA), High Resolution Solar Radiation Assessment for Nepal Project, Paris: UNEP/GEF; United Nations Environment Programme

(http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=430&ArticleID=4771&l=en

[3] Alternative Energy Development Board, Government of Pakistan (http://www.aedb.org/currentstat_solarthermal.php); Asia Cleantech (http://asiacleantech.wordpress.com); Ministry of New and Renewable Energy of India (http://mnes.nic.in); Schillings, Christoph, Richard Meyer and Franz Trieb (2004), Solar and Wind Energy Resource Assessment (SWERA), High Resolution Solar Radiation Assessment for Nepal Project, Paris: UNEP/GEF; United Nations Environment Programme

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Land Degradation and Deforestation in South Asia

The region occupies 4.8 percent of the world's total land mass and houses more than 20% of the global population. A majority of the population (around 60 percent of the labour force) depends upon agriculture for its subsistence, which is reflected by the fact that south Asia has the largest area under crops amongst the five sub-regions of Asia and the pacific. Naturally, increasing population, improving GDP rates and growing urbanization are creating immense pressure on the limited land resource in south Asia. About 16.6 % of the total regional land mass (around 4.8 million sq kilometers) has been degraded. Almost half of the population has been affected by the degradation of land in Bhutan, Bangladesh and Nepal. The primary reasons are the unsustainable land use and inappropriate land management practices pushed by underlying factors such as expanding population, poverty and dependency on natural resources for livelihoods, institutional and policy failures. The situation has been further aggravated by climate change and natural disasters.

Table 3.5. Land Degradation in South Asia

Country	% Territory affected	% total population affected	Afftected people
Afghanistan	1.17	2.56	671770
Bangladesh	47.52	49.12	72728775
Bhutan	57.47	54.99	1334662
India	18.02	16.50	177437809
Nepal	38.85	48.93	13332932
Pakistan	2.57	3.58	5838072
Sri Lanka	32.09	25.62	4788637

Source: Bai et al (2008)

Poor agricultural practices such as the overuse of agrochemicals have contributed in rendering soil progressively infertile. Humus loss reduces the ability of the soil to retain water, speeding precipitation runoff, increasing the probability of flooding and water erosion. South Asian agriculture is quite heavily dependent on irrigation. Over extraction of water for agriculture may render the land in the downstream saline. Pakistan has been impacted the most because of salinity. Around 9% of its total land mass has been rendered saline. India and Bangladesh have around 1% and .8 % of their land mass respectively impacted due to salinity. The increase in irrigation may also lead to water logging which affects erosion by washing away the topsoil and micronutrients.

Apart from the agricultural practices, increasing industrial activities and deforestation have impacted the land quality in a negative way. Deforestation is a major cause of degrading land quality. Table 6 shows the percentage land area covered by forests in the south Asian nations. Pakistan, Sri Lanka, Nepal and Bangladesh are losing out land under forests due to clearing of forestlands for shifting cultivation; permanent agriculture or settlements; fuel requirement for domestic combustion; timber for construction and furniture; and development of roads. Bhutan is the only country in the region, which is doing exceptionally well at this front India has been making progress in improving its forest cover by implementing proactive forestation and reforestation campaigns.

Table 3.6. Percentage of land area covered by forests in South Asia

	1990	**1995**	**2000**	**2005**	**2008**
Afghanistan	2.07%	2.07%	2.07%	2.07%	2.07%
Bangladesh	11.48%	11.38%	11.28%	11.18%	11.12%
Bhutan	64.57%	77.05%	78.37%	83.22%	84.06%
India	21.51%	21.75%	21.99%	22.77%	22.92%
Maldives	3.00%	3.00%	3.00%	3.00%	3.00%
Nepal	33.69%	30.48%	27.21%	25.36%	25.36%
Pakistan	3.28%	3.01%	2.74%	2.47%	2.30%
Sri Lanka	37.47%	35.34%	33.20%	30.82%	30.13

Source: FAOSTAT

To deal with the problem of land degradation deforestation, a regional approach may be helpful by making advancement in agricultural research, technology and extension services. Emphasis should be laid on improving rural infrastructure and joint strategies should be chalked out to stall rural-urban migration. Water resources management should be looked in conjunction with land management. Countries which are doing well in improving their forests such as Bhutan and India should share their knowledge and experience with the neighbours. Regional cooperation should be forged on improved tools and techniques of assessment and data management, setting standards for monitoring, and information sharing on good land-management practices. Other areas of cooperation could be measures such as development and implementation of national land use policies, integrated watershed management, integrated coastal area and river basin management.

Challenges in Water Resources

Water security is directly linked to water scarcity. The major factors responsible for this problem are population growth, urbanization, infrastructure development, decreased water quality, climatic changes and variability, extreme events, and

over exploitation of water resources. Regional water security is surrounded by many problems and all the problems are inter connected, i.e. climate, water, agriculture and energy and all these problems cannot be solved individually and with a single strategy. The absence of water security and declining water availability leads to consequences that include increasing competition over water resources, migration of people to cities and international conflicts over rivers crossing boundaries.

Water scarcity is already visible in the South Asian region. Some of indicators of water scarcity are groundwater decline and disappearance of water bodies. Ground water levels are falling in several regions of the world, including in the Punjab, which is the breadbasket of India and Pakistan (Kumar, 2003). Table 1 presents the water resources situation of South Asian countries with respect to region and world. It showed the great variability in the water resource availability, withdrawal and per capita water resources. It also shows that agriculture is the main water use sector in the south Asian region as compared to the world situation.

Table 3.7. Water resources availability and sectoral withdrawal

Regions	**Total annual internal renewable water resources (BCM)**	**Total annual water with-drawal (BCM)**	**Per capita internal renewable water respurces (m^3)**	**Sector wise withdrawal**		
				Agri-culture (%)	Domestic (%)	Indus-try (%)
World	40856	3017	7744	69	9	22
South Asia	4895	569	4236	94	2	3
East-Asia & Pacific	7915	631	5009	86	6	8
South Asia Countries						
Afghanistan	55	23.3	2503	98	2	0
Bangladesh	105	79.4	7934	96	3	1
India	1261	645.8	1729	87	8	6
Nepal	198	10.2	7996	97	3	1
Pakistan	52.4	169.4	1382	96	2	2
Sri Lanka	50	12.6	2582	95	2	3

Source: (Compiled from UNEP 2008 & World Bank)

Melting of glaciers in Himalayas leads to floods and landslides, which will affect water resources in the coming decades badly. The water available is not sufficient for agricultural activities and for satisfying hunger and poverty in this region and also the increasing population is more than the capability for sustainable use of natural resources. The shift of water use from one sector to another will also develop pressure on other sectors.

Degradation of water quality could be another cause of decreasing water availability as fresh water bodies have a limited capacity to self clean given the expanding pollution from urban, industrial and agriculture uses. Rise in water temperature due to climate change may lead to increase in microbial populations, which can have a negative impact on human health. Additionally, the rise in water temperature adversely affects the different organisms of the ecosystem due to a species' sensitivity to temperature. The water scarcity and quality problems also have direct influence on the natural environment and human health (increase in water borne diseases) and a secondary impact on agricultural productivity as well. Considering these situation and issues, water availability, its use and allocation have not received the proper attention it deserves in the relevant fora.

Trans-boundary Water Basins in South Asia

The Hindu Kush- Himalayan region (HKH) is amongst the largest storehouses of fresh water in the world and constitutes the primary source of water for about 500 million people in South Asia. However, availability of clean water remains one of the key issues for the region. The three major trans-boundary river basins include the Ganges-Brahmaputra-Meghna(GBM) river basin, the Indus river basin and the Helmand river basin (Afghanistan, Iran and Pakistan). The Ganges-Brahmaputra-Meghna (GBM) river system, which flows through the northern, eastern and northeastern parts of India, covers an area of about 1.63 million km2 stretching across Bangladesh, India, Nepal, Bhutan and China. The Indus River system flows mainly through Pakistan and India but a small part of China and Afghanistan are also touched by the system. The Indus river system is the largest, contiguous irrigation system in the world with a command area of 20 million hectares and an annual irrigation capacity of over 12 million hectares. The shares of different nations in the transboundary basins of the region are provided in Table 3.8.

Table 3.8. Share of south Asian Nations in major river basins in the region

Basin Name	Total area of basin (sq km)	Country	Area of basin (sq km)	Area of basin (%)
Ganges Brahmaputra Meghna	1,634,900	India China Nepal Bangladesh Bhutan Myanmar	1016700 321300 147400 107100 39900 80	62.19 19.65 9.01 6.55 2.44 0.00
Indus	1,138,800	Pakistan India China Afghanistan Nepal	597700 392800 76200 72100 10	52.48 34.49 6.69 6.33 0.00
Helmand	353,500	Afghanistan Iran Pakistan	288,200 54,900 10,400	81.53 15.52 2.95

Source: Asia: International River Basin register

Table 3.9 provides some indicators to assess the water security situations in the GBM, Indus and Helmand river basins. As can be seen, the Indus basin is the most water scarce region as the per capita availability is only 1329 cubic metre which is far lower than 1700 level, the generally accepted minimum level of per capita water requirement proposed by Falkenmark and Widstrand (1992). This includes both surface and ground water.

Table 3.9. Indicators for water resources for the GBM, Indus and Helmand basins

Indicators	GBM Basin	Indus Basin	Helmand Basin
Available water resources (m^3. per capita)	3473	1329	2589
Total water use (billion m^3 per year)	304	257	9
Per capita water use (m^3)	521	1190	1295
Total water resources (billion m^3 per year)	2025	287	18
Utilization Ratio (%)	15	90	50
Access to Improved Source of Drinking Water (AISDW) (percent of population)	83	87	43
Access to Improved Sanitation Facility (AISF) (percent of population)	40.0	51.8	39
Wastewater volume (billion m3 per year)	92.0	54.7	2.8
Waste water discharge ratio (%)	4.5	19.1	15.5
Forest cover (percent of basin area)	20.0	39.1	40

Source: Compiled from MS Babel, S M Wahid 2008

The annual per capita water availability for the GBM basin is almost double the threshold level. In the Helmand basin too water availability is much higher than the Indus basin which is 2589 cubic metre. However, in the GBM basin, the available water resources are unevenly distributed and primarily fed by monsoon. Precipitation is higher for the Brahmaputra-Meghna basin (5000-10000 mm per year) than the Ganga basin (500-1000 mm per year). This situation results in flooding of the foothills of Nepal and the lower Gangetic plains of India and Bangladesh, as well as severe water shortages in parts of India and Bangladesh.

The water utilization ratio measuring the percentage of total water available that is used is also extremely high at 90 in the Indus basin compared to 15 in the GBM basin and 50 in the Helmand basin. This shows the high level of development pressure in the Indus basin region and almost no scope for further development. As a matter of fact in a large part of the basin, ground water is over exploited. This development pressure is primarily being exerted by the agricultural activities in the eastern parts of the basin shared by Pakistan and India. Pakistan accounts for about 60% of the total water use followed by India, which uses about 38% of the resource. Access to improved drinking water sources, however, is better in the Indus Basin compared to the other two basins. Similarly, the Indus basin is also much ahead in terms of access to improved sanitation facilities.

Development pressure on water resources often also stress the ecological balance in a basin. Increasing population and economic development along with changing lifestyles can lead to increased pollution which further aggravates the pressure on available water resources. One indicator for this is the discharge of waste water into fresh water sources. In the Indus basin this alarmingly high as the annual volume of wastewater discharged into the Indus river system account for about 20 percent of the total annual available water resources. The threshold for this is considered to be 15 percent. In the GBM basin it is much lower than the threshold level but in the Helmand basin, it is also at a high level of 15.5 percent. The Indus basin however does much better than the GBM in terms of forest cover which increases the capacity of a river basin to preserve natural ecosystems. The Helmand basin does almost equally well. Thus all the three basins have serious ecological problems though the natures of the problems are different.

The GDP produced per unit of water use in the GBM basin is US$ 3.47 while that in the Indus Basin is US$ 3.34, though per capita water use in Indus basin is much higher. But overall, the water use efficiencies in terms of GDP per unit of water use in the region are very low at US$1.4 per cubic metre, compared to the global average of about US$ 8.6 and average of the five top food producers in the world

(Brazil; China; France; Mexico; USA) at US$ 23.8 (Babel and Wahid, 2008). These figures, however, should be used with caution as this kind estimate is not perfect not just because it does not consider purchasing power parity but also the fact that "water need" is different in different agro-climatic zones due to various factors not linked to efficiency in water resource use or management.

Trans-boundary Water Resources Issues for South Asia

The major problem South Asian countries face is of varying rainfall that causes floods and droughts, ultimately leading to social problems such as deaths, and environmental problems such as melting glaciers, soil erosion, decreasing ground water, pollution and creating trans-boundary issues. The major water related challenges in South Asia include - increasing demands on available water from development activities; the intrusion of salinity into inland water systems; the spread of waterborne diseases related to the extensive embankment of waterbodies; water pollution due to urbanization and industrialisation; decline in fisheries catch due to human interventions; and excessive logging. With increasing water scarcity and climate abberations such as floods and droughts, awareness is arising between cross-border utilization and management of water. Yet the approach of South Asian nations has been to look at the water flowing at the border rather than integrated management of resources. As a result, efforts to deal with transboundary water management has been bilateral rather than regional or multilateral. The scope for such cross-border management of water is much lower in the Helmand basin as more than 80 percent area of the basin falls in Afghanistan, and Pakistan shares only about three percent of the area.

Since South Asian nations tend to see cross-border water management to be a bilateral issue, countries have problems of water sharing with their neighbours (Afghanistan being an exception which shares border with Pakistan but not with India). As other countries do not share borders with each other, India being the common factor has disputes with its neighbours. India's water relations with Pakistan are governed by the Indus Water Treaty of 1960 which is often regarded as a success story as it survived worst of relations including full fledged wars between the two countries. While India believes that it has lived up to the Treaty which itself has been very generous towards Pakistan, Pakistan has time and again raised issues including with com-consumptive use of water. Given, the precarious water situation in the Indus basin which includes almost the entire country, Pakistan's apprehension is understandable, blind opposition to any Indian initiative may not help. For instance, Pakistan raised serious objections on the design of the Salal dam on Chenab in the late seventies. This not only delayed the project but also forced India to make certain design changes which has resulted in silting of its reservoir

not only jeopardising its intended performance but also put people of both India and Pakistan at risk. It may be noted that when the Treaty was signed the concern of silting was not so well known.

Water has been a major issue in India- Bangladesh relations, particularly in the context of Ganges water. The two countries signed the Ganges Water Treaty in 1996 and arrived at a mutually acceptable solution on the sharing of the water; but many other issues remain unresolved. Bangladesh remains apprehensive about India's intentions with regard to several other issues such as the sharing of the Teesta waters, India's plans for the interlinking of the rivers and the construction of the Tipaimukh dam. India and Nepal have a long history of water cooperation and have signed several water sharing treaties like the Gandak (1957), Kosi (1962), and the Mahakali (1997). The Mahakali Treaty (1997), a comprehensive document on water cooperation, yet water cooperation between the two countries remains a distant dream. The breach of the Kosi embankment and the devastating floods it caused in India and Nepal in 2008 has only highlighted the importance of such cooperation. India Bhutan cooperation on water resources is often cited as a model, particularly in the context of India-Nepal water relations, but Nepal does not seem to be impressed. India-Bhutan hydro-power cooperation has made Bhutan a power-surplus state, which earned huge amount of money by selling electricity to India which has helped its all round development, while Nepal remains a net importer of electricity from India and hugely power-starved despite its massive potential. It may be noted that India-Bhutan cooperation is limited to development of hydropower only rather than integrated management of water resources.

South Asia's water security and management of water resources cannot be addressed without the involvement of China. Though China's share in the Indus basin is not very high, its share in the GBM basin is quite significant. More importantly the Tibet region of China is the source for some major rivers in both the basins. Some estimates suggest that roughly 354 BCM of water flows from Tibet into India, of which 131 BCM is accounted in the Brahmaputra (IDSA 2010). Interestingly, the Chinese territories, falling in these two basins are largely uninhabited. Chinese plans for two hydro-projects: Zhikong on Lhasa river (which is one of the five tributaries of the Yarlung-Tsangpo (Brahmaputra), and Shiquanhe which is the upper reach of the Indus in the Ngari Prefecture have already raised concerns. It also has long-term plan to build more dams and hydro-projects on the Indus, Sutlej and Yarlung-Tsangpo. More importantly, there are widespread fears that China's diversion of waters of the Brahmaputra will cause hydrological imbalances in the northeast part of India which in turn will impact Bangladesh.

Trans-boundary water resources management

The possibility of two or more riparian countries working in cooperative, project-based water development activities in the GBM and Indus Basins were endorsed by South Asian Association for Regional Cooperation (SAARC) summit in 1997 and 1998. Moreover, the impact of climate change on water resources is recognized now and hence the focus on climate change in the 15th SAARC Summit held in April 2010 in Thimpu was a welcome development with regard to water cooperation. However, bilateral disputes on water and other issues as well as the lack of long term vision have affected actual cooperation. Transboundary management issues can be broadly divided into three categories: (i) sharing of river waters; (ii) cooperative development of water resources, and (iii) sharing of data and information on common rivers to facilitate flood forecasting and water quality control. South Asian countries have mostly been concerned with the first, and to some extent, on the third, and ignored the second issue altogether except in a limited sense in the India-Nepal context.

India intends to divert water from the Brahmaputra into the Ganga basin to tackle droughts during the dry seasons and avoid floods during the monsoons but Bangladesh opposes it. Bangladesh wants to share water multilaterally over time by involving Nepal, whereas India wanted to bilaterally share water with Bangladesh over space. Nepal is looking forward to tap the hydropower potential and the development of water resources for other benefits. But it does not have its own financial resources for doing so and it is not sure of how and on what terms to engage India. Pakistan and Bangladesh have been always concerned about Indian activities on water resources but have not shown such interest in activities by China which can also affect them. India however has recently shown interest in multilateral cooperation particularly in the context of Chinese activities in the Tibetan region.

These conflicting interests must be resolved by adopting an integrated approach towards the management of trans-boundary water resources for the maximum benefit for all basin stakeholders. There are several regional models all over the world. But the Mekong river model can be a template for South Asia. Mekong River Cooperation was promoted by four countries: Thailand, Lao PDR, Cambodia and Vietnam, with Myanmar and China as dialogue partners. Similarly, there could be Indus and GBM commissions with the relevant South Asian countries with China as a dialogue partner.

Conclusions

It is quite clear that there is much to gain from regional cooperation on energy in South Asia. Nevertheless, there has not been much progress on the issue. India has also been unable to access natural gas from Myanmar through pipelines via Bangladesh due to undue emphasis on political issues. However, Bangladesh can possibly benefit most from regional cooperation on energy. Some recent developments are however encouraging. Integration of energy markets at the regional level in South Asia can help the region access energy from outside the region particularly in West Asia, Central Asia and Myanmar apart from taking advantage of promoting efficiency in production, distribution and use of energy.

What is hindering energy cooperation in South Asia is the lack of mutual trust, political issues and the perceived dominance of India by the other countries in the region rather than resistance by powerful economic interest groups in the individual countries. The 14th SAARC summit has brought new hope for energy cooperation within the region. India has unilaterally declared duty free access to imports from Least Developing Countries (LDCs) in the region. This can act as a confidence building measure. The 14th SAARC summit has also talked about energy cooperation at the sub-national levels which can be the building bloc for greater region-wide energy cooperation in South Asia.

As far as environmental cooperation is concerned, there have been several initiatives in the region. The South Asia Co-operative Environment Programme (SACEP) is an inter-governmental organization, established in 1982 by the governments of South Asia to promote and support protection, management and enhancement of the environment in the region. Under SAARC, a Meteorogical Research Centre in Dhaka, a Coastal Zone Management Centre in Male, a Disaster Management Centre in Dhaka and a Forestry Centre in Thimphu has been established. At the 16th summit of SAARC countries in April 2010, Statement on Climate Change was adopted with a view to make South Asia a world leader in low-carbon technologies and renewable energy.

However, there is need for more actions on the ground. An ecosystem-centric approach to management of land, water and forest resources is required. Integrated approaches to water resource management including management of hydropower resources are the most crucial subset. Water Management efficiencies especially in the domain of agricultural usage must be improved. Increased investment should be made in water resource development and use. Poor ecological health in the basins calls for the provision of a desired balance of water allocation between human and nature's needs. Co-operative, basin level water resources development

is essential. Transboundary development and management of water resources including regional data collection and monitoring networks, river basin organizations, and arrangements for dispute settlements, and sharing of knowledge on climate change, vulnerability and adaptation responses, and water use efficiencies can go a long way in dealing with water security issues in the region.

There is a need for an integrated approach from all stakeholders to make an effort to solve the problem. Management of biodiversity, sharing of traditional knowledge, organic farming practices and cooperation in adaptation to climate change, including in the area of technology would be important. Cooperation in management of risks and disasters will be the most important part in dealing with environmental security particularly for the smaller countries and poorer people in the region.

References

1. Babel, M. S., and Wahid, S. M., 2008. *Fresh Water under threat: South Asia:* Vulnerability Assessment of Freshwater Resources to Environmental Change. United Nations Environment Programme (UNEP), 2008. [Online]. Available at:
2. http://www.roap.unep.org/pub/southasia_report.pdf [accessed 21 March 2011]
3. Bai, Z G, Dent D L, Olsson L and Schaepman M E (2008). *Global assessment of land degradation and improvement. 1. Identification by remote sensing. Report 2008/0,* ISRIC – World Soil Information, Wageningen
4. Falkenmark**,** M and C Widstrand**.** 1992**.** "Population and Water Resources: a Delicate Balance." Population Bulletin 47.3: 1-36; United Nations Population Division.
5. FAOSTAT Online Statistical Service. Food and Agriculture Organization of the United Nations (FAO). http://faostat.fao.org.
6. IDSA (Institute for Defence Studies and Analysis), 2010, *Water Security for India: The External Dynamics*, IDSA Task Force Report, IDSA, New Delhi.
7. Kumar, C. P., 2003. *Fresh Water Resources: A Perspective.* [Online]. Available at:
8. http://www.angelfire.com/bc/nihhrrc/documents/fresh.html [accessed 25 Feb 2011]
9. Nanda, Nitya and Anandajit Goswami (2008), "Energy Cooperation in South Asia: Prospects and Challenges", in *Man and Development*, 30(1), pp109-120
10. Sharma, B. R., and Sharma, D., 2008. *Impact of Climate Change on Water*

Resources and Glacier Melt and Potential Adaptations for Indian Agriculture. International Water Management Institute, New Delhi

11. Thapa, Bishal, Amit Sharma and Rashika Gupta (2007) 'Prospects for energy integration', *Himal South Asian* April 2007.
12. UNEP (2008), *Vital Water Graphics-An Overview of the State of the World's Fresh and Marine Waters. 2nd Edition.* Nairobi: UNEP.
13. UN-Water, n.d. *Climate change adaptation: The pivotal role of Water.* [Online]. Available at:
14. http://www.unwater.org/downloads/unw_ccpol_web.pdf [accessed 21 March 2011]
15. World Bank, 2008. *World Development Report*, New York

Chapter 4

Nepal: Energy Woes and Environmental Concerns

Dr. Nishchal N. Pandey

Introduction

Nepal possesses 83 thousand mega watts of un-harnessed hydropower potential half of which is economically feasible. But the current status is less than 650 MW. The government has recently set a goal to achieve 10 thousand MW by 2020. Achieving this lofty target requires huge foreign investment, market surety, political stability and the ability of the state to make hydro-power and environment security issues of national consensus rather than a politically divisive one. Currently reeling under 14 hours of power shortage during winter and occasionally having to face shortage of cooking gas and petroleum products, Nepal is vulnerable as far as energy security is concerned. On the environment front too, fragile eco-system of the Himalayas, melting of the glaciers, deforestation, land degradation, water pollution, noise and air pollution in the cities and soil erosion are some of the major issues. According to estimates, forest cover declined from 45 to 29 percent of the total land area from 1966-2000. Main causes of deforestation include population growth, high fuel-wood consumption, infrastructure projects, and conversion of forests into grazing- and cropland. According to government estimates, 1.5 million tons of soil nutrients are lost annually, and by 2002 approximately 5 percent of agricultural holdings had been rendered uncultivable as a result of soil erosion and flooding. This paper will delve into these two crucial issues and offers some suggestions for a regional mechanism to tackle both these challenges as both energy and the environment have cross-border importance and significance.

What Constitutes Energy Security for Nepal?

As mentioned earlier, Nepal's energy woes is primarily manifested by the huge gap between electricity produced and energy consumed. Due to the technical deficiencies and bilateral tribulations with India as regards to the Koshi and Gandak projects initiated in the 50s, there has also been much politicization over the issue. Various political parties have framed divergent policies as regards to energy issue. The Mahakali Treaty signed with India in 1996 was passed by a two-third majority of the parliament but the main opposition CPN (UML) split over the issue. Today, the situation has become so adverse that FDI is affected and even hotels and industries have been impacted by the power cuts. The concerned

departments and agencies are themselves not sure on how to attract foreign investment in this sector and how to develop hydro power potential in a sustainable way to meet the domestic demand as well as export it to India, perhaps also to Bangladesh. There are estimates that Nepal needs roughly One trillion rupees to fulfill the objective of harnessing 10 thousand mega watts by the next 10 to 11 years. The main concern is where is the money coming from? Besides there are problems of internal security, local peoples' unnecessary demands, incapable market development strategy and a lack of a coherent one-window policy. After the political change of 2006, Nepal has been declared a federal nation. If natural resources are to come under the jurisdiction of federal sattes rather than the centre, this is going to further compound the problem. The result is that in a nation with second highest potentiality of water resources, the people have to grapple with near 16 hours of daily load shedding in the winter. The available capacity as of 2009 is as follows:

Table 4.1. Hydro Power Statistics in 2009

Source	**Installed Capacity (MW)**	**Seasonal Availability (MW)**	
		Wet	Dry
NEA (RoR)	306	274	112
IPP Hydro	152	148	63
Import from			
Tanakpur		76	80
Thermal	55	25	30
Kulekhani I	60	60	60
Kulekhani II	32	15	15
Total MW		**598**	**360**

Source: Nepal Electricity Authority

It is evident from the above chart that Nepal needs to do a lot to create an enabling environment for hydropower generation. The first priority should be to get rid of the present load shedding which has hurt the consumers, industries and the tourism business severely. Nepal Electricity Authority (NEA) has already said that the country will have to cope with load shedding for next five years due to a huge gap in demand and supply of power. For long, this sector has been unnecessarily politicized with political parties making hue and cry over every single project signed with India. Time has come for the government and the political parties to realize that it is because of the years of disregard and predisposed opinion which has resulted in the present power crisis and the energy from our run-off rivers are going wasted. The negative balance of payment situation with India can only be

corrected if Nepal is able to export power to India.

The present installed capacity of electric power system in the country in total is 278 MW, which includes 233 MW of hydropower, and 45 MW of diesel power. Currently, the demand is being met by 56.55 percent of hydro electricity, 30.30 from purchases within Nepal, 12.97 percent from purchases from India and 0.28 from thermal. However, there is still acute shortage of electricity all over the country. To meet this growing demand feasible projects like Arun III (402 MW) and Kaligandaki (110 MW) may be executed within a period of 7-12 years therefore in the interim period, it is imperative to look for alternative arrangements till the above projects come into operation. The NEA accepts that there is a need to construct new small hydroelectric projects to meet the demand to hilly and remote Himalayan region where the national electricity system has not been extended in the near future. Apart from this, it is a necessity to extend proper distribution system in the rural areas where electrification has not been done.[1]

The Hydro Power Development Policy-2001 aims to develop hydropower as an exportable commodity and to attract FDI in the sector. But attracting FDI is easier said than done. This is a capital-intensive industry with high risks and a long gestation period. Cost of developing projects in Nepal are high due to lack of infrastructure – access roads and transmission lines, lack of local indigenous construction materials and equipment in addition to the fragile Himalayan mountains. Therefore, developing a project of the scale greater than 500 MW on full commercial terms, the scale of investment would be in the range of US $ 2.5 million to 3 million per MW.[2]

Precisely to forge a government-private sector partnership and discuss on vital issues such as financing, risk assessment, insurance, risk mitigation, power trade, construction contracting etc. Power Summits have been held from the last couple of years in Kathmandu. The last Summit was appropriately called the 'Indo-Nepal Power Summit' realizing the critical role of Indian investment in order to develop this sector. According to Dr. Sandip Shah, President of Independent Power Producers Association of Nepal, the "greatest achievement of the Summits have been the realization that power sector issues should be taken out of the G2G (government to government) realm and that it should be taken up in the B2B

[1] Nishchal N. Pandey, "Indo-Nepal Economic Cooperation", study report for the ICREAR, New Delhi: June, 2009.

[2] Dr. Sandip Shah, "Govt. should regulate not control hydropower sector", News from NICCI, (Apr-Sep. 2008), p. 7

(business to business) realm." Leading power developers from India, including GMR, L and T, Sutlaj, JVN, Jindal and IL and FS have actively taken part in the Summit (s) and have deliberated on issues like the impact of Nepal's hydropower policies on future power projects, risks associated with financing power projects, availability of credit in financing power projects and installation of transmission lines to facilitate power exchange, among others.

Table 4.2. Major Projects in the Pipeline [NEA+IPP+FDI]

Kulekhani III (under construction)	14 MW
Chamelia (Under construction)	30 MW
Upper Karnali	300 MW
West Seti	750 MW
Kaligandaki	100 MW
Upper Modi	42 MW
Upper Seti Storage	128 MW
Upper Marshyangdi – A	121 MW
Upper Marshyangdi – 2	125 MW
Budi Gandaki	600 MW
Rahughat	37 MW
Upper Trishuli A	60 MW
Upper Trishuli B	37 MW
Likhu – 4 +Balefi (under construction)	120 MW
Upper Tamakoshi	308 MW
Upper Tamakoshi –2	207 MW
Upper Tamakoshi –3	275 MW
Arun III	402 MW
Lower Arun	308 MW

Source: Gyanendra Lal Pradhan, "Vision 2020: A Vision for Growth," Hydro power Forum, FNCCI, Kathmandu.

It is evidently clear that these pipeline projects will take time to come into operation. The construction process is hampered by unavailability of construction materials most of which have to come from India due to unrest in the terai or labor disputes. The winter of 2010 has been especially dry as most of the dams of the run-off the river projects were recording critical water levels. Every other household started to install inverters and generators in their homes. This

compelled the government to seek India's help in supplying electricity. The government having to face tremendous pressure from the private sector and the general public recently brought out a list of immediate projects that would be implemented if various labor unions and local people don't disrupt the construction:-

Project	**Capacity**	**Completion Year**
Trishuli - 3A	61 MW	(2011)
Chamelia	30 MW	(2011)
Raughat	27 MW	(2011)
Trishuli 3B	40 MW	(2012)
Upper Tamakoshi	309 MW	(2013)

Source: NEA, Kathmandu

The only issue is frequent transfer of project managers and top officials due to political interferences, local people's unnecessary demands and also to some extent the rising costs of construction which exceeds initially earmarked budget. However, Nepal government has now become sensitive to the power woes of the country and even declared a 'power emergency'. With these planning, the holistic overview of the energy situation is as follows:-

Total Installed Capacity: 611 MW

From Hydro: 556 MW

From Thermal:55 MW

Import from India: 65 MW

Power Trading Corporation (PTC) of India has proposed to supply additional 500 MW electricity to Nepal. PTC could maintain the supply for next 20 to 25 years with a single unit costing IRs. three (NRs 4.80).[3] This news has come as a relief to Nepali consumers. However, this deal was not criticism-free. Some experts believed that India would be importing from Nepal at Rs 3 and export the same to us at Rs 4.80.[4] The pricing policy of per unit of electricity thus needs to be carefully analyzed and determined to meet the long-term relationship between India and Nepal. In the same way, Nepal must hold negotiations to reach an agreement with India to get a fair share of downstream benefit prior to taking the final decision to

[3] Note: The deal has since not been implemented.

[4] Ratna Sansar Shrestha, "India halts power supply deal-No Wonder!", > http://nepaliperspectives.blogspot.com/2009/04/india-halts-power-supply-deal-no-wonder.html<, accessed on June 15, 2009.

implement various storage projects. Instead of making hue and cry over certain agreed projects after they are already signed, the bureaucrats and experts must make their stand clear regarding downstream benefit for Nepal's rivers. Flood control, irrigation and timely repairs of already constructed dams must be given top priority by India.

As far as Indian investment in this sector is concerned there has been much progress in the last few years. By 2020, India would be set to buy 10,000 MW from Bhutan and generate 50,000 MW by 2025 from its own states. It is a virtual bottom-less pot as far as energy is concerned therefore power purchase from Nepal would certainly be in India's interest. Electricity exports to India would be a big leap economic for Nepal as well. Power Trading Corporation has signed a Power Purchase Agreement with an Australian company (Snowy Mountain Engineering Corporation), which is developing a 750 MW West Seti Hydro Power Project in Nepal. This Agreement was to promote private sector participation in the field of power infrastructure. Currently, 50 MW of power is exchanged between the two countries, with Nepal being a net importer of power.

Likewise, the Indian government has also agreed in principle to build the 240 MW Naumure, a storage type hydropower project located in Rapti river, at the border between Dang and Pyuthan districts, on grant basis for Nepal. To facilitate Indo-Nepal power trade, the two countries are building a 140 km link between Muzaffarpur in Bihar and Dhalkebar in Nepal at an estimated cost of over Rs.1,500 million for transferring around 200-250 MW. Some of the transmission lines were destroyed during the Koshi floods last year and they are being re-built as well.

Irrigation and Flood Control

Nevertheless, by talking too much and implementing little, Nepal could miss the bus as India is fast searching for alternate energy sources and seeing the endless feud and controversy in Nepal over this issue, withdrawing away from Nepal. Indian Union Water Resources minister of India Saifuddin Soz in an interview to BBC Nepali Service on September 12, 2008 said that "Our main interest is flood control and irrigation. Those are our first and second priority. If we get hydroelectricity as by product, that will be a bonus for us." It is evidently clear therefore the issues of irrigation will be of prime interest to India especially Bihar and U.P and to the terai in Nepal.

The Pancheshwar Multipurpose Project and the Sun Koshi Multipurpose projects are both designed to cater not only electricity but also flood control and irrigation.

The Pancheshwar conceived as a peaking power project, will have 5600 MW of installed capacity and create irrigation potential for 130,000 hectares in Nepal and 240,000 hectares in India. Likewise, the Sapta Koshi is designed to provide flood control, power, irrigation and navigational benefits to both countries. Government of India is providing about Rs. 70 crores as grant. This project, if implemented, will provide flood control benefit to Nepal and India, create power capacity of 3000 MW and irrigate 1.0 million hectares in India and 0.5 million hectares in Nepal.

Year 2009/10 witnessed new records of power and energy demand, generation and import. Annual Peak Demand was recorded 885.28 MW registering 8.96 % growth over 812.5 MW figure of previous year. Similarly Annual Energy Demand was recorded 4367.13 GWh out of which 3076.69 GWh was contributed by domestic generation, 612.58 GWh was imported and rest 677.860 GWh was managed. Northern India requires additional 10,000 MW, with total shortfall increasing to 34,000 MW by year 2012 India as a country will need additional 100,000 MW by 2017 Shortfall of 1,000 MW in Bangladesh is expected in 2007 Market could embrace Sri Lanka, Pakistan and even beyond Hydro power is being increasingly competitive due to rising fuel prices "Unlimited Market" in the region.

Foreign Investment in the Energy Sector

Given the existing and expanding needs, there is lot more to do and a major question is how to attract FDI in this sector? In the 80s, FDI inflows to Nepal were minimal with an annual average of US$ 500,000. FDI inflow showed an increment during the 1990s averaging US$ 11 million per annum during 1990-2000, peaking at US$ 23 million in 1997. This was mainly because of Nepal's liberal trade policies, tariff rate reductions, introduction of a duty drawback scheme, adoption of a current account convertibility and liberalization of the exchange rate regime. A reversal in the trend took place from the beginning of the 2000s. According to the World Bank study conducted in 2003, FDI inflow is the lowest in Nepal even when compared with other landlocked countries.

Many foreign investors in Nepal are individuals rather than corporate entities. Most of the FDI projects are of small size 72 percent, medium-sized 16.5 percent and large-sized industries 11.5 percent. Much of the FDI inflow is for joint ventures because of non-commercial risks by offering shares to local partners.[5]

[5] Kundan Pokharel Majgauya, *Foreign Direct Investment in Nepal*, >http://www.telegraphnepal.com/news_det.php?news_id=5150<, accessed on May 10, 2009.

FDI is considered beneficial in view of its contribution to technological transfers, enhancement of managerial capability and new opportunities for market access. Increases in FDI are also seen as leading to increases in exports by creating international markets through new marketing and organizational skills. However, FDI into Nepal is still in a primitive stage of development. There are technical, system, capital and talent obstacles not to mention other endemic problems such as infrastructure, raw material unavailability and poor law and order situation. In order to attract FDI and provide an incentive to foreign investors, Nepal government has after the economic liberalization move of the early 90s, enacted several laws and Acts related to FDI. Except Gold and Silver, full convertibility of the Nepali Rupee on current accounts was introduced, quantitative restrictions and import licenses were removed, tariff structure was rationalized, investment incentives were extended, a new Foreign Investment and Technology Act was promulgated in 1991 that provided national treatment to foreign investors, the process of liberalization of the financial sector was further liberalized with foreign joint venture banks coming into operation. Foreign investors are equally treated as local investors and the same act prevail regarding incentives and facilities to foreign investors. Any foreign national is granted 6 months of non-tourist visa if he/she wants to conduct some survey, study or research with the objective of making an investment in the country. If a foreign investor at a time makes an investment of US $ One Hundred Thousand, he/she is granted a residential visa to him and the dependent family.

Realizing that FDI flows depend on a whole range of factors such as macroeconomic conditions, infrastructure and human capital, domestic policies, and the bureaucratic environment, domestic reforms were implemented to attract FDI, and at least the government has ensured that the regulatory framework will remain stable, transparent and non-discriminatory.

Can Bhutan Model be Duplicated?

There are people in Nepal that believe that just like Bhutan has made significant strides in its hydro-power generation by going for power agreements with India, Nepal too can do the same. Afterall, Nepal also needs revenue, we also need electricity. It is indeed a far-sighted approach undertaken by Bhutan to allow the Government of India to construct projects and purchase electricity at a very low price and receive revenue which has taken its per capita GDP to more than US $ 5000. However, there are also experts in Nepal that believe that this model cannot be duplicated because of several reasons mainly huge construction costs, issue of water sharing and irrigation and also the much more complex political

environment within Nepal than in Bhutan. Bhutan does not have the issue of flood control or irrigation with India and this is markedly different with that of Nepal. Besides, major rivers such as Koshi, Mahakali and Mechi are Border Rivers for India and Nepal, when they change course there is a separate set of legal problems that arise. Dipak Gyawali, a hydro-exert says, "if the 336 MW Chukha hydroelectric project has dramatically increased Bhutan's per capita GNP, and the Chukha approach is to ensure something similar for Nepal, the following logic would apply:- Nepal has about fifty times more people than Bhutan, which would imply that India would need to fund 17,000 MW of equivalent hydro development in Nepal on the same terms as it does in Bhutan, i.e. 60% grant and 40% soft loan, with similar per kWh royalty provisions. It is doubtful if India has that kind of development money available: it certainly has not indicated so publicly. If India accepted that there is value in regulated water, priced it appropriately as per the principles laid down in the Columbia River Treaty regarding downstream benefits, it might have been possible to work out a financing plan for these types of hydro developments that could be more equitably justified. But as things stand, the neo-colonial, "cost plus" resource extraction model offers Nepal very little developmental benefits to be particularly excited with the projects and plans on the table."[6]

Therefore some other approach has to be found that can ensure energy security for Nepal in the decades to come so that we are not only able to export electricity to neighboring countries but also use it for our own consumption.

Energy Generation and Consumption Structure of Nepal

As mentioned at the beginning of this paper, Nepal is vulnerable not only from the point of view of power but also from the aspects of fuel and cooking gas. Due to the land-locked nature of the country, petrol, diesel, kerosene and cooking gas has to be imported and it has to pass through the volatile areas of West Bengal and North Bihar before entering Nepali territory. Even after entering Nepal, it has pass through the unsecure area of the terai before it reaches Kathmandu, Pokhara and other major cities of the country. The state monopoly Nepal Oil Corporation (NOC) usually subsidized kerosene and diesel which creates price discrepancies leading to perennial problems with the Indian Oil Corporation. The moment there is some blockage due to civil disturbance, strikes in Bihar or in the terai, long

[6]Dipak Gyawali, *Hype and Hydro in Nepal: What went wrong and What Corrective Measures are Needed?* paper presented at a conference on 'Energy Security, Reviving the Economy and Nepal's National Interests' organized by Centre for South Asian Studies (CSAS) and Konrad Adenauer Stiftung (KAS), Kathmandu: Jan. 21, 2011.

serpentine queues can be seen at the petrol pumps in Kathmandu. Therefore, Nepal is insecure even in the area of fuel and gas. There has been a request made for the construction of a pipeline from Raxaul to Amlekhgunj but this is yet to be implemented. It is yet another irony that drinking water is also in scarcity in the Kathmandu valley due insufficient supply, leakage and mismanagement. In a country where there are hundreds of rivers and rivulets, such a predicament is simply incomprehensible. "Nepal is the upper riparian country for some of the rivers in the Ganga basin. The country currently utilizes less than 10 percent of the available water, but the fact is that it doesn't expect to use more than 25 percent of all the water available even by the year 2025."[7]

Nepal desperately needs to mull over alternate energy generation but the lackluster approach of the government has hardly been an encouragement.

The total energy generated in the year 2009 is 9.814 million TOE

The traditional biomass fuel energy supplied – 8.340 million TOE (84.98 %)

Wood fuel	7.365	million TOE (75.04 %)
Agriculture residues	0.402	million TOE (4.09 %)
Cattle dung	0.573	million TOE (5.83 %)
The commercial fuel energy supplied	1.414	million TOE (14.40 %)
Petroleum Products	0.964	million TOE (9.82 %)
Coal	0.249	million TOE (2.53 %)
Electricity	0.201	million TOE (2.04 %)
The renewable fuel energy supplied	6000	TOE (0.61 %)
Biogas energy	57360	TOE (0.58 %)
Micro-hydro power	1980	TOE (0.02 %)
Solar Power	660	TOE (0.006 %)

Source: Economic Survey, Ministry of Finance, 2009

[7] Asit K. Biswas, R. Rangachari, Cecilia Tortajada (eds.) *Water Resources of the Indian Sub-Continent*, Lee Kuan Yew School of Public Policy, Singapore. 2009. p. 102

The Sector wise Consumption of the Energy in Nepal- 2009[8]

1.	Residential	8.756 million TOES (89.21 %)
2.	Industrial	448 thousand TOES (4.56 %)
3.	Transport	364 thousand TOES (3.70 %)
4.	Commercial	149 thousand TOES (1.51 %)
5.	Agriculture	80 thousand TOES (0.81 %)
6.	Others	21 thousand TOES (0.21 %)

Source: Economic Survey, Ministry of Finance, 2009

The commercial energy resources consumed last year command 1.414 million TOE, which is shared by the following energy commodities.

Petroleum Products	964000 TOE	68.17 %
Coal	249000 TOE	17.60 %
Electricity	201000 TOE	14.21 %

According to Prof. Riddhi Bir Singh of the Centre for Energy Studies, Kathmandu, 'about 68 percent of the commercial energy is fulfilled by the imported petroleum products that include the liquid and gaseous fossil fuels. The share of the petroleum products fuel at the national scale is just 9.82 %. But the economic burden it generates is so strong that to fulfill 9.82 % quantity of the petroleum products the nation has to expend more than 60 percent of the nation's total merchandise export earnings.'

As an alternate route, former Prime Minister G.P. Koirala once requested the Chinese side for supplying oil and gas to the Nepali market. Iran, Turkmenistan, Qatar, Myanmar are exploring potential markets for their surplus natural gas and Nepal could tap into that by talking with the Chinese authorities. The extension of Golmud-Lhasa railway to Shigatse and then on to Nepal border in the next few years will change the whole structure of supply of essentials for Nepal but the country will need to do more homework so as to properly negotiate with the countries involved.

[8]Note: Riddhi Bir Singh, *Petroleum Products and Gas*, paper presented at a conference on "Energy Security, Reviving the Economy and Nepal's National Interests' organized by Centre for South Asian Studies (CSAS) in cooperation with Konrad Adenauer Stiftung (KAS), Kathmandu: Jan. 21, 2011.

Renewable Energy

It has been mentioned earlier that Nepal has not been giving due focus on the equally critical area of renewable energy generation. While wind-energy generation in India is currently estimated to be 40,000 MW, Nepal has not given due attention to this crucial sector. At least, some pilot projects in specific locations could have been initiated and despite the high installation cost, the consumers could benefit in the long-run. We could have taken assistance from India in this area.

Solar and bio-gas, wind energy and micro-hydro power initiated at the local level would help mitigate the existing problems of shortage. While some micro-scale projects have certainly been undertaken, this is not enough as depicted in the following chart. The current state of renewable energy that is officially recognized is the aggregate product of the biogas energy, solar photovoltaic power and the micro-hydro power. The total renewable generation share just 0.61 % at the national level equivalent to 60000 TOE. The relative share of the renewable energy in Nepal is generated by:

Biogas	57360 TOE (95.6 %)
Micro-hydro power	1980 TOE (3.3 %)
Solar Power	660 TOE (1.1 %)

Environmental Concerns

Tibet and Nepal are origins of many rivers and rivulets that flow downstream to the Indo-Gangetic plains. Fragile eco system of Nepal, deforestation, disappearing wetlands and rise of pollution levels has alarmed international experts. Additionally, there are concerns of waste problem in Kathmandu and other big cities. Waste disposal becomes a problem whenever there is controversy related to the disposal site with the local villagers unwilling to allow waste to be deposited in the vicinity. Hence, the Kathmandu Metropolitan office has been altering site every now and then. Pesticide pollution is another concern because pesticide is used indiscriminately nowadays by farmers causing health problems to consumers.

Nepal has experienced an average maximum annual temperature increase of 0.06^{0}C. This rate of increase is higher in the mountains. Despite having only 0.4 percent of the total global population and being responsible for only 0.025 percent

of total GHG emissions in the world, it is thought that Nepal will be affected disproportionately, especially from increasing atmospheric temperature. Changes in the annual rainfall cycle, intense rainfall and droughts have been observed. Similarly, both days and nights are becoming warmer. The number of days with 100 mm of heavy rainfall is increasing. Timing and duration of rainfall is changing and this is becoming a regional phenomenon in South Asia. As glaciers recede from rapid snow and ice melting, glacier lakes are expanding. The adverse impacts of climate change have been noticed in agriculture and food security, water resources, forests and biodiversity, health, tourism and infrastructures. Climate-induced disasters and other effects have caused damages and losses to life, property, and livelihoods.

According to the Ministry of Environment of the Nepal government, millions of Nepalese are estimated to be at risk to climate change. In the past 90 years, a glacier in the Everest region has receded 330 feet vertically. Because of glacier melting, new glacier lakes have formed. Although there will be an increase in river flows until 2030, this is projected to decrease significantly by the end of this century. The problems arising due to climate change are increasing over the years. Nepal has to implement adaptation programmes even if it is not being responsible for climate change. Hence, Nepal has considered climate adaptation as a national agenda and has taken several initiatives for implementing different programmes for risk reduction in the recent years.

Government Measures

The Nepal government with support from various donors has implemented a number of measures to tackle the twin challenges of energy insecurity and environmental degradation impacting on the livelihoods of the people. Former Prime Minister Madhav Kumar Nepal held his cabinet meeting at Kala Patthar, Mt Everest (5,242 m) on Dec. 4, 2009 which was regarded as a historic exercise to generate awareness on the adverse impact of climate change. This was held just prior to the Copenhagen Summit. Issuing a ten point declaration, the cabinet meeting declared to increase protected areas in the country to 25 percent from the existing 20 percent. It also declared new conservation areas i.e. - Gaurishankar Conservation Area in Dolakha and Api-Nampa Conservation Area in the far-west. The declaration proposed world leaders to revise provisions of the Clean Development Mechanism Trust to make the fund accessible and profitable to the developing countries. In addition, the cabinet meeting called for obtaining support of the world community to effectively implement projects in accordance with Nepal's needs, in order to address the adverse impact of climate change on Nepal's

social-economic sector, specially water-resources, agriculture, bio-diversity, forests, human life, and health. Also endorse the proposal requiring developed nations to contribute at least 1.5 percent of their GDP to the Climate Change Fund.

As a follow-up to the Mt. Everest cabinet meeting, the Government of Nepal established the Climate Change Management Division in the Ministry of Environment (MoE) in 2010. The MoE prepared the National Adaptation Programme of Action, which was endorsed by the Government on 28 September 2010. Local Adaptation Plans of Action (LAPAs) are being prepared to implement adaptation programmes. In the process of implementing the statement made by Prime Minister Madhav Kumar Nepal during COP 15, the Mountain Alliance Initiative has been launched, international expert consultations were organized, and relevant reports were prepared. To coordinate climate change activities and implement collaborative programmes, a multi-stakeholder Climate Change Initiatives Coordination Committee (MCCICC) has been formed with representation from relevant ministries and institutions, international and national nongovernment organizations, academia, private sector, and donors.

Climate Adaptation and Disaster Risk Reduction

Some of the specific measures include setting up of a Climate Change Council under the chairmanship of the Prime Minister. Its objectives are to: i) provide coordination, guidance and direction for the formulation and implementation of climate change related policies ii) provide guidance for the integration of climate change related aspects in the long-term policies, perspective plans and programs iii) take necessary measures to make climate change a national development agenda iv) initiate and coordinate activities related to additional financial and technical support to climate change related programs and projects and also initiate and coordinate for additional benefit from climate change related international negotiations and decisions. The Council has already met 4 times.

Other policies adopted by the government are:

- Implementing priority actions identified in the National Adaptation Programme of Action (NAPA), and identifying and implementing medium- and long-term adaptation actions in the climate impacted and climate-induced disaster-prone areas, communities, and people;
- Linking and implementing climate adaptation with socio-economic development and income-generating activities to the extent possible;
- Monitoring the status of glaciers and glacier lakes through studies and implement adaptation activities in priority vulnerable glaciers;

- Forecasting water-induced disasters and risks created from climate change and providing early warning information, developing necessary mechanism for the implementation of preventive measures and ensuring regular supervision, and enhancing capacity;
- Identifying the people, communities and areas impacted by climate change and implementing adaptation and impact mitigation measures based on local knowledge, skills and technologies;
- Formulating and implementing integrated programmes taking into consideration the objectives and the provisions of the conventions related to climate change, desertification and biodiversity;
- Developing a necessary mechanism for forecasting and preventing vector-borne, infectious and communicable diseases induced by climate change; and
- Developing and expanding bilateral and multilateral cooperation for risk reduction and adaptation to address the effects of climate change in the international trans-boundary areas.

Another issue of primary important for Nepal is its location between two declared nuclear weapon power states. After the Fukushima disaster, it is necessary for Nepal to impress upon both its large neighbours to be extra vigilant on its nuclear power generation reactors near the Nepal borders to minimize impact of accidents. This is all the more imperative as this sub-region is in an earthquake zone.

Conclusions

SAARC has been at the forefront in recognizing the need for a collaborative mechanism to address this challenge. "The region as a whole is highly dependent on foreign sources for its energy requirements. Regional cooperation can promote utilization of the potential within the region and reduce its outside dependence. Such cooperation will not only be beneficial in promoting greater efficiency within the region, but will also be useful in accessing energy from countries outside the region."[9] The Thimpu Summit held from April 28-29, 2010 made a statement on climate change and made a number of important directives to the SAARC Secretariat such as: "commission a study on climate risks in the region, undertake advocacy and awareness programs on climate change to promote the use of green technology and best practices to promote low-carbon sustainable and inclusive development of the region, plant ten million trees over the next five years

[9]Nitya Nanda, "Energy Cooperation and Connectivity in South Asia", in Dipankar Banerjee and N. Manoharan (eds.) *SAARC: Towards Greater Connectivity*, IPCS, KAS, 2008. p. 169

(2010-2015) as part of regional a-forestation and reforestation campaign, commission on a SAARC Inter-governmental Mountain Initiative on mountain eco-systems, particularly glaciers and their contribution to sustainable development, complete the ratification process for the SAARC Convention on Cooperation on Environment at an early date to enable its entry into force, etc.

In fact, before the Thimpu Summit, SAARC Disaster Management Committee organized two Expert Group Meetings in New Delhi on 5-6 February 2009 and 3 July 2009 to discuss and recommend the modalities for setting up a Natural Disaster Rapid Response Mechanism (NDRRM). Subsequently, a draft Agreement to institutionalize the regional response mechanism was prepared and circulated to all Member States.

Secretary General of SAARC Fathimath Dhiyana Saeed addressing an inter-governmental meeting to finalize the draft of a SAARC Agreement on Rapid Response to Natural Disasters in Maldives on May 25, 2011 put forth key points on the need of a regional response mechanism to address common challenges. "The Himalayas have the largest deposits of glaciers outside the polar region, which are melting due to climate change. The immediate consequence has been the increasing incidence of flash floods, glacial lake outburst floods and riverine floods. The long term impact of this phenomenon presents a serious threat to the perennial river systems of the Indus, Ganga and Brahamputra that sustained life and civilizations in South Asia for millennia", she said and added, "South Asia's long coastline faces cyclonic storms, storm surge and inundation regularly, rising sea levels now threaten the survival of many low lying coastal and deltaic regions, including the very country that is hosting this meeting", she added.

There are several regional initiatives already underway but more needs to be done by the SAARC in the areas of energy and the environment. A regional energy grid especially electricity grid if undertaken could have positive effect on the lives of the people of South Asia. Not much can be done on fuel as all SAARC countries have to import oil.

While individual member states certainly need to evolve national plans and also be always mindful of the negative aspects of climate change plus energy woes, they need to collectively do more in this regard. Only cooperative regional mechanisms and approaches will be able to consolidate national endeavors.

Chapter 5

Pakistan: Energy Insecurity and the Failure of Institutional Response

Arshad H Abbasi

Introduction

Energy woes have plagued Pakistan since its inception, however, the scope and intensity of the present energy crisis confronting the country is unprecedented . For a country struggling to develop, the energy shortage has had catastrophic impacts on the economy, which will inevitably affect long-term plans of sustainable development and future schemes of poverty alleviation. By 2009-2010, severe energy shortfall had reduced the overall GDP growth by 2.0 %, the ramifications of which were acutely evident on the burgeoning population and widespread poverty levels in the country . According to the Ministry of Water and Power (MOWP), as a consequence of the energy crisis, the country is suffering losses amounting to Rs. 219bn in the industrial sector, in addition to the loss of 400,000 jobs and a cut in exports worth Rs. 75bn a year. The energy crisis has not only affected the country's economic growth but it has paralyzed life both in the rural and urban areas due to riots resulting from long hours of load shedding which is emerging as a frequent phenomenon. Amidst rampant energy insecurity, the country has inevitably been speared towards an incorrigible economic disaster that has spearheaded massive unrest and political destabilization. Yet even as ambitious schemes are constructed to counter the energy crisis, insufficient efforts are being devoted to rooting out the sources of the crisis itself and thus failing to lay the foundation for a long-term mechanism for ensuring energy security in the country.

Energy Crisis in Pakistan

Pakistan, having a surplus of electricity in the year 2002, is now short of more than 5500 MW at a time when its peak demand is 18100 MW. One of the causes of this energy crisis is the failure to anticipate the growing demand of electricity annually that was 3% in the year 2003 and rose up to 10% in the year 2008 due to higher economic growth and unplanned continuous rural electrification due to political pressure.

The fundamental cause of the energy crisis is its dependency on fossil fuels. The system has the capacity to generate almost 17,500 MW of electricity but it's not working on its full capacity due to non-affordability of the rising cost of electricity generation, severe shortage of gas and the skyrocketing cost of imported furnace

oil. Pakistan's daily gas requirement is 6.5 billion cubic feet (BCF) against its current supply of 4.0 BCF, which means that Pakistan at present faces a shortage of 2.5 BCF. The major consumer of gas is the power sector, which consumes nearly 40% of the total production of gas, has not only declined the hydroelectricity share from 52% to 30% but also caused the depletion of our limited gas reserve. To overcome the impact of the shortage of gas supply, the thermal power plants have had to switch from gas to furnace oil. Consequently the cost of generation has tripled as compared to the the cost of gas. Not only this, the already crippling economy of country is over burdened with a loan of US$ 3.7 billion for the import of furnace oil.

Due to the previously mentioned reasons, the cost of providing electricity to consumers could not be fully recovered, while the tariff for consumers remained unchanged from 2002 to 2007. For the first time in early 2007 the government increased the electricity tariff but still could not pass the whole cost of production on the consumers. The gap in cost of electricity generation and government-notified tariff had swelled to Rs. 3.39 per unit in 2010. Gas crisis and the subsequent shifting toward oil coupled with the inability of the power distributions companies to pass on the cost of electricity to the consumers, had turned power sector hostage to Circular Debt. Thus, dependency on fossil oil pushed country's power sector between the devil and deep blue sea, if power plants runs on oil it created circular debt, if not then large scale load shading is the only option.

When Zardari government started ruling the roost in March 2008, the crisis was piling up. The sycophant Adviser of Ministry of Water and Power (MOWP), had briefed Zardari and his Prime Minister that Rental Power Plants (RPPs) is the panacea of energy crisis. In line with the party decision, the federal cabinet approved installation of 14 rental power plants to generate of 2,700MW. The RRP, initiative rental power plants was turned into a mega corruption swindle and the country's energy crisis only deepened. In this most extroverted deal, the country has to pay a high captive cost, but due to gas shortage, the cost of electricity generations very high, which is why the RPPs are only are contributing 68 megawatts in the national grid. This was the big blunder committed by Zardari's government. Otherwise, hydroelectricity which is so far the cheapest and the most environment friendly source of energy was neither considered nor given due priority. Keeping a generation mix dominated by cheap Hydroelectricity generation the government could have achieved the objective to keep consumer-end tariffs at affordable levels while also passing on the true cost of electricity.

Deliberate and abnormal delay in hydropower projects and wastage of heavy foreign exchange in RPPs is not the only crime of MOWP. In 2008, when the

government was finding it difficult to lure foreign investment to overcome the increasing energy shortfalls, an entrepreneur requested MOWP for permission to start 600-MW Mahl hydropower, which was advertised by the Board of Investment (BOI) for private sector investment. The private entrepreneur arranged 800 million dollars to generate and then sell electricity just Rs.4 per unit. Unfortunately, all his efforts aimed at benefiting the nation and public at large through development of cheap and environment-friendly hydroelectricity were made unsuccessful by Adviser to MOWP. As a last resort, the investor published an appeal to the Prime Minister and the President of Pakistan for intervention to develop the Mahl hydropower project, on 27 of March 2010 on the front page in this most popular daily paper to avail their attention in this regard. Nevertheless, he has never had any reply from both the offices. However, in April-2011, adviser to MOWP sent another demand to Friends of Pakistan (FOP) seeking funds of US$ 37 billion for hydropower projects, including Mahl.

Current Energy Dynamics

Only a superficial reading of the current energy dynamics would locate the cause of the energy crisis in the absence of energy sources in the country**.** This conclusion which is conventionally accepted in most circles and is heavily being propagated by the government is based on insufficient knowledge and the need to divert away attention from the actual and more persistent roots of the problem. Energy sources are in fact available in the country; Pakistan is endowed with an enormous potential for hydropower and has vast reserves of renewable energy however these remain largely untapped. Pakistan's deficiency of energy sources is only pertains to the absence of oil fields and diminishing gas reserves, which despite being finite sources of energy and unsustainable options for the country, constitute the largest portion in Pakistan's energy mix. Hydropower alone has the exploitable potential 56,773 MW of which only 6% has been tapped to date. Thus it should be stated at the outset that the current energy crisis is not sourced in the absence of indigenous energy sources but rather is rooted in the dynamics of bad governance characterizing the energy sector including the delayed implementation of policies and a series of misguided policies that prompted the development of thermal sources of energy which directly undermined efforts to exploit the plentiful reserves of indigenous renewable sources of energy.

Pakistan has a long history of hydropower with the first plant being made operational even before the country's independence. Installed at Renala in 1925, it was situated on a canal and the generation capacity was one megawatt. As the country struggled with energy shortages right after its inception, efforts were

directed to tapping into its hydropower reserves to alleviate the crisis. However it was the 1960 Indus Water Treaty which truly revolutionized and pushed the development of hydropower generation in the country. Since then 6, 355 MW has been added to the national grid, which is almost 95% of the total installed capacity of the hydropower projects. The Tarbela dam which was completed in 1997 with a total cost of 16, 380 million rupees, is considered a milestone in energy generation in the country. As of 1st December 2007, the national economy had benefitted a total of Rs. 221,902 million, which is more than 13.5 times the original cost. Hydropower costs only Rs. 0.37 per kWh of generation and is by far the cheapest source of energy for Pakistan in addition to being a renewable energy source and domestically available. By the late 1980s, the hydropower thermal ratio in the energy mix stood at 67:33 as both large scale and small scale hydropower projects were rapidly being developed in the country. However by 1990s, the reign of hydropower was replaced by thermal sources of energy.

After Tarbela, the major hydropower project in the pipeline was the Kalabagh multipurpose dam however it was marred by political controversies and provincial rivalries thus despite the host of benefits of the project, it could not be launched. This was a major setback in hydropower development which also constrained further development in the sector whilst simultaneously paving the way for thermal power plants.

With the ministry of water and power's [MoWP] failure to initiate the Kalabagh dam project, the contingency plan to cope with the rising energy demands was through dual fuel thermal power plants. in 1990 and 1993, two mega power plants namely Jamshoro with 850 mw capacity and Muzaffargarh with 1350 mw capacity were constructed by Wapda. The construction of these plants drastically changed the power dynamics of the country, altering the hydropower thermal mix ration in the favor of thermal power. These changes were being facilitated by the restructuring in the power sector, a scheme initiated by the government of Pakistan as early as 1985. With the power policy of 1994, the shift to thermal power as a preferred means of energy resource was institutionalized.

The rationale behind MoWP'S changing preferences was based on the discovery of indigenous gas reserves which was to serve as the primary fuel in power plants. at that time, natural gas was cheaper and had a shorter gestation period as compared to hydropower plants thus was considered a better option. However, positioning the power sector to be completely reliant on finite indigenous gas reserves and thermal power was an unsustainable move. It consequently led to prove debilitating for Pakistan's economy and led to the energy crisis in 2010. The misguided emphasis on thermal power in the 1994 power policy has had catastrophic impacts as it led to

a rapid decline of the country's gas reserves, a hike in electricity costs, the circular debt fiasco, the financial instability of WAPDA and lay the foundations for submerging the country in a deep spiral of energy insecurity.

Hydropower as a Clean Energy Source

As the Power Policy of 1994 was unable to overturn the energy demand-supply deficit, the basis of the operation of a power sector inclined towards thermal energy was revisited. The Power Generation Policy 2002 was a direct result of MoWP's two-year long consultation of all stakeholders in the energy sector. The policy was intended to narrow the gap between energy generated from thermal and hydro sources by adding clean hydroelectricity to the national grid. It was realized that thermal sources could not be relied on to establish a long term plan of energy security in the country and thus the Power Generation Policy 2002 chalked out a scheme to harness a cumulative 22,555MW of hydropower in the coming years**.** Regrettably, just two projects having an installed capacity of 153 were completed in nine years against the 2002 targets. Had the schemes identified under the Power Generation Policy 2002 been implemented according to plan, Pakistan would have had 4210MW of cheap hydroelectricity diffusing the energy crisis confronting the country right now.

Table 5.1. Hydropower Project Started in 2002

Name of Project	**Installed Capacity (MV)**	**Commissioning date**
Pehur Canal, KPK	12	December-04
Jinnah (Indus), Punjab	96	December-05
Malakand-III , KPK	**81**	**December-05**
New Bong AJK	74	December-05
Golan Gol , KPK	106	June-06
Allai Khawar ,KPK	121	June-06
Khan Khawar ,KPK	**72**	**June-06**
Duber Khwar, KPK	130	June-06
Raised Mangla, AJK	180	July-06
Gomal, KPK	130	July-06
Mathin Kot, Punjab	100	June-07
Thal Reservoir, (CJ Link)	52	June-07
Gulpur (Punch), AJK	60	June-07
Kurm Tungi, KPK	58	June-07
Tarbela 15-16, KPK	960	December-08
Rajdhani, AJK	139	June-10
Kohala (Jhelum), AJK	740	June-10
Abbasian (Jhelum), AJK	245	June-10
Neelum Jhelum, AJK	969	June-10

The apparent 'go-slow' strategy of the MoWP vis-à-vis hydropower paved the way for thermal and rental power projects, increasing the reliance on imported fuels and putting enormous pressure on indigenous gas reserves. Despite the adequacy of the policy in place, MoWP never showed a serious resolve to implementation of the policy. In power policies, it was envisioned that an additional of 4210 MW of hydropower would be added however MoWP allowed another 8 thermal base plants having a gross capacity 1700 MW to be constructed with no simultaneous developments in hydropower. In addition to this, MoWP made a policy to hire rental power projects and chalked out an agreement in 2008, whereby $ 136 million were made as an advance payment to hire four oil based plants with a capacity of 580 MW projects with a payment of $ 1.24 billion rent for five years. The Asian Development Bank has already sent a strong note against rental power projects and a case of corruption is already proceeding against the minister and officials of MoWP in Pakistan's apex court. It was the population of the country who were forced to bear the brunt of the corruption of MoWP and the failure of implementing the Power Generation Policy 2002.

However, whenever the question about hydroelectricity is raised, the MOWP has always given a stereotypical answer thathydropower project takes a long time and needs a huge capital investment.This is a rather weak argument in light of modern hydropower project management. Many examples are available across the world where hydropower projects were completed in record time. The US, for example, was facing a serious energy crisis during the Second World War. The country's then president, Franklin D. Roosevelt, put a high priority on the operation of the Douglas Dam which installed a capacity-building plant of 166 MW of electricity. The project was completed within 12 months and 17 days in 1943. Similarly, American engineers set another record by completing the Cabinet Gorge Dam on Clark Fork River in half the stipulated time to generate 231MW of hydroelectricity and store 106,000 acre feet of water.

In our neighborhood, Indian policymakers are working towards adding 50,000MW of clean and renewable hydropower to their energy mix and have resultantly set some significant records in this regard. Many public sector hydropower projects, for instance, 520MW Omkareshwar project on the Narmada river has been completed in four years. Small hydropower projects are taking just 20 to 22 months for completion. However, at the top of the list of excellent hydropower project management is the 86MW Malana hydroelectric power project in Himachal Pradesh. It is unique because it was constructed within 30 months against its five-year schedule, and at almost 50 per cent less cost than the

approved budget — and that too at a high altitude amidst difficult mountainous terrain.

While Hydropower was still considered as an option in discourse on power generation in Pakistan, it was only recently that other renewable sources of energy were given sufficient attention as a source of generating power. It was the Power Policy of 2002 when for the first time in the country's history, the need for a reduction of dependency on fossil fuel was highlight and emphasis was laid on the importance on renewable energy. One of the most unprecedented moves in the country's history of power generation was setting the target of 500Mw of energy to be added by wind by 2010. The recognition of Pakistan's indigenous renewable sources as means of power generation was a welcome one and it was hoped that exploitation of renewable energy sources would eventually diffuse the dependence on thermal energy. Additionally, the GOP established a dedicated institution, the Alternative Energy Development Board (AEDB) in 2003 to achieve its goal in mitigating Pakistan's reliance on fossil fuel and dynamically promoting renewable energy. However by the end of 2010, only 6 MW of energy from wind had been added to the National Grid which is not only a clear indication of the government's lack of resolve to exploit renewable energy but also speaks volumes of the efficiency of the AEDB.

Excluding hydropower, wind as a source of energy continues to receive much attention in Pakistan's energy circles and features predominantly in plans of developing the renewable energy sector. This was evident in the Renewable Energy Policy 2006 which offered various incentives for IPPs including guarantees to purchase electricity, wind variation risk, zero sales tax and no import duty. However none of the wind projects were completed in time and the target of 500 MW addition to the national grid through wind energy was far from being met. One of the reasons cited for the delay in the construction of wind power plants were the high prices of wind turbine. However not only have the prices of wind turbines fallen in recent times but India, which is rapidly emerging as a leader in the Wind market, manufactures wind turbines at a cost much lower than the global cost which the AEDB could have facilitated the IPPs to avail. However bad governance, widespread corruption and a lack of political resolve led to the failure of realizing the potential of wind energy in Pakistan which many had hoped would set the foundations for diffusing the reliance on thermal energy and subsequently alleviating the energy crisis.

The gross wind potential in Pakistan has been estimated at 346,000MW with the wind corridor at Gharo alone having a potential of 50, 000 MW. These

estimations form the basis of extreme optimism that surrounds the development of wind energy in the country. Solar energy is only second to wind in terms of its maturity as an energy source in Pakistan. The gross potential of solar energy stands at 2.9 million Mw owing to Pakistan's favourable geographical position. While there have been no ambitious developments in creating on grid solar applications, pilot projects have been launched and solar energy has formed the cornerstone of Pakistan's Rural Electrification Program. A widespread introduction of solar pumps, solar heaters, solar cookers and solar heating system has enough potential to significantly diffuse conventional fossil fuels. Moreover solar energy could play an instrumental role in providing energy to areas where there are small populations and the extension of the national grid is not economically feasible or impossible. The introduction of energy could thus initiate a scheme of sustainable development that could alleviate poverty in remote areas.

Institutional Failure

Along with hydro, wind and solar, other potential sources of renewable energy which could be exploited to initiate a long term, sustainable program of energy security have been summarized in Table 5.2.

Table 5.2. Renewable Energy Sources in Pakistan

Source	Cost per Unit	Installed Capacity On Grid	Potential MW	Comments
Solar	11 Rs-17 Rs.	0 MW	2.9 million	Despite the vast potential, large scale projects have yet to be launched. Remote electrification through photovoltaic technologies, solar desalination plants, solar cookers, solar water heaters and solar dryers are in use in different areas.
Wind	11-16 Rs.	6 MW	346,000	Micro wind projects underway to provide electrification in remote villages of Sindh and Balochistan, 691 household catered to. 50 MW on grid project to be launched soon at Jhimpir. The wind corridor at Gharo alone has a potential of 50, 000 MW.

Hydro	0.38 Rs	6,464 MW	46,000	Only 14%of the current potential has been utilized however projects are fast underway to increase the share of hydropower in the energy mix from the 6.63 MTOE in 2009-2010 to 38.93 MTOE by 2030.
Geothermal	__	0 MW	80,00 MW	Evidence of geotonic activity and through preliminary surveys, potential for geothermal to provide on grid energy expected. No effort to study and assess potential, no on grid project planned for the near future. Small scale use, currently limited to heating pumps.
Tidal	__	0 MW	1.1 MW (Karangi-Kohchar Creek)	Potential of Sindh creeks identified after limited survey, potential also at Sonmiani Hor and Kalmat Khor on the Balochistan Coast. Need assessment of potential of energy generation. No project initiated yet.

Given the potential of renewable energy sources in Pakistan, it is justified to question why their potential has not been harnessed as energy insecurity continues to worsen. Despite the Renewable Energy Policy 2006 and the presence of two institutions namely AEDB established to promote Renewable Energy and Pakistan Council for Renewable Energy Technology [PCRET] which has been designated the task to coordinate R&D and promotional activities in different renewable energy technologies, the renewable energy sector has failed to mature given the need, urgency and potential of the indigenous resources. This scheme of things can be largely, if not solely, be attributed to the failure of AEDB which despite its mandate could not launch the renewable energy sector in Pakistan.

Despite the magnitude of funds directed to AEDB, its progress has been slow at best. To date, the funds have not been able to translate into a coherent long term strategy to align the efforts of AEDB towards a sustainable inclusion of renewable energy sources in the country's power mix. Without a clear focus and diffused efforts, the momentum which would compel the development of RE technologies has not been initiated. Owing to this, renewable energy continues to occupy a marginal position within the discourse on meeting energy security amongst political actors and policy makers. The GOP has repeatedly facilitated the compromise of targets with regards to the generation of electricity from

Renewable Energy Technologies, thereby inadvertently playing an effective part in stunting AEDB's growth as a forward-looking performance driven institution. However in spite of the reduction of the targets by GOP, AEDB has demonstrated a lack of capacity on its part in producing a credible strategic framework to achieving them. Additionally, AEDB's fixation with wind technologies prompted an exclusion of other renewable technologies within its development program. The focus of AEDB on wind energy could have been lauded had it produced any concrete results however wind power generation stands at only 6 MW against its set target of 500 MW by 2010. AEDB's task of attracting potential investors is further complicated by the security situation prevalent in the country. In the face of security concerns, AEDB should have doubled its efforts to attract investors yet it failed to generate an environment conducive to the development of the renewable energy market thus could not even attract domestic investors. One of the major hurdles in the promotion and contribution of RE in the energy mix has been AEDB itself. The policy of AEDB has been inclined to project itself as a potential player in the renewable energy market instead of creating a fair market and a level field for all IPPs.

However it must be noted that AEDB has played a central role in the Rural Electrification Programs whereby many off grid locations have been electrified primarily through wind and in some instance solar technologies. The existence and success of this program has initiated many nongovernmental actors to follow suit and introduce renewable technologies at a small scale to rural populations. Even geothermal power has been harnessed in this case for heating purposes in some areas in the North. However, AEDB has failed to electrify the number of villages that it had initially targeted for and could not diversify the sources of renewable energies to provide electricity to remote areas. There is a dire need for an exhaustive monitoring and evaluation system for AEDB's programs which despite its short years of existence, has failed to translate its host of funds into a coherent program for renewable energy and diminishing its credibility of achieving its mandate.

Conclusions

The failure to expand hydropower and inability to exploit renewable energy sources in Pakistan is directly responsible for the deepening energy security in the country. Short term solutions sourced in reliance on thermal power have run their course and while they should have been complimented with simultaneous development of the renewable energy sector, this sector remains in a nascent stage. Excluding hydropower, the contribution of renewable energy to the country's

energy mix is negligible despite their vast potential. The MoWP played a critical role in undermining hydropower to favor the development of thermal energy and failed to implement hydropower projects in the timeline stipulated. AEDB fared even worse as it exclusively focused its attention on wind technologies and failed miserably to even generate a sizeable portion of energy from wind. After 7 years of existence and enormous funds used, AEDB only has a 6MW wind project and a small number of pilot projects to show to its credit. Sources apart from Wind, and solar and waste to energy to a lesser extent have not been tapped into at all. The cumulative energy potential of renewable sources including hydro is vast enough to meet the country energy demand for years to come. However while it is folly to expect that the renewable energy sector could be developed overnight, even the foundations of this sector remain incoherent and restrictive at best. The policies in place with regards to energy generation are adequate and comprehensive however the implementing institutions have failed to translate the policy directives into action. The burden of this has to be extensively borne by the people of Pakistan and as the energy crisis only seeks to deepen in the coming years, schemes of development will remain paralyzed. Yet this dismissal situation is not the consequence of an absence or even lack of energy sources but is a direct result of institutional failure, mal governance and lack of political will to harness the indigenous sources of energy. Instead of investing in thermal sources and directing foreign reserves to import oil and gas, efforts should be directed to create a system of energy governance which is both transparent and exhaustive.

Chapter 6

Sri Lanka: Securing Energy and Environment in the post-conflict Era

Chaminda Hettiarachchi

Introduction

Being an island, Sri Lanka does not share common land borders with India; unlike some other South Asian countries, it is not enmeshed in the hazardous experience of sharing river waters flowing across contiguous national borders. However, the island nation has never been totally isolated from multi-faceted pressures and contacts exerted across the seas. As a member state of the South Asian subsystem, there are several important areas where the Island nation can collaborate with its neighbors in managing and optimizing environmental and energy security on a regional basis. Sri Lanka has an area of 65,525 square kilometers, a population of 20.5 million (2010), and a per capita gross domestic product (on PPP) of about $5,000 (2010).[1] Sri Lanka is currently engaged in large-scale reconstruction and development projects following the end of the three decades conflict with the Liberation Tigers of Tamil Eelam (LTTE). Therefore, increasing access to electricity and rebuilding the nation's road and rail network in the former conflict affected areas of the North and East of the island remains a top priority with the Sri Lankan Government. Additionally, Sri Lanka seeks to reduce poverty by using a combination of state directed policies and private investment promotion to spur growth in affected areas, develop small and medium enterprises, and through the promotion and enhancement of agriculture , fisheries and livestock sectors. Sri Lankan growth rates averaged nearly 5% in during the war, but increased government spending on development projects has enhanced the growth rates after the conclusion of the war in 2009. Sri Lanka's economy is poised to achieve high growth rates of 8-10% in the postwar period.[2]

The efficient functioning of the power sector has a fundamental bearing on economic development and poverty reduction. Without an adequate power supply, basic services like industrial and non-industrial operations, and access to information, communications, and digital connectivity are likely to be adversely

[1] UNDP Human Development Report 2010 http://hdrstats.undp.org/en/countries/profiles/LKA.html (accessed on 1st Aug. 2011)

[2] CIA The World Fact book http://hdrstats.undp.org/en/countries/profiles/LKA.html (accessed on 1st Aug. 2011)

affected. Without access to electricity, rural areas are unlikely to maximize income-generating activities that are essential to reduce poverty.

Sri Lanka's energy sources consist primarily of biomass, hydro-electricity and petroleum that contributed to 47%, 8% and 45% of total energy respectively in 2010. In the power sector, the installed capacity for electricity generation from hydro, thermal and wind power presently stands at 2,817 MW. Eighty percent of the households have access to the grid connected electricity while another 3% of households are provided with basic electricity connection through off-grid systems.[3]

The demand for electricity is estimated to rise at an annual pace of 8% - 10%.[4] However, this growth forecast should be adjusted for the newly emerging demand from the post-conflict areas.

Sri Lanka's power sector faced difficulties to meet the growing demand for electricity during the last several decades. The 2001–2002 power crisis faced by the nation drew attention to the importance of timely implementation of new power generating plants to meet the growing demand. This has also highlighted Sri Lanka's vulnerability to rainfall fluctuations and the limitations of hydropower plants during severe droughts. Regular power cuts take place to curb daily consumption and facilitate conservation of water for power generation, irrigation, and drinking water. Half of the hydroelectric generating capacity is in the Mahaweli cascade (Sri Lanka's largest hydro catchment reservoir), where irrigation requirements determine how the release of water is prioritized, while all hydroelectric capacity has direct or indirect links to town water supply systems. Since the late 1990s, the Government has allowed Independent Power Producers (IPPs) to build, own, and operate power plants to encourage private sector participation in meeting power supply requirements. During the last fifteen years, electricity generation through hydropower has been reduced drastically. In recent years, power shortages have been mainly due to inadequate expansion of thermal capacity and a growing demand for power. To date, the power sector is grappling with financial insolvency and lack of new power generation facilities.[5] This paper will try to introduce environment and energy security from a Sri Lankan perspective covering the concepts, priority areas, institutional arrangements and future directions and also try to find out possibilities for regional cooperation in managing such issues.

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[3] *Economic and Social Statistics of Sri Lanka 2011* - Central Bank Publication, p. 58.

[4] National Energy Policy and Strategies of Sri Lanka Ministry of Power and Energy, Government of Sri Lanka, p. 2.

[5] *Sri Lanka Country Assistance Program Evaluation: Power Sector 2007* Sector Paper of ADB, p.1-2.

Environment and Energy Security in Sri Lanka

The significance of environmental security extends far beyond the environmental sector. Environmental security covers a wide range of subjects: water scarcity, air pollution, energy security, deforestation, natural and man-made disasters, environment sustainability for meeting the Millennium Development Goals. Environmental degradation, resource depletion and natural disasters have direct implications for the security of individual states and the international community as a whole. The impact of environmental damage can pose a threat to global security as well as regional security. At the regional level, security may be threatened as a result of the unsustainable use of shared natural resources, or because of transboundary pollution. South Asia as a region is characterized by extremely high environmental stress resulting from scarcity of water, high urban population density, energy shortages, deforestation air pollution and natural" and man-made disasters.[6]

As a tropical island, Sri Lanka has a high level of bio diversity, abundant water resources, and valuable minerals. However, the environment balance has been threatened by various developments such as unplanned urbanization, increased inhabitation and industrialization.

Following are some of major environmental security issues in the Island. ·

- Land degradation, in the form of decline of arable land, decrease in land fertility and agricultural productivity, loss of irrigation and hydropower potential, is one of most acute problems
- Even though Sri Lanka enjoys plentiful rainfall, some parts of the Island face acute water scarcity. Increased demand resulting from the expansion of the industrial sector not only increases the demand for more water but also pollutes the water available for drinking and irrigation purposes.
- Plantation agriculture has reduced the natural forest cover from 90% about a century ago to 20%. This has also disturbed the natural ecological balance and reduced the fertility of the land in the Island.
- Sea erosion is a major issue in the costal belt of the country where population density is very high. Coral mining, clearing of coastal vegetation, clearing of mangroves, and sand mining in the beach beds are the main activities affecting sea erosion. Haphazard construction and dumping of waste have also led to pollution, coastal erosion and degradation of habitats.

[6]Dr. Syed Rifaat Hussain "Non -Traditional Security (NTS) Challenges in South Asia" www.rsis-ntsasia.org/resources/publications/policy-briefs/.../rcss.doc (accessed on 1st Aug. 2011)

- Biodiversity is being increasingly threatened as a result of excessive habitat patterns and deconstruction of ecosystems due to deforestation, filling of wetlands, over- exploitation of biological resources, deconstruction of coral reefs, and pollution of water sources.
- Solid waste is also a growing problem, particularly in the urban and industrialized areas. The major concern is the waste collection and poor disposal of hazardous and clinical waste.
- Air pollution in Sri Lankan cities is also on the rise. Increasing vehicle usage, lack of infrastructure development in road network, expansion of industrial zones, and use of diesel as the main fuel are some of the main reasons for air pollution in the country.

The Ministry of Environment, Sri Lanka is the main government institution for the management of environment and natural resources in the country. One of its main responsibilities is also to maintain the equilibrium between meeting the demands of economic development and minimizing the exploitation of natural resources for this purpose. From 2005, the Ministry has carried out many activities to address the above issues. Creating awareness among the public, coordinating among all the government and other institutions, designing and implementing environment related regulations and policies, are some of main tasks of the Ministry. However, given the scale and the complexity of the issues, there is a great deal of work that needs to be accomplished by the Ministry.[7]

Sri Lanka as a developing country as well as an island nation in South Asia has several dimensions to consider in managing its environment while ensuring sustainable economic growth. In addition to water security, food security, energy security and human security, it also has to consider other aspects such as natural disaster management, post-war national development and other similar issues. While the Asian Tsunami in 2004 devastated much of the Southern and Eastern coasts of the island, frequent floods, sea erosion, droughts and other natural disasters also continue to pose threats to the country. Therefore, energy security, even though very important, constitutes only one aspect of the environmental security in Sri Lanka. However, in the recent times, energy security has dominated the country's political debate and policy discussions. This is due to the fact that energy security is becoming an important issue for the Island nation and is an area where some considerably important policy decisions are being made. Owing to this background, the focus of this paper is on the energy security of this

[7] www.environmentmin.gov.lk (accessed on 2nd August. 2011)

country. However, it is important to note the link between environment security and energy security in this context.

Key Aspects of Energy Security in Sri Lanka

The power and energy sector in Sri Lanka has created a high level of dialogue among the key stakeholders at the national level. In this context, the country has been able to draw a fairly comprehensive national energy policy. The national energy policy envisages providing basic energy needs, ensuring energy security, promoting energy efficiency, conservation of indigenous resources and adopting an appropriate pricing policy. The government endeavors to reach a minimum level of 10% of grid electricity using non conventional renewable energy by 2015 and 6 % of households to use off-grid electricity systems by the year 2015. The 10 year horizon development framework of the Government which commenced in 2007 emphasizes sustainable development of energy sources & delivery systems at competitive prices. It is targeted at increasing fuel diversity and security through investment in both, conventional sources and non conventional renewable energy. The grid and off- grid energy systems are planned to provide electricity to 98% of households by 2016.Together with economic benefits, renewable resources provide the advantage of achieving ecological efficiencies such as minimizing pollution and mitigating adverse climatic factors through the provision of clean, environment-friendly energy.

Institutional Structure of the Energy Sector

The following institutions are directly involved in the electricity industry in Sri Lanka through the national grid:

Government, regulatory and facilitation agencies

- Ministry of Power and Energy (MOPE)
- Public Utilities Commission (PUCSL)
- Sri Lanka Sustainable Energy Authority (SLSEA)

Electricity Utilities

- Ceylon Electricity Board (CEB)
- Lanka Electricity Company (Pvt) Ltd (LECO)

Independent Power Producers (IPPs)

- 9 thermal IPPs
- About 80 Small Power Producers (SPPs)

In the off-grid services, there is a number of suppliers of solar photovoltaic systems and about 300 community cooperatives developing and managing small village-level hydroelectric systems are active in the country.

Ministry of Power and Energy of the Government of Sri Lanka is the main government body with the mandate to implement government policies related to Electricity and Energy Sectors. Its responsibilities include formulating policies, programmes and projects under the subject of Power & Energy, and all areas that come under the purview of the Institutes within the Ministry. The Sri Lanka Sustainable Energy Authority was established on 01 October 2007, enacting the Sri Lanka Sustainable Energy Authority Act No. 35 of 2007 of the Parliament of Sri Lanka. The SLSEA was established to realize the necessity of having an apex institution to drive Sri Lanka towards a new level of sustainability in energy generation and usage, through increasing indigenous energy and improving energy efficiency within the country. Its mission is to guide the nation in all its efforts to develop indigenous energy resources and conserve energy resources through exploration, facilitation, research & development and knowledge management paving the way for Sri Lanka to gain energy security by protecting natural, human and economic wealth by embracing best sustainability practices.[8]

The electricity supply industry is dominated by state sector institutions, namely the Ceylon Electricity Board (CEB) and Lanka Electricity Company (Pvt) Ltd (LECO). CEB is expected to be divested vertically and horizontally to form one generation company, a single transmission and bulk-power trading company with several distribution companies. A regulatory structure in the form of the Public Utilities Commission of Sri Lanka (PUCSL) is already in place, for all physical infrastructure sectors, inclusive of the electricity and petroleum industries. Although the PUCSL has been already set up under the provisions of the Public Utilities Commission of Sri Lanka Act No. 35 of 2002 to regulate the physical infrastructure sectors, it will be empowered to execute regulation only when the individual industry legislations are enacted and made effective. At present, only the electricity industry, the water service industry and petroleum industry are listed in the PUCSL Act. LPG industry is owned by the private sector except for the contribution of about 15% of the total LPG supply by the state-owned Ceylon Petroleum Corporation (CEYPETCO), which at present is the only player in the petroleum refining business. CEYPETCO is already competing with Lanka Indian Oil Company (Lanka IOC) in petroleum distribution. PUCSL, which will be the future petroleum subsector regulator, will have the authority to decide on

[8] www.energy.gov.lk/ (accessed on 2nd August, 2011)

the future structure of the petroleum sub sector. Unlike the electricity and petroleum sub-sectors, biomass still remains a sub-sector which has not been formally organized. With new developments where contribution of biomass as a primary resource of energy for electricity generation could become substantial, the biomass sub-sector would also become more organized.[9]

Existing Energy Situation in Sri Lanka

Several interesting observations can be made regarding the existing energy mix. Currently, hydropower (8%), petroleum (45%) and Biomass (47%) are the main energy resources in Sri Lanka. Thus indigenous, renewable sources of energy provide 55% of the national primary energy needs. All petroleum products are imported, and used for transport, electricity generation, household, commercial and industrial requirements. Electricity and petroleum products are the main forms of commercial energy, and an increasing amount of biomass is also commercially grown and traded. Total primary energy consumption is around 10,000 kTOE (thousand tonnes of oil equivalent) with per-capita consumption about 0.4toe. Demand will likely to increase to 15,000 kTOE by the year 2020 at an average annual growth rate of about 3%. [10]

Biomass

About 70 % of the national biomass consumption is in the informal sector, for household cooking, small commercial and industrial applications. Biomass use in industry is growing, as a result of price increases in petroleum fuels. The Government has announced a new initiative to grow biomass as a commercial fuel, and an incentive scheme has already been implemented to grow biomass as under-crop in coconut plantations.

Petroleum and Gas

Ceylon Petroleum Corporation (CEYPETCO) imports crude oil and finished products, operates the 50,000 barrels per day refinery, and markets the products in bulk and through retail outlets. Lanka Indian Oil Company (LIOC) imports products and markets them in bulk and through its own retail outlets. Ceylon Petroleum Terminals Ltd (CPSTL), jointly owned by CEYPETCO and LIOC, operate the two main petroleum storage facilities.

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[9] The Electricity Act of 2009 and the Development of the Sector p. 4-5. http://sanvada.org/policyanalysis/sanvada11_15/The%20Impact%20of%20the%20New%20Electricity%20Act.pdf (accessed on 2nd Aug, 2011)

[10] http://power.lk/about-us/energy-policy/ (accessed on 2nd August, 2011)

Electricity

The Ceylon Electricity Board (CEB) and eight independent power producers generate electricity in Sri Lanka, using hydropower and petroleum fuels. In addition, over fifty privately-owned renewable energy-based small power producers, (mostly small hydropower), also sell their electricity to the national grid. CEB operates the high voltage (HV) transmission system and grid substations. Both the CEB and Lanka Electricity Company (LECO) distribute electricity. In 2005, the total electricity sales were 7201 GWh, at an average price of 7.71 LKR/kWh (CEB average) excluding VAT. The national grid serves electricity to an estimated 73.2% of the households, while about 3 % of the households are served by off-grid systems based on solar power or community small hydro/wind/biomass power plants.[11]

Major Problems in the Energy Sector in Sri Lanka

Given this context, Sri Lanka currently is facing multiple problems in its energy sector. Some of these are cumulative problems due to historical reasons as well as due to the country's failure in upgrading the technologies in energy production and distribution. Some of these problems have been due to mismanagement and poor governance of the current institutions in the country. The other major reason is the socio-economic changes and increasing demand for energy, particularly for economic and development activities. The major energy problems faced by Sri Lanka have been listed below.

1. **Inadequate supply of electricity**– The electrification level of Sri Lanka till 2011 is around 75% and the government targets to reach 100% by 2016.[12] However, about 25 % of the population has no electricity at home and this remains a major problem for economic development, poverty alleviation and also as a challenge to empowerment of people in the rural area. Since the percentage is high in conflict affected North and East, the political and ethnic elements of the problem are also significant.
2. **High cost of electricity generation-** The generating system is presently facing a severe crisis and the generation costs are high. With the current energy mix, petroleum contributes to a very high percentage of energy input in generating electricity in the country. Since all petroleum products are imported at global prices, the cost of electricity generation remains very high and the government subsidizes the costs and sells the electricity below the cost of production.
3. **Problems in transmission and distribution** – Sri Lanka has an extensive

[11] http://re-expo.net/SRI/Sri%20Lanka%20-%20Power%20sector.pdf (accessed on 2nd August, 2011)
[12] http://power.lk/about-us/the-ministry/ (accessed on 2nd August, 2011)

transmission and distribution network across the country. Unfortunately, the network is old and technologically outdated. Under-investment and delays are causing severe constraints to the operation resulting in unreliable and poor quality power supply. One of the major reasons for supply failures and frequent maintenance closure is inadequacy of the transmission and distribution network.

4. **High price of electricity –** Pricing policies and strategies is need to be resolved. The cost of producing and delivering electricity exceeds 14 LKR/kWh. The average price of electricity is presently 10.75 LKR/kWh, while being high, is grossly inadequate even to cover the recurrent costs of supply.[13] In addition, the price discrimination among various user groups is also very high and some economists have questioned the practice as it is unhealthy for a balanced socio-economic development of Sri Lanka.
5. **High debt burden of the electricity sector** – In Sri Lanka, government institutions such as the CEB have been mismanaged by various governments that came into power. The appointment of persons on political grounds and the use of these institutions for job creation are common practices. As a result, the electricity supply industry is burdened with a total debt in excess of LKR 90,000 million.[14]
6. **High price of petroleum products-** Since Sri Lanka has to import its total petroleum requirement, the country is highly vulnerable to global price fluctuations**.** Therefore, the rapid increase in petroleum prices affects all sections of the society and the economy.
7. **Corruption and mismanagement -** Corruption and mismanagement of resources in the sector have become very dominant in policy debate.

Evaluation of National Energy Policy and Strategies of Sri Lanka

Sri Lanka revised the National Energy Policy in 2006 and the new strategies consists of: Energy policy Elements, Implementing Strategies and Specific Targets, Milestones and Institutional Responsibilities. The policy has been developed with the vision of: Sustainable development of energy resources, conversion facilities and delivery systems to enable access to and use of energy services by the entire population, and the safe, reliable delivery of such energy services at a regionally competitive price through commercially viable

[13] Revving up Sri Lanka's Power Sector 2010 RAM Sector Report Power Industry, p. 10.

[14] http://www.treasury.gov.lk/docs/MahindaChintanaTenYearDevelopmentPlan.pdf (accessed on 3rd August, 2011

institutions subjected to independent regulation.[15]

The major guiding policy elements are:

1. Providing basic energy needs
2. Ensuring energy security
3. Promoting energy efficiency and conservation
4. Promoting indigenous resources
5. Adopting an appropriate pricing policy
6. Enhancing energy sector management capacity
7. Consumer protection and ensuring a legal playing field
8. Enhancing the quality of energy services
9. Protection from adverse environmental impacts of energy facilities [16]

The national energy policy is a comprehensive and well written document. This was prepared by the Ministry of Power and Energy of Sri Lanka in 2006 with the view to revising it by the end of three years that is in 2010. Unfortunately, this policy revision has not occurred and the targets and other milestones in the document remain outdated. However, the 2006 policy still remains officially valid. The problem with an outdated policy is that, it does not reflect new realities in the country, particularly changes in the post-war scenario. Changes in the government and also the reshuffle of the cabinet can be identified as the main reason for non-implementation of the policy to a satisfactionary level. High unionization of the sector employees, inefficient management and poor user education and awareness level are also reasons for the policy implementation being unsuccessful. The current minister in charge of power & energy has declared to accelerate the proposed changes in the ministry and in the sector as well.[17]

However, results are slow to come due to controversial changes being suggested. There are some issues faced by the sector which have forced the policy makers to focus more on "fire fighting" than attending to long term policy changes. After all in Sri Lanka, it is common to see well prepared policy documents not implemented at all or implemented partially. The other key issue is that national policies are prepared without consulting other relevant ministries. The energy policy for example has implications on water policy and environmental policies in the

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[15] http://power.lk/about-us/vision-mission/ (accessed on 3rd August, 2011)

[16] *National Energy Policy and Strategies of Sri Lanka*, Ministry of Power and Energy Government of Sri Lanka

[17] http://power.lk/about-us/hon-ministers-message/ (accessed on 3rd August, 2011)

country but different policies have been prepared without cross consultation, hence allowing some inconsistencies.

Renewable Energy in Sri Lanka

All over the world, renewable energy sources are becoming important due to scarcity of petroleum and other non-renewable sources, climate change and the increasing requirements placed on sustainable development. Sri Lanka has also commenced using Non- Conventional Renewable Energy (NCRE) in a limited way and presently accounts for around 3% of the energy mix.

A combination of factors has contributed towards focusing on generating electricity through non conventional renewable sources. Electrification of rural areas involves high capital investment, operational costs and the difficulties associated with extending grid connected electricity lines to remote areas. In this context, renewable sources of energy including solar power, small scale hydro power have emerged as an economical and sustainable alternative source to promote medium term electricity generation to the rural populace, albeit in small measures.

The National Energy Policy emphasizes sustainable development of energy sources & delivery systems at competitive prices. It has identified fuel diversity as a strategic objective and renewable energy development to be a part of this strategy. NCRE generating facilities have been commercially developed by private investors since 1996, based on a standard power purchase agreement with the CEB. This concession is offered to all power plants using a renewable source of energy or waste heat. The capacity should be less than 10 MW, and the power plants are embedded in the MV distribution network (i.e. they are not connected to the HV network, as in the case of large power plants. Cautious development and management of the NCRE portfolio can assist the CEB to cushion the customer prices in the face of high oil prices while contribution to fulfill the policy of fuel diversity.

According to government sources, the cost of production of electricity by large power plants are obviously attractive than small scale off-grid plants. Promoting use of off-grid renewable power is therefore suitable only to sparsely populated areas where the cost of extending of the grid is cost prohibitive. Use of off-grid electricity brings many advantages compared to other options available. Ability to meet basic needs, cost, controllability, local value addition and employment generation are some of them. Given the many natural resources of the country, there is great potential for generating off-grid electricity. In the case of community

based schemes, the satisfaction gained by the communities is something that is very hard to quantify.

Renewable energy has been recognized by the government as a means of achieving long term stability of energy prices and as a tool for income distribution. Accordingly, the dedicated agency for renewable energy development and energy efficiency of Sri Lanka, the Sustainable Energy Authority (SLSEA) has been established and an Energy Development Fund, by the name of Sri Lanka Sustainable Energy Fund (SLSEF), and a host of other integrative measures has been already been approved by the Government.

The major problem has been the non-implementation of the policy due to political and other reasons. For example Sri Lanka has agreed to increase the clean energy percentage in the energy mix by introducing and encouraging renewable energy and incrementally decreasing petroleum usage and coal for energy production. However, the government continues to build coal driven power plants while the use of petroleum products for energy generation also continues to be high. In addition to these "mix signals", government has not done much to increase awareness and educate the public on the benefits of the renewable energy use. Therefore, the implementation of measures to increase the NCRE is still slow and there is a long way for Sri Lanka to go, if it is to have an optimum renewable energy component in the overall national energy mix.

Regional Cooperation in Energy in South Asia

It has been observed that there has been an increasing trend towards greater connectivity between India and Sri Lanka in the recent past.[18] The Free Trade Agreement signed between Sri Lanka and India in 2000 has achieved considerable success. After a lapse of 30 years due to the war, a new ferry service has been launched recently between the two countries. On December 14, 2011, the first Indian passenger ferry *Scotia Prince* arrived at the Colombo harbour from Tuticorin in India. Another ferry service is due to commence from Rameshwaram in India to Thalaimannar in Sri Lanka.[19]

In the field of energy also, New Delhi and Colombo have agreed to construct an electricity grid interconnection between the two countries. According to the proposed project, 285-km electricity transmission line between Madurai-Danuskody of India via Palk Straight to Thalaimannar and Anuradhapura of Sri

[18] Willie Mendis, "Fukushima Heats the Palk straight," *Island,* 20-04.2011.
[19] "Stepping Stone to SL Naval Hub," *Daily News,* 15.06.2011.

Lanka will be built at an estimated cost of US$ 430 Million.[20] Initially it will have a transmission capacity of 500 MW of power and it could be increased up to 1000 MW by 2016. The proposed construction of the 500 MW coal power plant in Trincomalee by India could also be linked to the grid connection, and when there is a surplus, Sri Lanka can also export power to India.

An electricity grid connection is already in operation between Bhutan and India. There are proposals to build natural gas pipelines connecting Burma, Bangladesh and India on the one hand and Iran, Pakistan, and India on the other. There are also plans to construct 140 km of new power lines to export power from India to Nepal. Even though there are considerable obstacles, Sri Lanka too can greatly benefit from regional cooperation in the energy sector. India can act as a gateway to Sri Lanka, and the construction of an electricity grid connection between the two countries will enable Sri Lanka to enter the Regional power trading market so that the country will be able to purchase electricity at a cheaper price.

Nuclear Power

In addition to India and Pakistan which have been traditional users of nuclear energy for power generation, two other countries in South Asia have expressed their desire to introduce nuclear plants to generate power. Bangladesh expressed its intentions several years back and has also carried out necessary feasibility studies. It was only three years back that Sri Lanka announced its desire to introduce nuclear power generation technology but no feasibility studies have so far been undertaken. Following the Fukushima nuclear disaster, however, scientists as well as other concerned parties have questioned the wisdom of opting for nuclear energy.[21] Power and Energy Minister of Sri Lanka has said that the plan to use nuclear energy for power generation by 2025 would still be an "open option" in Sri Lanka.[22]

Even if Sri Lanka does not resort to the nuclear option, there is still a potential danger from the nuclear plants across the Palk Strait in South India because of close proximity. For example, the cluster of nuclear power plants which is under construction at Kudankulam on the southern tip of India can pose a serious threat to Sri Lanka. "Kudankulam is only 240 km from the west coast of Sri Lanka, in

[20] "India-Sri Lanka HVDC Interconnection" http://en.wikipedia.org/wiki/India_%E2%80%93_Sri_Lanka_HVDC_Interconnection. (accessed June 27,2011)

[21] "Atomic Energy for Lanka, the Debate Goes on…" *Nation*, 20.03.2011; "Nuclear Power for Sri Lanka?" *Sunday Island,* 26.062011.`

[22] "Nuclear Energy here – An open Option," *Sunday Observer,* 03-04-2011.

line with Puttalam. If any of the 8 nuclear plants, being constructed or planned there develops a radiation leak due to some unforeseen reason, its impact would be felt directly by Sri Lanka."[23] As a precautionary measure, the Sri Lanka Atomic Energy Authority has proposed to the Ministry of Power and Energy that the Sri Lankan Government should reach a Memorandum of understanding (MOU) with India over possible safeguards in the event of a nuclear accident.[24]

Conclusion

Sri Lanka has made significant achievements in meeting country's energy needs. The country has one of the highest percentages of electrification in comparison to other South Asian countries and it does not experience regular power cuts as commonly seen in some of other countries in the region. The country has been able to overcome major power crises situations which prevailed during the last two decades. The Island nation has a national grid with extensive coverage and the most of the "off grid areas" are provided with alternative energy solutions. Sri Lanka has also initiated using non-conventional renewable energy to meet its energy demands. With all of the above achievements, energy is still one of most challenging sectors for policy makers in Sri Lanka.

Sri Lanka has been able to design a comprehensive national energy policy with well defined strategies and implementable actions. Political leadership in Sri Lanka has paid special attention to problems prevailing in the sector. The country has created national level discussions and debate about on energy sector development, particularly on the major problems of the sector and on the emerging needs of energy for Sri Lankan society with the active participation of civil society, donor agencies, citizen and government institutions. However, recent developments such as high economic and industrial growth have changed energy demand in the postwar era and frequent droughts and natural disasters have brought new challenges in ensuring energy security in the Island nation. This situation has been intensified by other external factors such as rising global oil prices, climate change and the need for environmentally friendly development models.

In addition to the energy sector, the area of environmental security issue also presents a new challenge to Sri Lanka. Land degradation, deforestation, sea erosion, threatened bio-diversity, air and water pollution are some of the major

[23] Janaka Ratnasiri, "India's nuclear Power Programme and Its Threat to Sri Lanka," *Island,* 16.03.2011.
[24] "Nuclear Plants in South India: SL seeks MoU," *Island,* 16.04.2011.

environmental challenges. The country has designed and developed extensive policies and strategies to overcome these concerns and address these issues. Sri Lanka has established a set of specialized institutions, introduced several Acts and Regulations and developed relevant capacities and technical expertise to address these challenges. However, due to complexities and far reaching implications, the changes are slow to happen and hence the next few years are crucial for developing a dynamic energy sector and ensuring environmental security in the country. Involvement of the public in policy making, transparency of implementation and monitoring processes and awareness building among main stakeholders are far from satisfactory. In addition to corruption, mismanagement of public resources and lack of commitment by the country's leadership in implementing agreed policies and strategies are also concerns. Therefore, innovative approaches towards introducing best practices in energy and environmental management are crucial for Sri Lanka.

As a member state of South Asia, there are several important areas where Sri Lanka can collaborate with its neighbors in managing environmental and energy security issues. Since the energy sector is undergoing a dynamic transformation in South Asia, it is one of the most relevant sectors where the countries can learn from each other. Co-operation is needed as most of the countries in the region are facing similar challenges in energy and environment security. However, local priorities and ground realties differ in each country. Therefore Sri Lanka should collaborate and cooperate with its neighbors in creating a "win-win situation" for energy security in South Asia. SAARC as the main regional body in South Asia can play a major role as a facilitator and enabler in such collaborative efforts. SAARC should initiate energy and environment security initiatives (e.g. energy charter) as regional dialogues and drive member countries to achieve the desired results as regional groups and at the same time SAARC can act as the facilitator to share best practices and country specific success stories among member countries.

Recommendations

1. **Implement Proposed Sector Reforms and Measure the Performance**

Sri Lanka has proposed and initiated reforms in the energy sector at the national level as defined by the National Energy Policy of 2006. Unfortunately, such reforms are either slow moving or have been halted due to various reasons. It is understood that such changes are complex and challenging due to political implications, heavy cost involved, and expertise required. However, it is crucial that the reforms are continuously implemented to overcome current and future

challenges of the energy sector and to enable an environment for a dynamic energy sector. It is also important to monitor measures and communicate the performance of policies implemented to ensure continuous improvements of service delivery of the energy sector while maintaining the momentum of changes and reforms.

2. Propose Integrated Solutions to Energy problems

Solutions to energy should not be limited to sector related solutions and should be integrated solutions considering relevant other sectors such as water, environment and economic development. Therefore policy decisions should be taken at a high level by cross functional teams such as cross-ministerial committees rather than line ministries.

3. Increase NCRE Component in the Energy Mix

Renewable energy has been recognized by the government as a means of achieving long term stability of energy prices and a tool for income distribution. However, the major problem has been the non-implementation of the policy due to the lack of political will. The high cost of initial investment, lack of proven technology and expertise are also reasons for this. Therefore, concrete actions should be taken to increase the clean energy percentage in the energy mix by introducing and encouraging renewable energy and incrementally decreasing petroleum usage and coal for energy production. While the government should show its commitment to such policies to enhance these projects, it is also necessary to increase awareness and to educate the public on the real benefits of the renewable energy use. Specific incentives and schemes should be created for people to shift into NCRE sources. Sri Lanka should try to become the "green energy hub in South Asia" and it can draw from best practices of other countries in the world where concepts of "green energy" and "green economy" are practiced rigorously.

4. Make Investments to Reduce Network Losses

CEB's network losses are lower compared to its counterparts in other South Asian countries. The Government and CEB have persistently taken actions to further reduce losses. Loss reduction is still a prime area for immediate investments due to high cost of power generation and the economic value of energy lost. The national energy policy and the 10-year development framework emphasize the need for concerted efforts to reduce network losses. However, implementation of this plan lagged behind the requirements due to the financial constraints faced by CEB. Therefore, innovative approaches are required to address this issue by focusing on energy monitoring and information management which also involves the private

sector players.

5. Improve Industrial Relations in the Energy Sector

The energy sector is a highly unionized one and it needs to pay special attention to union-related problems such as negotiations of collective agreement, hiring and firing schemes, and implementations of new acts and regulations. Therefore, special strategies should be designed to manage such problems and create a "win win" situation for all the stakeholders of the sector.

6. Redesign Energy Pricing Strategy

The current energy pricing policy in Sri Lanka is inefficient and ineffective. Price discrimination among various user groups is not conducive to the economic growth of the country. Industries in particular, complain that the energy pricing in Sri Lanka makes them non-competitive in the global markets and that there should be changes in the pricing policy. Policy makers should revisit current pricing mechanisms and should design new strategies to introduce more efficient pricing policies to various user groups by also considering pricing competitiveness at a regional level.

7. Improve Financial Performance of the Institutions

Even though in 2010 the financial performance of CEB has improved, it is still running on an operational loss. In addition, CEB is perceived as a highly inefficient and corrupt institution. Therefore, it is important to take necessary action to continuously improve the financial performance of the organization and implement policies and practices to create a "clean image" for the organization.

8. Encourage and Enhance Private Sector Participation in Energy Sector

A fundamental problem in Sri Lanka's electricity generating system has been its inability to diversify into inexpensive fuels. Plans and efforts by CEB were repeatedly hampered by a mix of political, commercial, social, and environmental pressure groups, as well as excessive expectations that the private sector would come forward to build large, lower-cost base load power plants. Opportunities exist for the Government to promote private sector participation in power generation, as part of an overall strategy to implement a least-cost development plan for the power sector that would help stabilize electricity tariffs. Such opportunities include considerations for the development of fuel delivery and power transmission infrastructure to create an enabling environment for prospective IPPs to participate in large scale, base load power plant investments.

9. Increase Public Engagement in Decision Making Process in Energy Sector Policy Making

As discussed, the current level of engagement and awareness of the general population in the energy sector's decision making process at the national level is fairly limited. Some of the reasons for this have been the complexities in the sector, the high level of technology involved, and also the scale and structure of the sector itself., Specific measures should be adopted by the policy makers to increase awareness among people and to educate the public on specific challenges faced by sector and how the country should face such challenges as a nation. It is also important to engage people in the decision making, policy design and implementation process.

10. Develop a National Information System (NIS) on Energy and Environment Resources

One of the major problems the country faces is the lack of data and information on energy and environment. Therefore, a comprehensive NIS should be developed to include data such as sources, consumption patterns over time, decisions made and forecasts. A comprehensive NIS can be built by sharing information already available at various institutions working in the energy and environment sectors and other national and international agencies and institutions carrying out research on relevant issues. A useful NIS can be valuable to policy decision making and it should be made available in public domain as a measure of transparency and governance . Such a system can also be a basis for a Regional South Asian Information System in the future.

11. Educate the Public in Better Energy Management and Consumption Practices

One of most difficult yet important aspects in energy management is managing demand by changing consumption patterns and consumer behavior. These efforts can contribute greatly towards overall energy saving in the country. The public should be educated about good energy consumption and saving practices. Public awareness campaigns and other communication strategies should be carried out with the aim of reaching defined targets. In addition to traditional media, emerging web based technologies can be used for such a purpose.

12. Promote Regional Cooperation in the Energy Sector

Sri Lanka and India have already launched a project to construct an electricity grid connection between the two countries. Power generation costs in Sri Lanka are

much higher than in India. Power transmission and interconnection may offer commercial opportunities for trade between the two countries. The possibility of power interconnection can potentially attract public sector-private sector partnerships and investments. Several South Asian countries have either proposed or already launched similar projects with India, and therefore, the construction of an electricity grid between Sri Lanka and India will enable the island nation to enter into the regional power trading market.

13. Actively Engage in the Nuclear Debate in South Asia

Even after the Fukushima disaster, Sri Lankan government maintains that the plan to use nuclear energy for power generation by 2025 would still be an "open option." It is however clear that the government is not actively pursuing the nuclear option due to safety concerns, technological and financial constraints. Even if Sri Lanka does not have nuclear plants within its territorial limits, there is still a potential danger from the nuclear plants across the Palk Strait in South India because of close proximity. As a confidence building measure, it is desirable to reach a Memorandum of Understanding (MOU) between the two countries over possible safeguards in the event of a nuclear accident. Sri Lanka should also keep itself actively engaged in the nuclear debate and discussion in South Asia as it can have a significant impact on the country's energy sector.

14. Sign a South Asian Energy Charter

In December 1991 the EU signed an Energy Charter Declaration for the purpose of providing legal safeguards for investment, transit and trade. The European Energy Charter Treaty provides a model for South Asia. Since South Asian governments as well as investors have fears and apprehensions about possible adverse repercussions arising out of regime changes and inter-state conflicts, it is necessary to have confidence-building measures as well as legal safeguards to ensure long term planning and investments. The signing of a South Asian Energy Charter will be an important measure in this regard.

PART- II

ENERGY AND ENVIRONMENTAL SECURITY: TOWARDS REGIONAL COOPERATION

Chapter 7

Regional Approach: Water as Cooperation

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Though in South Asia, there have been two major treaties of sharing water between India and Pakistan, and India and Bangladesh on two major systems – the Indus and the Ganges, the region is still far behind reaching an understanding on water sharing at the bilateral level. Though there is no major regional understanding yet on sharing the river waters, existing agreements at national level within the South Asian countries are far from satisfactory.

While the failure to share waters of major and minor river systems between and within the countries in South Asia is a major issue, access to clean water, augmenting the existing resources, and avoid water wastage is a bigger issue. Clearly South Asia lacks water governance.

This essay focuses on the problems of water governance, and what could be done to improve the situation. This essay primarily draws from the examples of water sharing in India and Pakistan at the national level, and India-Pakistan at bilateral levels.

Water Governance: Understanding the Problematique[1]

While South Asia has signed multiple agreements at the national and bilateral levels, it is yet to move into the next phase, of how water could be governed. The main issues of water governance include the failure of agreements, absence of technical research, securitization of water debate,

Securitizing the Water Debate[2]

In recent years, there has been a growing fear that future wars at the global level will be fought over resources. A substantial section in South Asia, especially in Pakistan, believes that the next Indo-Pak war will be fought over the Indus waters. Suddenly, one sees a mushrooming of 'water wars' literature during the last decade.

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[1] The author is writing a series of articles titled "Indus Waters Governance." The first part of this essay is primarily drawn from his earlier writings on the subject.

[2] This section is drawn from an earlier article written by the author. See "Don't Securitize the Water Debate," http://www.ipcs.org/article/pakistan/indus-waters-governance-iv-dont-securitize-the-water-debate-3224.html.

Undoubtedly, there have been problems and crises over water in South Asia between nation-states and within each country at State/Provincial levels. But then, most of these crises have been handled politically. There have not been perfect solutions, but attempts towards an understanding and reconciliation. There are still issues between Tamil Nadu and Karnataka, (Indian) Punjab and Haryana, Sindh and (Pakistani) Punjab within India and Pakistan, and at bilateral levels between these two countries.[3] But the negotiations on these issues have not broken down.

On the other hand, there have been success stories as well; the Ganges agreement between India and Bangladesh at the South Asian regional level, and the Mekong River Basin at the international level are great examples of cooperation at bilateral and multilateral levels. Then, where does the 'water wars' theory emanate from?

In the last two decades, there has been extra emphasis on 'securitizing' bilateral and international issues. From food to environment, every issue has been elevated to a security issue. The concept of security has become elastic and extended itself to include everything in its ambit. Unfortunately, this process has gone too far, and has started trivializing issues instead. In the near future, one is likely to hear (if they have not already) of traffic security, garbage security and so on. As a result of this process, new scholars emerged with new (and possibly damaging) literature, on water cooperation.

Second, in the regional context in South Asia, there has been a deliberate effort, to project water as a security issue. Unfortunately, this could prove to be counter-productive. For example, there are a set of actors, for whom, water is their livelihood. This includes primarily those people who are directly engaged in agriculture and agricultural activities. Then, there are another set of actors, who may also need water for their daily use, but whose livelihoods are not directly dependent on it.

For centuries, the 'Water Actors', mainly the farmers, have evolved an understanding and have lived with the other community, irrespective of whether they are upper or lower riparian. Despite occasional problems, they have evolved ways and means to address the water crises – be it floods or drought. Even today, if left up to them, the problem of scarcity or floods would be addressed amicably.

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[3] See TS Subramanian, "Cauvery pressures," http://www.hindu.com/fline/fl1822/18220440.htm; "Karnataka pledges to release more Cauvery water to Tamil Nadu," The Hindu, 25 August 2010; "Karnataka pledges to release more Cauvery water to Tamil Nadu," http://www.deccanherald.com/content/81221/punjab-unleashes-water-war.html; "Punjab, Haryana too fight water wars," Times of India, 7 June 2004; "The Cauvery Water Dispute," The Outlook, 6 February 2007;

Unfortunately, in South Asia, over the last decade, there has emerged a new wave of 'Non-Water Actors' who attempt to monopolize the water debate and hijack it from those who are actually at the receiving end. Media, Security experts, certain social organizations, militant groups, and even cine-actors - have taken the water issue from the farmers, and harp on about it incessantly, regardless of the fact that they are not directly related to the issue. For example, the Tamil cine actors went on a strike demanding water from Karnataka, and certain media publications in Pakistan repeatedly publish factually incorrect stories in the front page accusing India of stealing their waters.[4] Amidst the human calamity in Pakistan, owing to the floods, a leading national daily, for almost one week was trying to drum up support for the building of the Kalabagh dam, by asking people to vote for its referendum!

Such efforts receive wide publicity, thanks to the reach of print and electronic media, which then starts a process, drawing in other non-water actors into the debate. In this mayhem, the original demand and the voice of the water-actors get dissipated. In fact, they may have a better understanding on how to resolve the issue, but they tend to get steadily pushed out to a point where they no longer have a say in the matter, or if they do, they cannot be heard.

This 'securitization of water debate' in South Asia, especially in India and Pakistan at the national and bilateral levels, has created a lobby, who then tries to impose their solutions and perceptions as the best one for the water actors. A farmer in Larkana (in Sindh) and in Tanjore (in Tamil Nadu) districts, may have a different problem and a different solution. But then, the securitization of water debate by the media and security experts, has already taken the problem away from the original victim.

The State remains both a silent spectator and an indirect instigator. In certain cases, the State and its institutions are simply inefficient to address the issue; for example, in Pakistan, the failure of WAPDA and the IRSA, has given rise to a set of problems over water sharing, which is now being seized by the non-water actors. In other cases, the States and the provinces, deliberately allow this issue to be taken over, so that they may use this as a bargaining chip in negotiations at the bilateral level between India and Pakistan, or vis-à-vis the federal governments within India and Pakistan.

Securitizing the water debate is a dangerous trend; and unfortunately, this will continue. The State has to arrest this by taking over the debate, and allowing the water actors to be the primary negotiators of the problem.

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[4] "Troubled waters," www.hindu.com/fline/fl2508/stories/20080425250802800.htm

Water Sharing: The Problems Within[5]

The Provincial Assembly of Punjab in Pakistan passed a resolution in October 2010 recommending the federal government to build the controversial Kalabagh dam. According to the resolution, tabled by Chaudhry Zaheeruddin, the Leader of Opposition, "This house (Provincial Assembly of Punjab) recommends to the federal government that as experts say that the Kalabagh dam is feasible and beneficial for entire Pakistan, therefore, it should start its efforts for developing a consensus among all the four provinces for its earliest construction."[6]

There have been numerous other resolutions passed by the Provincial Assemblies of Sindh, Balochistan and the NWFP in Pakistan, relating to the sharing of Indus Waters. In India, the J&K Legislative Assembly has passed a resolution demanding the scrapping of the Indus Waters Treaty signed between India and Pakistan. While every provincial legislative assembly has the right to protect its own interest and pass resolutions, will such an approach lead to resolving the water crisis between the various stakeholders and improve the water governance? Or should there be a political consensus, following a societal consensus on sharing waters amongst the stakeholders?

While the above mentioned resolution is related to the construction of Kalabagh dam, the problem is actually relating to the sharing of Indus waters between various provinces within Pakistan. Construction of Kalabagh dam and its opposition is only an expression of a deeper misunderstanding.

The Provincial Assembly of Sindh, since 1994 has passed a series of resolutions against the construction of Kalabagh dam and the Greater Thal Canal. The latest was during June 2010, when all the members of the Sindh Provincial Assembly passed a unanimous resolution, rejecting the construction of the Kalabagh dam. When the resolution was about to be tabled by one of its ministers in the Provincial Assembly, the MQM suggested that it should be moved by every member present in the house, including the PPP, MQM and PML-F, thus projecting a common stand cutting across the party lines.[7]

The unanimous resolution in Sindh Provincial Assembly against the construction of Kalabagh dam, followed an acrimonious debate in the national parliament, where a suggestion to construct the dam was opposed by members from the

[5] This section also is drawn from an earlier article written by the author.

[6] Dawn, 6 October 2010.

[7] Daily Times, 17 June 2010

smaller provinces.[8] While the PML-N and PML-Q in the Parliament, cutting across their party lines, came together in demanding the construction of the dam, PPP, ANP and MQM came together against the dam, cutting across both provincial and party lines. In fact, the pro-dam section consider the opposition to the project as being "anti-national", those who oppose the dam consider the project as the negation of democracy and federal structure of the country.[9]

Similarly, in India the state legislatures passed unanimous resolutions over the sharing of waters between Tamil Nadu and Karnataka. Tamil Nadu, being a lower riparian, passed repeated resolutions in the legislative assemblies as a way to pressurize the government of Karnataka and the Union government of India.[10]

Within India, in 2002, there was a heated debate in the J&K Legislative Assembly on the Indus Waters Treaty; cutting across the partly lines, the members called for the scrapping of the treaty. Tarigami, a CPM legislator, was quoted saying, "We are suffering because of Pakistan's water needs. Fine, compensate us for what we have lost. And if you cannot do that, review the situation. After all, people make laws."

Undoubtedly, Legislative Assemblies and Parliaments are ideal forums to discuss issues of importance; every legislature has the right to pass acts and resolutions. Especially, if there is unanimity within the legislature, such an initiative and its outcome should be considered as of high importance and utility. But on the water issue, is it prudent to pursue such a course of action?

While the legislatures are legally correct in pursing such an option, it would be useful to generate a debate at the societal level and reach a political consensus outside the Provincial Assemblies and Parliaments. Legislative resolutions, passed without political consensus create a negative impact at the societal levels; it also encourages the hard liners to use such resolutions to create hysteria, thereby undermining any political consensus. In terms of sharing waters or building dams, a legislative resolution, even in advisory nature is perceived as a legal document, with negative consequences.

It would be useful and prudent to avoid water debates in the legislatures. Instead the various stakeholders should be allowed to meet at the Track-II level, between the provinces and between states. It is imperative to create a societal consensus

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[8] Daily Times, 17 June 2010

[9] "Troubled waters," www.hindu.com/fline/fl2508/stories/20080425250802800.htm

[10] Praveen Swami, "A Treaty Questioned," Frontline, 10 May 2002

outside the legislature; given the vertical divide on provincial lines within the legislatures on water issues, such a course will only complicate the problem.

On water issues, the legislatures should attempt to build a consensus outside, and pass a resolution based on it, instead of moving a resolution first and trying to create a consensus for the same.

Crisis of Institutions[11]

One of the primary problems in sharing waters has been the failure of institutions, especially those which are responsible for water governance in South Asia. For example, in India and Pakistan, besides the Indus Waters Commissions in India and Pakistan, within Pakistan, two institutions/organizations responsible for effective water governance include the Water and Power Development Authority (WAPDA) and the Indus River Authority System (IRSA).[12]

The crisis during the 2010-11, within the IRSA in Pakistan over the opening (and closure) of Chashma-Jhelum link canal, highlights the problem of institutions that govern water sharing. The IRSA is primarily a five member body, with four representatives - each representing Punjab, Sindh, Balochistan and the NWFP, and the fifth representative nominated by the federal government. For the last few months, IRSA has been witnessing numerous dramas in terms of its functioning.

Consider the following events since January 2010 in the IRSA. In early February a meeting was convened to discuss Punjab's water drawing in December 2009. Punjab requested opening the Chashma-Jhelum link canal and for allowing it to draw more water. This meeting was a disaster; Punjab's member of the IRSA walked out, as other representatives from Sindh, Balochistan and the federation (who also belong to Sindh) opposed the former's proposal. Instead, Sindh wanted that Punjab should first compensate for the additional water it drew in December 2009. Subsequently, when the IRSA decided with a majority vote (with Punjab, Balochistan and NWFP) against that of Sindh and the federal member, to accede to Punjab's demand, the IRSA member from Sindh reported that his province would withdraw from the IRSA. Balochistan, on the other hand withdrew its member to the IRSA, for voting along with Punjab.

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[11] See D. Suba Chandran, "Crisis of Institutions," http://www.ipcs.org/article/pakistan/indus-waters-governance-i-crisis-of-institutions-3191.html. This section primarily draws from an earlier article by the author.

[12] Though this section primarily deals with the problems faced by the IRSA in Pakistan, it is taken only as an example. Most of the institutions dealing with water governance in South Asia, face the same problem.

The issue within the IRSA heated up again during May-July, mainly between Punjab and Sindh. In May 2010, the government of Punjab asked its representative not to attend the IRSA meeting, accusing the IRSA and Sindh for engaging in fudging the actual figures and politicizing the issue. In June 2010, the Chairman of IRSA – Aman Gul Khattak (from NWFP) resigned the post, as he could not convince the members to reach any understanding in terms of water sharing, especially the opening of CJ Canal.

In early July, the acting Chairman of the IRSA (who belongs to Punjab) unilaterally allowed the opening of CJ Canal. Members from Sindh and Balochistan resigned from the IRSA, following the unanimous decision of the acting Chairman. The federal member of the IRSA (who belongs to Sindh) also resigned.

Where does the problem lie? Why cannot the IRSA perform its duties, after all, it was agreed upon by all the four provinces to work together, following the Water Apportionment Agreement in 1991? The following three issues constitute the primary problem and detract the IRSA from being an effective organization.

Though the members of the IRSA are appointed by the respective provinces, they are qualified engineers and are expected to work together efficiently in water sharing according to the 1991 agreement. Unfortunately, the provincial politics and differences creep into the functioning of the IRSA. Especially, if there are different political parties at the federal and provincial levels, the political understanding plays an important role in the performance of the IRSA.

Today, though a coalition partner at the federal level, PML-N sees itself as an opposition vis-à-vis the PPP. The fact that the PML-N and PPP are leading the provincial assemblies in Punjab and Sindh respectively, also play an important role in hindering the IRSA from delivering on its duties.

Corruption in the institutions dealing with water is another major issue within. The engineers at the local level, who are supposed to supervise the telemetry system, are considered highly corrupt. The telemetry installed during Musharraf's period with a huge cost, is purposefully allowed to rot, as the engineers are bribed by local feudal lords to ensure the system does not work. The telemetry system is supposed to provide actual information and data on water distribution. Sindh considers this as a deliberate ploy, leading to water theft.

One of the greatest failures of IRSA and WAPDA (Water and Power Development Authority) is relating to governance. Today, both the institutions are

considered as inefficient, corrupt and biased. WAPDA is seen as more corrupt, while the IRSA as more biased

Differences between upper and lower riparian regions are nothing new in sharing of the waters. This is a universal problem, which one could witness in the neighbouring region and at the global level. What makes the situation unique in Pakistan, in the context of IRSA, is the ganging up of smaller provinces, which also happen to be the lower riparian. Perceptions, rather than facts, determine any proposal or idea to share the waters.

IRSA will remain ineffective, as long as its members are politicized and marred by bad governance. The case of WAPDA is slightly different, but again highlights the problems of institutions that deal with water sharing. An effort to strengthen water sharing should focus on strengthening the administrative, legal and political institutions/organizations/structures of waters.

As mentioned earlier, though the IRSA was given the primary attention in dealing with problems afflicting the institutions, by no means, IRSA is the only institution. Other institutions in South Asia – both at the national and provincial levels, face the same problem of governance.

From Water as Conflict to an Agent of Cooperation: Building Water Communities

South Asia, as a region has to address its water security through political and technical cooperation, besides learning from other regions. Politically, the region will have to invest in building confidence and building the multiple communities together. Technically, the region will have to invest in studying numerous issues and challenges arising out of climate change, water scarcity, floods and famines. Finally, the region will also have to invest in learning from the best practices of other regions; from Mekong basin to the Amazon, there have been multiple success stories in jointly harnessing the water resources.

Avoid Water War Discourse

The first major regional initiative should be aimed at reducing the discourse and rhetoric of water wars both at the national and regional levels. In particular in Pakistan and India, there are numerous problems between the provinces and states in terms of sharing the waters.

The water war discourse is spread primarily by un-informed people and groups, for narrow political objectives. There is so much of mis-information in the public

domain, not based on any facts, but rather on fears and assumptions. Besides the above two sections, media – both electronic and print, play a vital role in increasing the gap between the communities through mis-information.

The responsibility to address the mis-information primarily lies with the State in South Asia. From Parliament to State and Provincial legislatures, there are multiple forums with substantial representative nature, which could be used by the State to allay fears over water and present data and information based on facts on ground.

The State in South Asia – both at the national and State/Provincial levels should encourage departments/ministries dealing with water to publish White Papers at regular intervals. Besides, the ministries and departments dealing with water, as a routine publish an annual report, as a part of their regular activity. In most cases, this has become a routine affair for the water bureaucracies, which do not understand the potential of these reports in addressing the concerns of the people.

Annual reports of water ministries and departments should be given an added emphasis by the governments at national and regional levels.

De-Securitize the Water Debate

As a part of the above, an immediate requirement is to de-securitize the water debate in South Asia. Unfortunately, during the last few years, a new discourse has found its place with literature based on emotional outbursts and not on substantial facts. "Water Wars" is one such concept, that is increasingly discussed in the public domain in the recent years. For example, there are numerous literature mushroomed in the recent years, that the future Indo-Pak confrontation would be over water.

"Water as a tool" to starve or flood the neighboring region/country is certainly a thesis that is being propounded repeatedly in the recent years. Many in Pakistan argue that India has evil designs to flood or starve Pakistan by building a series of dams like Baglihar across the Chenab river. In fact, there is a plethora of literature – that J&K is neither a territorial nor an ideological dispute between India and Pakistan , but rather a conflict over resources. Many in Pakistan and within Jammu and Kashmir seriously believe today that Kashmir dispute is all about the Indus river and its tributaries. While a section within Pakistan believes that the Indus Waters Treaty is not in their interest, many within J&K believe that India and Pakistan have monopolized their waters.

Another example of securitizing of water issue is what is happening between the

states of Tamil Nadu and Karnataka over sharing the waters of Cauvery, and between the provinces of Punjab and Sindh over the sharing of the Indus. The media, political parties, legislatures, academics and the strategic community in these regions hijack the water debate from the primary end users – the farmers. Without taking into account what the farmers want, or how the primary end users would like to address the problem, on their behalf, multiple actors speak and express freely through the media. Such an expression, in most cases, not based on hard facts, only end up vitiating the environment by pitting one society against the other.

For example, how well informed would be a cine-artists guild, which went on a fasting in Tamil Nadu, pressuring that the government of Karnataka should give the due share of the Tamil farmers? How well informed was the debate in the legislative assemblies of Sindh and Punjab, when legislations were passed against the other, and presented as the will of the people? On both these above cases, the media, especially the regional and vernacular media was split along the ethnic lines and projected a point of view, undermining the other.

There is a strong need to de-securitize the water debate, and address the same based on hard facts and data, and not based on emotions and inherent prejudices against the other community. While in any given society, there are always likely to be differences among the communities divided under provinces and nations, an uninformed debate over water can only increase the divide.

Regional Water Councils

The State should encourage building mutiple regional water councils within every regions at a societal level, where provinces/states sharing the same river basin could debate and discuss multiple issues on a regular basis. While the IRSA in Pakistan is originally designed by the State to play a such a role, over the years it has failed to achieve the primary objective. In India, multiple water tribunals have been established, which also have failed to yield the desired results.

Beyond the governments and courts, there is a need to have formal structures for an informal dialogue between the societies in South Asia. In India, the government has established a Northeastern Council (NEC) to address developmental issues in India's northeastern region. A similar structure is needed, exclusively to debate water issues.

Such a regional council will bring states/provinces sharing the same river basin at the national level to debate issues relating to water. Such initiatives are likely to go

beyond discussing the issue of water sharing.

Track-II Societal Dialogues at three levels

Currently, the dialogue on water is held primarily by the government actors at inter-state and intra-state levels. The track-I dialogue, led primarily by the water bureaucracies represented through the ministries and departments, primarily see water as a political issue, that needs to be resolved.

Since the beginning of civilization in South Asia, especially the growth of agriculture, multiple communities have lived along the river basins, sharing the same waters, without much of technical support. However, there have never been a debate about a possible water wars until recent years. The primary explanation could be, discussions on water was led by the communities and not the governments.

If water issue needs to be addressed in South Asia, the dialogue should be led by the societal actors and not the governmental actors; while the governments see water as a commodity, people see it as a life line. A farmer living across the political boundary whether created by provinces or countries, could understand the feeling, pain and the need relating to a fellow farmer on the other side. Hence, there is a need for a society led dialogue.

This societal dialogue should take place at three levels. First, there should be a dialogue within each country at provincial levels. For example, Sindh and Punjab in Pakistan, Karnataka and Tamilnadu, and Haryana and Punjab (both the above groups in India) should organize intra-state dialogues on waters first. The objective of this dialogue is not only should be aimed at sharing the waters, but also relating to construction of dams and reservoirs along the river.

At the second level, there should be a track-II dialogue between the countries, for example, between India and Pakistan, India and Nepal, and India and Bangladesh. All the above sets of countries have serious problems over sharing the waters. Though there have been treaties signed in the form of Indus Water Treaty (between India and Pakistan), Ganges Water Treaty (between India and Bangladesh), they are adhered more in letter than in spirit. Contracting parties at the State levels have been using the treaties to prevent the other side from pursuing a course of action.

At the third level, there should be a societal dialogue at regional level. The region will have much to learn from each other in terms of best practices and making

optimum use of existing water practices. For example, in South India, the farmers have been extremely successful in using drip irrigation, which makes effective utilization of available water. Similarly, there is a need to study other climatic issues related to water flow and scarcity.

From Treaties to Basin Communities

The above set of dialogues should help build basin communities from treaties. As mentioned above, currently, the societies are highly divided on national and provincial lines in sharing the waters. Societies living along the same river has threatened to wage wars over water sharing.

South Asian has to envision waters as cooperation, than as conflict. Pursuing a "basin community" approach would bring the people closer to each other in terms of sharing the waters and making maximum advantage.

Unfortunately, the existing social relationship between the communities in terms of sharing the waters has been more hostile than cooperation. It is extremely unfortunate that historically, the land that came to be known as India because of the Indus river, is divided over the same river. Civilizations, cities and towns developed along the rivers. In fact, many trains in the sub continent have been named after the rivers. However, still the communities are divided.

How to create a "basin community" feeling among those people who share the same river? Organizing track-II dialogues is one strategy; there could be other strategies – from using the rivers as a part of tourism and create a sense of identity over the waters. From long cruises to floating restaurants, water tourism could be easily encouraged in all major river systems of South Asia. Indus, Ganges and Brahmaputra systems would be able to provide numerous opportunities relating tourism. From river festivals to water sports, rivers could also bring people together and unite them emotionally.

There is an urgent need to carefully craft such opportunities to create a basin community feeling among the people who live along the river systems.

Regional Water Disaster Management Force

During the last few years, some of the SAARC countries have established National Disaster Management Authority (NDMA). While this institution in some countries, for example the NDMA in India is a statutory body and well established with a large vision, sufficient funding support and coordinate between various first responders, other countries, are in different stages of developing a disaster management institution.

In South Asia, the primary problem in any natural disasters has always been linked to the management of post-disaster relief and rehabilitation. Some of the worst natural disasters that stuck the region – in the form of earth quake or floods, many people lost their lives not due to the disaster, but because of the failure of the States to reach out to the victims on time and provide relief. In fact, in many cases, the State could reach the affected areas, only a week after the disaster.

The primary problem in disaster management – has been related to the creation of a well coordinated institution, with sufficient man power, equipments, training and supplies. More importantly, there cannot be a single hand book of disaster management, which can become the bible; each region is unique and have different set of issues and problems arising out of a disaster situation. For example, in the developed world, there is a mandatory time limit, expecting the State authorities, especially the emergency services – from ambulance to fire engines, irrespective of the remoteness of the region where the disaster has stuck, to be present within an hour. The healthcare industry in most of Europe and North America is well developed. More importantly, the engineering revolution in the above regions in terms of laying roads and clearing them, and related machines and methodologies to move disaster management team from one place to another, have bypassed South Asia.

The South Asian region, unfortunately still work with primitive measures and methodologies in dealing with disasters. The region is yet to evolve a hand book of disaster management; there is so much each country could learn from each other in preparing such a hand book.

While India has an experience in building an institution, Bangladesh, Nepal and Pakistan have enormous experience in facing floods and providing relief. The region has a dire need and sufficient expertise to build a handbook of disaster management relating to water, and more importantly to create a water disaster management force, which could be rapidly deployed within hours.

Regional Technical Centers to study Climate Change and Water Flow

Multiple regional centers have been established under the auspices of the SAARC. On similar pattern, the region should try to establish a regional center to study climate change and water flow. Such a center should be a technical center, collecting and providing sufficient data, well in advance.

Such a technical center in South Asia should not only focus narrowly on cyclone and flood warning, but also on the entire spectrum of water issues. Availability of

credible data has always been a primary problem in water sharing; though multiple departments and agencies within every government is responsible for data collection and dissemination, the second aspect needs considerable attention.

Given the level of technical sophistication – from telemetry to satellites, availability of water and flow in the river systems, extent of the severity of floods and cyclones and related problems can be identified and disseminated, thus avoiding any mis-information.

Conclusions: Joint Management to Augment Water Resources

One of the biggest problems in South Asia relating to water sharing between the countries, has been the attempt to divide rivers or the water share, and consider at "my waters". The need today is the jointly augment the available water resources, than to divide them in strict jackets based on a treaty.

The treaty approach, which has been the primary model to "divide" and "use" the waters by respective societies have only increased the divide between the provinces and states in South Asia. Continued emphasis on the "letter" of such treaties, rather than the "spirit" behind such understandings, have only polarized the societies further.

Unfortunately in South Asia, the countries have reached an understanding, signed a treaty and have been fighting over whether the other side has violated it or not. There is a need to jointly augment the water resources, both through and outside the treaties. Closer to South Asia, the Mekong river basin provides an example of how the countries in a region could jointly augment the water resources and make full use of the river basins.

There is an urgent need in South Asia to build water communities; this would avoid the water wars rhetoric and help South Asia to cooperate in sharing the waters.

Let the societies not burn over waters!

Chapter 8

Towards a Gas Corridor in South Asia: Overcoming the Challenges

Maj. Gen. ANM Muniruzzaman

Introduction

Energy is the *sine qua non* of development. In the generation of wealth and significant economic progress it is a prime agent. Historically, energy trade holds a special place in world affairs. The demand of energy and its required supply accordingly remains a yardstick in economic progress of states. Likewise, states in South Asia while have shown significant economic growth in recent years, they are in great need of maintaining an equilibrium in both supply and demand side. In the last decade or so, the issue of a regional energy corridor therefore became a much debated topic in South Asia. On the other hand, as the issue of sustainability in environment and development has come to the fore front of global agenda, the use of natural gas as source of energy has obtained a special place for its economic and environment friendly dimension. Economists predict that, natural gas will supply the major share of incremental global energy requirements between now and 2030. The abundance of natural gas, worldwide as well as domestically, coupled with its environmental soundness and multiple applications across all sectors, means that natural gas will continue to play an increasingly important role in meeting demand for energy. In this regard even though South Asia lacks adequate production of natural gas, it abuts some states which rank high on global gas reserves. This brings it a historic opportunity to import surplus gas from these countries. In the last decade and now, at the policy level, the issue of regional gas corridor through pipeline coming from the Gulf and Central Asia to South Asia has got much importance**.** A number of gas pipeline projects therefore saw progress. However though theas opportunity to import gas from outer regions is abundant, so are the challenges that involve effective implementation. Financing, supplying necessary physical infrastructure, technical maintenance, security of pipelines, influence of external players, environmental and human rights remain major barriers.

This paper, therefore, makes an attempt to articulate discussion on the future energy demand of South Asia. It looks at the challenges that are likely to come in the implementation of gas-pipeline projects in this region. Finally it focuses on a meaningful and multilateral energy regimes addressing the distinct needs of all

countries and regulating the energy cooperation to meet for future energy security in South Asia.

The Future Energy Need of South Asia

The economy of South Asia is rapidly growing. The demand of energy is also equally increasing. In recent years, the region has shown an accelerated rate of real GDP growth. The World Bank Global Economic Prospect Report, January 2011, gives an idea of faster aggregate growth rate of South Asia to an estimated 8.7 percent in FY2010-11 from 7.0 percent in FY2009-10. On a calendar year basis, GDP for the region as a whole is estimated to have expanded 8.4 percent in 2010 after 5.3 percent in 2009 excluding India which represents 80 percent of the regional GDP.[13] Individually, India is persistently showing GDP growth of 6 to 9per cent per annum in recent years. Afghanistan is showing rapid economic growth of about 8per cent because of pouring in of huge amount of external assistance. Bangladesh ranks third with about 6per cent of GDP growth in 2009-10. Bhutan shows a GDP growth rate of about 6 per cent. Maldives, Nepal, Pakistan and Sri Lanka are showing economic growth rate of 3.5 to 5per cent.[14] Moreover, South Asia has shown a trend of attracting foreign direct investment in recent years. "World Investments Prospects Survey 2010-2012", based on responses to a questionnaire from 236 Transnational Corporations (TNCs) and 116 Investment Promotion Agencies (IPAs) and compiled by the United Nations Conference on Trade and Development (UNCTAD), has predicted that, South Asia is going to be the top priority destination for Foreign Direct Investments (FDI) in the next two years.[15]

Given the growing pace of economy in tandem with bourgeoning population, industrialisation**,** and urbanisation, South Asian countries require increasing energy supplies to fuel their rapid economic expansion. Hence, this region is becoming increasingly reliant on energy imports. It is estimated that the energy demand will grow in tandem with the economic growth at an almost equal rate. In last two decades, the energy consumption was 5.8 per cent against low energy production of 2.3 per cent; the demand for energy is growing at a rate of 9 per cent

[13] South Asia: Recent developments, Global Economic Prospects January 2011, World Bank, (http://siteresources.worldbank.org/INTGEP/Resources/335315-1294842452675/SA-Annex.pdf), Accessed 23 May, 2011.

[14] Regional Energy Security for South Asia, The New Nation 2 June, 2011,< www.savebd.com/.../regional-energy-security-for-south-asia>, Accessed 28 May, 2011.

[15] 'World Investment Prospects Survey: 2010-2012', United Nations Conference on Trade and Development, <http://www.unctad.org/en/docs/diaeia20104_en.pdf>, Accessed 15 May, 2011.

annually.[16] The region's primary energy demand is projected to increase from 582.1 MTOE in 2005 to 1,264.3 MTOE in 2030 at an annual rate of 3.2%. India alone will continue to take the bulk of the share of South Asia at 92.7% in 2030, nearly unchanged from 92.4% in 2005. Likewise, India will account for the biggest portion of incremental growth in the primary energy demand of South Asia—92.9% between 2005 and 2030.[17] In order to grow at a higher rate and overcome poverty and backwardness, South Asia has to grapple with the energy crisis at the national levels and also collectively at the inter and intra-regional levels. Reliable and uninterrupted energy supply for the region is a demand summoned by the time.

The Idea of Regional Energy Grid

Regional energy grid is an initiative that facilitates the sharing of energy by linking each country's grid to form a unified energy network. It entails interconnectivity and synchronization of the regional and national power networks to facilitate transfer of energy. Such interconnectivity allows regions facing shortage at any point to tap surplus in other areas. It increases the diversification of primary energy resources. It reduces costs of fuel transportation. It allows harnessing the regional resources more efficiently. Some of the examples of regional energy grid include West European Gas and Power Grid; Power grid linking Central Asia; North American Power Grid; West European Gas and Power Grid; GCC states power grid bringing the Gulf States-Saudi Arabia, Bahrain, Kuwait, Oman, Qatar and the UAE together.

The idea of this regional grid is a much talked about but less advanced issue in South Asia. Despite enormous possibilities of establishing a common energy source for South Asian countries, at the state and regional level, a lack of understanding and procrastination among the states has become evident. However, in the last decade or less, some progress regarding gas corridor tapping surplus gas resources from Central Asia and the Gulf have been visible. The inherent environmentally benign nature, greater efficiency and cost effectiveness of natural gas has made it the most preferred fuel in India and Pakistan. These two countries have made their efforts to build gas pipelines to bring gas from some neighbouring states to meet their rapidly increasing energy demand.

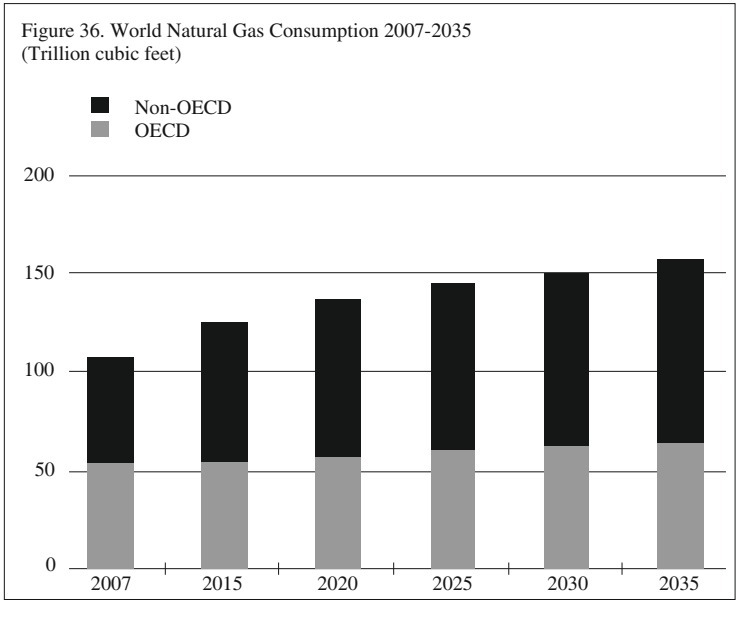
[16] http://www.mediawitty.com/Media/NewsDoc/_1188.Pdf

[17] 'Sub regional Outlook: Energy Demand of west and East Asia', Asia Pacific Energy Research Centre (APERC) analysis (2009), <http://www.adb.org/Documents/Books/Energy-Outlook/Chapter-III.pdf>, Accessed 15 May, 2011

Gas Corridor in South Asia

An understanding among the experts is that, if the 20th century has been described as the century of oil, the 21st century has heralded the era of natural gas. Natural gas is about twice as clean to burn than oil. And the world's demand for it is expected to increase by 50% over the next 25 years.[18] The demand for natural gas has sharply increased in the last two decades at the global level. The assessment in The International Energy Outlook 2010, made by U.S. Energy Information Administration (EIA) has shown an increasing trend of total natural gas consumption worldwide. The consumption grows about 44 percent from 108 trillion cubic feet in 2007 to 156 trillion cubic feet in 2035.[19] It is also expected that the share of natural gas in the primary energy basket will increase rapidly. The growth rate of world's demand for natural gas will average 3.1%.[20]

Table 8.1. World natural gas consumption



[18] Williamson, Lucy, 2006, 'Qatar's fortunes boom with gas', BBC News, Qatar, <http://news.bbc.co.uk/2/hi/middle_east/4709696.stm>, Access 20 May, 2011.

[19] 'Natural Gas', International Energy Outlook 2010, US energy Information Administration, http://www.eia.gov/oiaf/ieo/nat_gas.html, Accessed May 20, 2011.

[20] Sarmadi-Rad, M.A.'Iran's Strategy for Export of Natural Gas', Working Party on Gas UN/ECE 15th Session January 2005,Geneva, <http://www.unece.org/se/pdfs/wpgas/countries/iran.pdf>, Accessed 23 May, 2011.

A number of factors are believed to drive the growing demand and highlight the role of natural gas worldwide. As there is increasing opposition against the use of environment unfriendly dirty fuels'like coal and high sulphur fuel oil, the concern of environment has been key driver in the rise of natural gas demand. For power generation, gas is the preferred medium. There continues to be technological innovations in gas for power generation, which greatly increased output efficiency. There is an emerging demand for gas in BRIC markets like China, India and Brazil.

Table 8.2. World Energy by Type

World Energy by Type Primary	**Energy Demand (Quadrillion BTUs)**							**Average Annual Average**			**Share of Total**	
	1980	1990	2000	2005	2010	2020	2030	1980-2005	2005-2030	2010-2030	2005	2030
	296	359	414	469	506	575	863	1.9%	1.2%	1.2%	100%	100%
Oil	128	136	156	171	173	191	204	1.2%	0.7%	0.8%	36%	32%
Gas	54	72	89	101	112	138	164	2.5%	2.0%	1.9%	21%	26%
Coal	70	86	90	112	128	133	134	1.9%	0.7%	0.25	24%	21%
Nuclear	7	21	27	29	28	38	50	5.6%	2.3%	2.9%	6%	8%
Biomass/ Waste	29	36	41	44	47	48	48	1.6%	0.4%	0.1%	9%	8%
Hydro	6	7	9	10	11	14	16	2.2%	2.0%	2.0%	2%	3%
Other Renewables	0	1	3	3	7	13	20	8.0%	7.4%	5.8%	1%	3%
Source:Smil, Energy Transitions; ExxonMobil,												

Source: http://www.exxonmobil.com/corporate/files/news_pub_eo.pdf

The vastness of world's gas resources is another reason of huge role of natural gas in the 21st century. According to the BP Statistical Review of World Energy 2008, proved world natural gas reserves in 2007 were 177.36 trillion cubic metres (tcm), which represents an increase of 66% over the 20 years since 1987. BP Statistical Review of World Energy 2011 has shown that, global natural gas reserves increased by 0.5 trillion cubic meteres (+0.3%) to 187.1 trillion cubic meters.

There are three main options for moving gas to the market place: pipelines, liquefied natural gas and compressed natural gas**.** The world is getting more and more connected with gas pipelines in this century as high strength steel and automated equipment allow pipelines to become economical over long distances.[21]

[21] Cheney, Dick, 'Where the Prize ultimately lies', < http://www.studien-von zeitfragen.net/Zeitfragen/Cheney_on_Oil/cheney_on_oil.html>, Accessed 23 May, 2011.

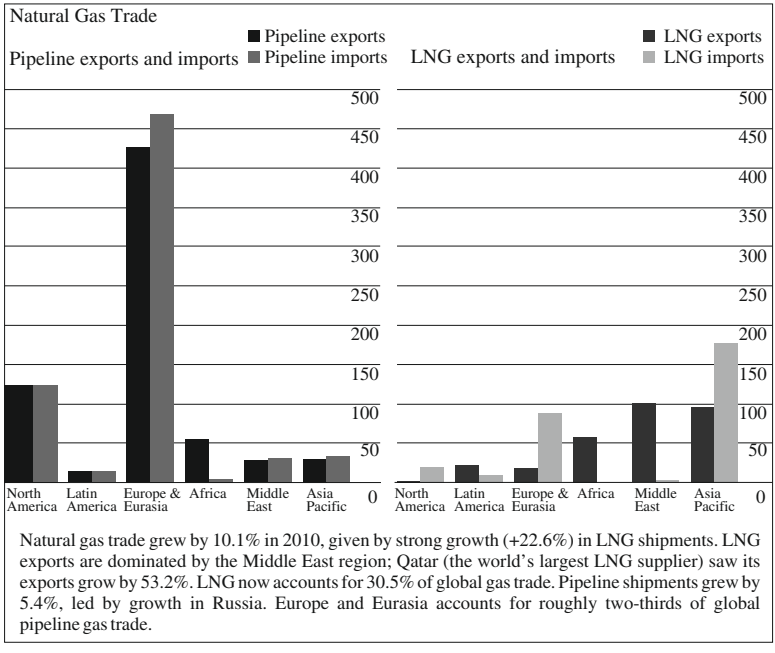


Table 8.3. Gas exports by pipeline

Some notable examples of gas corridor are Trans Siberian Natural Gas Pipeline from Russia to Western Europe, Malaysia- Singapore Gas and Power lines, Malaysia – Indonesia pipeline.

Likewise, the South Asian Gas Corridor is an idea for the gas supply from outer regions to South Asia through pipelines. The purpose of this corridor is to lay the foundation of a common energy market amongst the South Asian countries as well as provide them with sustainable energy supplies to help their national economies. Importing gas to the South Asian region through pipelines will be operated on a common carrier basis, jointly developed and owned by the participating nations. There are a number of proposed gas pipeline projects under discussion, which could lay the foundation for a regional gas corridor.

The Prospects for Gas Export from Inner and Outer Regions

South Asia is geographically proximate to the Persian Gulf and Central Asia and can tremendously benefit from their immense resources of gas. Iran, Turkmenistan, Qatar and Myanmar are exploring potential markets for their

surplus natural gas. One assessment shows that, Pipelines from and by these countries would cost 35 per cent less than the cost of liquid natural gas (LNG) in India and Pakistan.[22] Pakistan which bridges central Asia and South Asia is the shortest land route between the gas resources of the Central Asia and the Persian Gulf. According to International Energy Outlook 2010, published by the US energy Information Administration, the world's top reserves of gas are 6.609 trillion cubic feet. The top countries holding the biggest world reserves are Russia, with 25.4 percent or 1.680 trillion cubic feet (tcf), followed by Iran (15.8 percent or 1.046 tcf), Qatar (13.6 percent or 899 tcf),Turkmenistan (4 percent or 265 tcf) and Saudi Arabia (4 percent or 263 tcf). It means that, three of the five largest gas reserving countries, Iran, Qatar, and Turkmenistan are adjacent to South Asia. There is feasibility to import gas from these countries via Pakistan to India, Bangladesh and eventually to other South Asian countries.

Table 8.4. Countries with Top Gas Service

Rank in the world	Gas reserves	World's percentage
1	1.680 trillion cubic feet (tcf)	25.4%
2	1.046 tcf	15.8%
3	899 tcf	13.6%
4	265 tcf	4%
5	263 tcf	4%

Source: http://pakistantimes.net/pt/detail.php?newsId=17275[23]

Countries as Sources of Gas Corridor for South Asia

Five countries with huge gas reserves have been proposed as potential exporters of gas to South Asia. Turkmenistan in central Asia, Myanmar in South-east Asia, and Iran, Qatar and Oman from the Middle East and the Gulf have already shown their interests to sell gas to India and Pakistan. Some of the countries have already signed agreements with certain South Asian countries, though the process is running slowly.

***Turkmenistan*:** The huge gas resource in Turkmenistan has brought a great potential for South Asia to import gas from this country. It is bordered by the Caspian Sea to the west, Kazakhstan to the north, Uzbekistan to the east, and Iran and Afghanistan to the south. As shown, the present gas reserves of this country is 265 tcf and reserves rank fourth worldwide by volume representing 4% of the

[22] Energy Cooperation in South Asia, South Asian Journal, July-September issue.2005, <www.southasianmedia.net/.../Journal/9_energy_cooperation.htm>, Accessed 28 May, 2011.

[23] TAPI shall address energy needs of Pakistan,'Pakistan Times' Business & Commerce Desk, http://pakistantimes.net/pt/detail.php?newsId=17275, Accessed 23 May, 2011.

world total. The British audit firm Gaffney, Cline and Associates (GCA) informed during May 2011 that Osman-Yoloton, a gas field of Turkmenistan, is the second largest field in the world.[24] Osman and South Yologon – is a huge sea of gas near the Turkmen border with Iran and closer to Afghanistan. Recent estimates by GCA show that the Osman-Yoloton has 23 trillion cubic meters (tcm) of in place gas reserves. Since the end of 2009, Turkmenistan has been exporting natural gas to Russia, Iran, and China. It has signaled its interest in providing gas for the European Nabucco project. Turkmenistan's president Berdymukhamedov said on 30th September 2010 that his country had the capacity to almost quadruple its gas exports in the next 20 years and was ready to meet demand from Europe.[25]

For its proximate location with Turkmenistan, South Asian countries can great benefit from tapping its surplus gas resources through pipeline. A proposed gas pipeline from Turkmenistan to South Asia is on its way to be implemented. We are going to that discussion very shortly.

***Iran*:** Iran is endowed with the second largest natural gas reserve of the World. It is centrally located among the world's major oil and gas producers. Iran is rapidly emerging as a major supplier of natural gas to the regional world markets. Endowed with 28.2 trillion cubic meters of proven natural gas reserves of the world, Iran is planning to become a major natural gas producer and exporter for the world market within the next decade.[26]

As for the location of gas deposits it should be noted that Iran's major gas deposits are located in the southern part of the country. The major recognized natural gas deposit of the offshore portion is the South Pars field in Persian Gulf. The reserve of this gas field is estimated to be 500tcf, or 8% of the entire world's or 40% of Iran's total natural gas reserves. This field also includes 18 billion barrels of condensates (liquids).[27]

According to Iran Petroleum Ministry, Iran's proved natural gas reserves are about 15.8% of world's total reserves, 33% are as associated gas and 67% is in non-associated gas fields.[28] The National Iranian Gas Company (NIGC) announced in

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[24] 'Auditor Expected to Certify 23 TCM Gas Reserves in Turkmen Field', News Central Asia, <http://newscentralasia.net/2011/05/30/auditor-expected-to-certify-23-tcm-gas-reserves-in-turkmen-field/>, Accessed 24 May, 2011.

[25] Soos, Andy, 2010, 'Turkmenistan's Major Natural Gas Find', Environmental News Network, <http://oilprice.com/Energy/Natural-Gas/Turkmenistans-Major-Natural-Gas-Find.html>, Accessed 29 May, 2011.

[26] Sarmadi-Rad, M.A.'Iran's Strategy for Export of Natural Gas', Working Party on Gas UN/ECE 15th Session January 2005,Geneva, <http://www.unece.org/se/pdfs/wpgas/countries/iran.pdf>, Accessed 23 May, 2011.

[27] Ibid

[28] Iran's gas export to Turkey up by 50%', Iran Oil Ministry Annual Bulletin, 5th Edition, pages 190-193. <*wn.com/Iran_Natural_Gas_Reserves*>, accessed 29 May, 2011.

January 2011 that it exported 8.25 billion cubic meters of gas to Turkey via pipeline in 2010, according to the oil ministry's official website Shana. The exported volume, with an estimated worth of about three billion dollars, is only four percent of the country's total gas production, the website reports. Iran plans export as much as 5 million cubic meters of natural gas daily to Syria by the end of 2011 after construction of a pipeline via south Turkey is completed.[29] At present, Iran is producing only a small share of its gas reserves. This means that Iran is one of the few countries capable of supplying much larger amounts of natural gas in the future.

Myanmar: South Asia has another geographical advantage in importing gas from the neighbouring state of Myanmar. In recent years this country has shown interest in trading gas to outside. Ministry of energy in April 2011 claimed that the country has reserves of some 89.722 trillion cubic feet of natural gas. The recent figures from the energy ministry would mean that Myanmar has more natural gas reserves than the entire European Union.[30] Currently, the crude oil in Myanmar is refined in the country. Natural gas has become a major export of the country. Natural gas from Yatanar and Yetagon gas fields were sold to Thailand in 1998 and 2000. The agreements have been signed to sell natural gas from these projects with 30-year contracts.[31] Moreover, it has already sold gas to Thailand and natural gas from Shwe Project of Offshore Rakhine and Zotika Project of Gulf of Mottama will be sold to China and Thailand. Construction of pipelines is underway to start the sales commencing from May and October 2013.[32]

Qatar: Qatar has the world's third-largest gas reserves holding slightly under 14% of the world's reserves.[33] In South Asia, currently, Qatar supplies the bulk of rising natural gas imports into India in the form of liquefied natural gas (LNG).[34]

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[29] Ibid

[30] 'Myanmar estimates possession of 3.2 billion barrels of oil reserves, 89.722 trillion cubic feet of natural gas reserves', Myanmar Business Network, < http://www.myanmar-business.org/2011/04/myanmar-estimates-possession-of-32.html>, accessed 28 May, 2011.

[31] *Ibid*

[32] *Ibid*

[33] Natural Gas Information 2010, International Energy Agency, <http://www.iea.org/publications/free_new_Desc.asp?PUBS_ID=2044>, Accessed 28 May, 2011.

[34] Bhardwaj , Priyanka, 2009, 'A Qatar-to-India Pipeline?', Energy Tribune, <http://www.energytribune.com/articles.cfm/2245/A-Qatar-to-India-Pipeline>, Accessed 30 May, 2011.

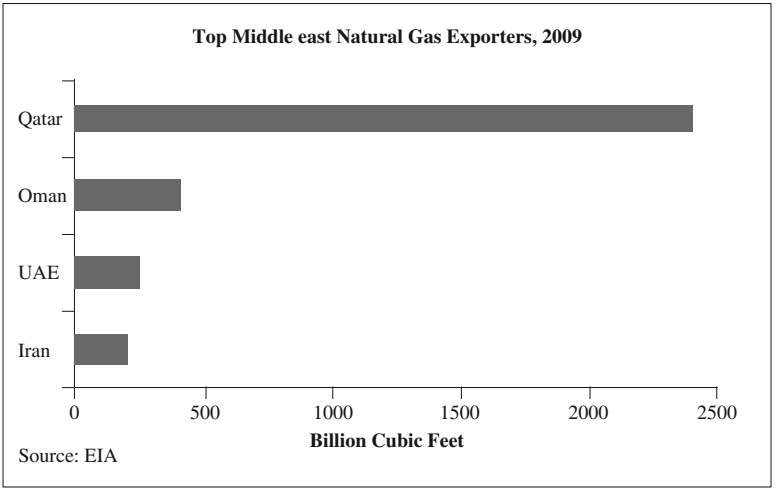

Table 8.5. Top natural gas exporter countries in Middle East

Oman: Oman has proven reserves of natural gas amounting to 30 trillion cubic feet (Tcf) as of January 1, 2011. The Ministry of Oil has announced plans to reassess natural gas reserves, seeking to increase reserves by a trillion cubic feet per year for the next 20 years.[35]

Proposed International Gas Pipeline Projects For South Asia

The feasibility study at the level of policy makers and stakeholders confirmed five potential pipeline projects can be established. While progress on some of them is significant, others still remain on the table of discussion. Following is an overview of these proposed pipeline projects. ***Turkmenistan-Afghanistan-Pakistan-India Gas Pipeline (TAPI)***

Though the original project started in March 1995 when an inaugural memorandum of understanding between the governments of Turkmenistan and Pakistan for a pipeline project was signed, four Asian nations, namely Turkmenistan, Afghanistan, Pakistan and India, signed a $7.6 billion gas pipeline project in Turkmenistan's capital Ashgabat in December 2010. TAPI is an extension of TAP which proposed a pipeline project including Turkmenistan, Afghanistan and Pakistan. Under this agreement, the four Asian nations have agreed to construct a 1680-Km gas pipeline with the financial assistance from the

[35] 'Country Analysis Brief, Energy information Administration, <http://ei-01.eia.doe.gov/emeu/cabs/Oman/Full.html>, Accessed 28 May, 2011.

Asian Development Bank. The pipeline, which starts from the gas-rich Turkmenistan and ends at India's northwestern border town of Fazilka via Afghanistan's southern city of Kandahar and Pakistan's central city of Multan, is expected to supply 3.2 billion cubic feet of natural gas a day to the three energy-hungry South Asian countries of Afghanistan, Pakistan and India upon its completion in 2014.[36] Under the pipeline agreement, Pakistan will get 42 percent of the supply quota while India's quota standsat 42 percent with the remaining 16 percent for Afghanistan.[37] This project will reach implementation, if the tension between India and Pakistan does not remain a raodblock.

Iran-Pakistan-India Gas Pipeline (IPI)

For India, in order to satisfy the counties' increasing demand for energy, this proposed 2,600-kilometer gas pipeline will carry natural gas from Iran's South Pars Fields in the Persian Gulf to Pakistan's major cities of Karachi and Multan and then farther down to New Delhi, India. This project would cost 7.5-billion dollars. Officials from Iran, India, and Pakistan say they have agreed to complete the project by 2012, and Iran plans to begin exporting gas to India and Pakistan by 2013.[38] However, the geostrategic compulsion in South Asia frequently disturbs this proposed project. For its bitter relations with Iran, United States continues to oppose establishing gas pipeline from Iran. USA on the other hand, urges India and Pakistan to pursue the TAPI project.

Qatar–Pakistan Gas Pipeline

This project was proposed in 1990 to import gas through an offshore pipeline. Qatar's north field was the expected source which has 300 TCF of gas reserves. The pipeline was said to be 1620 kilometre long with a 44 inch diameter and a capacity of 2 BCFD.[39] The Proposed offshore gas pipeline which would cost $ 2.7

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[36] 'Pakistan business: Gas pipeline to help beat energy crisis – daily', The Economist, <http://www.eiu.com/index.asp?layout=VWArticleVW3&article_id=1747704359&region_id=&country_id=1140000314&channel_id=180004018&category_id=&refm=vwCh&page_title=Article&rf=0>, Accessed 30 May, 2011.

[37] *Ibid*

[38] Vohra, Subhash,2008, 'U.S. Concerns Over Iran-Pakistan-India Gas Pipeline', Payvand Iran News , <http://www.payvand.com/news/08/jun/1158.html>, Accessed 30 May, 2011.

[39] Malik, Zakauddin, 2002, 'Taking Pakistan into the 21st Century: The Economic and Political Challenges', Woodrow Wilson International Center for scholars,, <http://www.wilsoncenter.org/events/docs/malik.pdf>, accessed 30 May, 2011.

billion[40] starts from Qatar's north field and goes to Gadani in Pakistan. Gas import was supposed to start in year 2010-11.[41] This pipeline to Pakistan can be extended to other South Asian countries in future

Oman-India pipeline

India is actively considering building a 2,000-km-long deepwater transnational gas pipeline from Oman for transporting natural gas sourced from Turkmenistan, Iran and Qatar.[42] Estimated to cost about $5 billion, the pipeline would pass through the continental shelf of Iran and Pakistan.[43] The project is still viable if some major limitations are removed.

Myanmar-Bangladesh-India Gas Pipeline

India was making attempts to import gas from Myanmar. The offshore gas field of Myanmar in Block A-1, located off the coast of Arakan State in the Bay of Bengal is believed to contain between four and six trillion cubic feet of recoverable gas. The Project is expected to cost between one and three billion U.S. dollars to build. This pipeline is said to be 900-km long. From the Rakhine Coast there are two options for pipeline through Bangladesh:

- One will go through Paltwa and Aijwal in Mizoram through the State of Tripura and enters into Bangladesh at Brahmanbaria crossing Jamuna River pass by Jessore enters West Bengal at Bongaon.
- The other option will be to enter Bangladesh at Teknaf along the coast to Feni through Brahmanbaria where a spur line from Tripura can be connected with the gas fields of Tripura.

For lack of political will and some technical difficulties this project still remains on the table without any progress.

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[40] ' Pakistan and Qatar to take decision on gas line this week', BusinessRecorder, <http://www.shiachat.com/forum/index.php?/topic/49747-pak-qatar-gas-pipeline/>, Accessed 30 may, 2011.

[41] Haq, Dr Noor ul and Asifa Hasan ,(ed), 'Gas Pipeline Projects in South Asia', <http://ipripak.org/factfiles/ff64.pdf>, Accessed 30May, 2011.

[42] 'India considering deepwater gas pipeline from Oman: Report', The Economics Times <http://articles.economictimes.indiatimes.com/2010-09-20/news/27602807_1_gas-pipeline-south-asia-gas-enterprise-oman>,Accessed 28 May, 2011.

[43] Prakash, Om, 2001, 'The Oman-India Gas Pipeline Project: Need to Resurrect Again', institute of peace and conflict studies-IPCS, <http://www.ipcs.org/article/india/the-oman-india-gas-pipeline-project-need-to-resurrect-again-503.html>, Accessed 30 May, 2011.

Why is gas corridor important?

Enhancing Energy Security

A network of gas pipelines will enhance energy security in the region, essentially of India and Pakistan helping in an optimal and efficient harnessing of energy resources. India is the most vulnerable because it needs a huge energy supply to feed its rapidly growing economy. To maintain an impressive 8-9 per cent growth rate of the Indian economy, the energy sector needs to be nurtured. India's natural gas consumption presently is 180 million standard cubic meters per day (6.4 Bcf per day) while the domestic production is 80 million standard cubic meters (2.8 Bcf per day).[44] On the other hand, Hundreds of Industrial units in Pakistan have been closed partially due to the insufficiency of natural gas, leaving tens of thousands of local workers unemployed, posing a serious threat to the social stability in the country. Over the 2000-to-2008 period, the demand for natural gas in Pakistan has witnessed an average annual growth of 10 percent. Currently the country consumes natural gas on a 4731-mmcfd basis whereby its domestic production stands only at 4,528 mmcfd, leaving a deficit of more than 200 mmcfd to be filled.[45]

Table 8.6. Gas resources in South Asia

Item	Unit	Afghanistan	Bangladesh	Bhutan	India	Maldives	Nepal	Pakistan	Sri lanka
Gas									
Resource potential	billion cubic meters (bm3)	120+ 1,000 (deep wells)	814.5	0.0	63	0.0	0.0	7,985	0.0
Proved resources	bm3	120	578.3	0.0	1,380	0.0	0.0	1,284	0.0
Used so far	bm3	NA	144.1	0.0	460	0.0	0.0	488	0.0
Available resources	bm3	120	434.2	0.0	920	0.0	0.0	795	0.0
Current annual production	bm3	0.176	11.9	0.0	32	0.0	0.0	34	0.0
Resource/ production ratio	bm3	Over 600	36	0.0	29	0.0	0.0	23	0.0

[44] Bhardwaj, Priyanka, 2009, 'A Qatar-to-India Pipeline?', Energy Tribune, <http://www.energytribune.com/articles.cfm/2245/A-Qatar-to-India-Pipeline>, Accessed 30 May, 2011.

[45] 'Pakistan business: Gas pipeline to help beat energy crisis – daily', The Economist, <http://www.eiu.com/index.asp?layout=VWArticleVW3&article_id=1747704359&region_id=&country_id=1140000314&channel_id=180004018&category_id=&refm=vwCh&page_title=Article&rf=0>, Accessed 30 May, 2011.

The construction of the pipeline is also vital for the development of smaller neighbours which borders India and Pakistan. At present, Bangladesh is going through a crucial time in terms of energy. . With power, gas and water crisis people are suffering extremely. Load shedding is a regular phenomenon. During a time period of 24 hours, electricity/power is available for 7-9 hours and thisalso varies from place to place. This has obstructed the growth of agriculture and industrial production. On 30 March, 2011, a newspaper reported that due to the energy crisis the industrial production has declined by 30 percent. It has also reduced national investment.[46]

Keeping pace with global economic completion, South Asian countries are faced with a major challenge of ensuring energy supply for their rising economy. In recent years, South Asian countries have experienced impressive economic growth (see the table-8.7 on GDP growth of South Asia). To sustain such a rapidly rising economic trend, a viable energy supply is imperative.

Table 8.7. 3.1.7 GDP growth, South Asia[47]

	2009	2010	2011
South Asia	6.7	7.8	7.8
Afghanistan	22.5	8.9	6.8
Bangladesh	5.7	6.0	6.3
Bhutan	6.0	7.0	7.0
India	7.4	8.5	8.7
Maldives	-3.1	3.5	3.5
Nepal	4.0	3.5	4.0
Pakistan	1.2	4.1	2.5
Sri Lanka	3.5	6.5	7.0

Source: Asian Development Outlook database

Regional Economic Cooperation

It will start the process of regional economic cooperation in South Asia in a major way without being hostage to regional politics. Neo-functionalist school of regional integration argues that, economic integration spills over into political integration. Regional integration is intrinsically sporadic. In an economically

[46] Manik, Mahfuzur Rahman, 2010, 'Energy security', The Daily Star, April 11, 2010. <http://www.thedailystar.net/newDesign/news-details.php?nid=133804>, Accessed 5 June, 2011.

[47] Economic trends and prospects in developing Asia, Asian Development Bank, <http://www.adb.org/documents/books/ado/2010/update/ado2010-update-subregional.pdf>, Accessed 4 June, 2011.

integrated South Asia, national governments will find themselves increasingly linked with regional pressures thus compelling them to resolve their conflicts. South Asia for many years has become hostage to state-to-state tension. Tension between India and Pakistan have made the entire region unstable. States mostly directed towards economic growth may compromise political differences, of which South Asia is the most vulnerable.

Ensuring Stability

Regional economic integration has for some areas proved to be a stabilising factor in inter-state relations. Commenting on the importance of the TAPI gas pipeline, Susan Elliot, US Deputy Assistant Secretary of State on South and Central Asian Affairs said, 'The pipeline's route may serve as a stabilising corridor, linking neighbours together in economic growth and prosperity.[48] Political initiatives in minimizing differences between the countries so far proved futile. An economic system that will establish stakes for all and interlink all stake-holders bears the best possibility to tie the states in a common understanding not to resort to violence. As stability begets economic growth, an economic relation also leads towards a stable region.

Economic Growth

There is a broad agreement among economists that trade openness, pursued under the right conditions, promotes economic growth. Many countries in the world have combined their involvement into the multilateral system. The economic cooperation of western European countries with Russia and establishing gas corridor through Trans Siberian Natural Gas Pipeline from Russia to Western Europe has provided the required energy supply to accelerate economic growth and aver the brunt of global financial crisis. Establishing a pipeline system by one South Asian country will cost double than it would need if done by all South Asian energy deficient country. Therefore, an integrated regional energy corridor linking the energy grid of all countries will have two positive impacts: a massive economic growth fuelled by uninterrupted energy supply, and spill over of regional economic cooperation in other aspects of South Asian politics.

Balanced Distribution

A Gas corridor will ensure balanced distribution of available gas resources in Asia. Myanmar, Turkmenistan, Iran and other Asian countries have surplus gas

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[48] 'Pakistan business: Gas pipeline to help beat energy crisis – daily', The Economist, <http://www.eiu.com/index.asp?layout=VWArticleVW3&article_id=1747704359&region_id=&country_id=1140000314&channel_id=180004018&category_id=&refm=vwCh&page_title=Article&rf=0>, Accessed 30 May, 2011.

resources that can be utilized by exporting to gas deficit countries. As mentioned before, gas import from these countries will open the door of new trade and investment in South Asia. A viable economic relation is expected to increase among the exporting and importing countries which may garner state to state and region to region economic and political cooperation.

Challenges for the Gas Corridor Projects

As unprecedented opportunities for gas import exist, so do the difficulties and challenges that may create obstacles in establishing energy corridor in South Asia. For diverse factors, this region remains an example of instability and tension. It hosts a number of issues and conflicts that make any positive initiatives unsuccessful. In recent years, South Asia has become the hub of global war against terrorism. As far as a regional energy corridor is concerned, this complex political milieu highlights certain challenges.

Security Challenges

Gas pipelines can be targeted by terrorist organizations. As the TAPI route passes through areas with major insurgencies, security is clearly an issue. In Pakistan and Afghanistan, Pipeline security will be expensive unless cooperation from tribal areas of Pakistan is sought. Within a war zone, it is unlikely that multinational companies will make investments. Many NATO countries would be unwilling to make long-term commitments to support pipeline security in Afghanistan. Moreover, Pipelines in the territory of Pakistan can be victim to US drone attacks. To destroy terrorist havens, America may not consider the issue of state infrastructure. A secure gas pipeline, considering all security challenges, needs to be ensured. A viable security lies in the system that naturally averts the crisis.

Financial Challenges

Establishing gas pipelines come at a huge cost for the countries. The question of supply cost, maintenance cost, pipeline cost, sharing the burden may be barrier. For some countries including Bangladesh, financing remains vital when the issue of a gas corridor is taken into consideration. Attracting large scale investments is important since it requires a great deal of financial cost.

Physical Infrastructure and Technical Maintenance

South Asia lacks required infrastructure for a gas corridor. The nature of land and topography, the threat of natural calamities such as earth quake, floods, and cyclones pose serious threats for gas pipeline. The question of disputed territories needs to be addressed in establishing gas pipeline throughout South Asia.

Moreover, lack of expertise, poor energy infrastructure, and poor energy supply system pose challenges as well. Improper maintenance, faulty equipment and improper digging may cause pipeline explosion. Dependence on the external sources for technical maintenance poses long term challenge in implementation.

Political Goodwill and Misunderstanding

Lack of political goodwill creates the greatest barrier in implementing proposed gas corridors. Many Indian security experts have shown suspicion of Pakistan's goodwill, and lack of trust for the supply of sustainable basis. Due to the frequency of India Pakistan tension/conflict, the TAPI project has continued facing challenges. The Myanmar-Bangladesh-India gas pipeline project has stopped due to India's indifference to the requirements of Bangladesh. Moreover, Bangladesh has used this project as a bargaining stick to press India to reduce trade imbalance. Mistrust between Bangladesh and India and then tension between India and Pakistan threaten the sustainability of a regional energy regime.

Mistrust and the Controversial Role of MNCs

Establishing a gas corridor will require technical, financial and other cooperation from multinational corporations. But there is a general lack of trust of MNCs in South Asia**.** The controversial role of MNCs in some countries like Nigeria and Angola pose a serious question on giving them a role in projects. Moreover, the demand of high price of MNCs involving in construction may make the projects financially not viable. South Asian states therefore need a viable strategy that would address the technical aspects of the deal with the MNCs involving in gas pipeline construction.

Interference of External Players

The United State consistently asked Pakistan and India to refrain from any project involving its arch-rival Iran. Thes Pressure from the United States not to import gas from Iran is due to strategic reasons. Over the past years, the U.S. ratcheted up pressure on foreign governments, international energy companies and major lending agencies to reduce their involvement with Iran.[49] Though there is considerable pressure from within Pakistan to continue this project, the government of Pakistan remains indifferent to IPI gas pipeline project due to US pressure. The U.S. wants the Turkmenistan-Afghanistan-Pakistan-India gas pipeline be implemented instead. South Asian countries need a common understanding in which all will agree to collectively serve their interest regardless of pressure from external powers.

[49] Fatemi, Tariq, 2010, 'IPI project and the US', The Dawn, , <http://archives.dawn.com/archives/29795>, Accessed 10 June, 2011.

Gas Price Uncertainty

The uncertainty of price and volume of gas supply remains a vital issue that will need to be addressed. The international gas market has no price regulation mechanism such as those found in the petroleum market. Thus, gas prices, for all practical purposes, appears to be whatever the end user is willing to pay. Moreover, price projection of gas through pipelines is difficult owing to fluctuation. Such a situation poses long term uncertainty, and keeps open the door for energy insecurity in South Asia.

Environmental and Human Rights Concerns

It is seen that, gas pipelines are accident prone. For example, in January 2011, the U.S. saw the Houston Gas Pipeline Accident. Improperly installed gas pipelines can pose serious ecological risks. The question remains can gas pipeline become environment friendly. The irony is that, there is no meaningful framework to address the trans-boundary impacts of large gas pipeline projects in South Asia. Before going to building gas pipelines, it is necessary that, the basic and detailed engineering analysis will be performed to meet all requirements for environmental impact assessment.

Moreover, installing gas pipelines can involve uprooting local people, and destroying their natural habitats. There remains serious human rights issue in properly rehabilitating the victims. Improperly rehabilitated people may pose long term threats. Therefore a framework that will address the issue is vital.

Conclusion

A regional energy corridor that will link up all regional energy grids is not a choice, rather a necessity for South Asia. While the world`s powerful states and states in different regions are scrambling to acquire secure sources of energy, South Asia has failed to move on even one pipeline project, which only shows how oblivious the leadership has been to the region`s increasingly desperate need for energy. Difference in the realm of politics may remain persistent. But there is no alternative to continue indifferent to vastly growing energy needs of South Asia to keep pace other regions. If political issues obstruct the economic cooperation, economic issues can be taken into forward to defuse the political differences. In the 21st century where economic power will be determining force, the only way to propel South Asia's growth is to ensure energy security for the region. We need a new energy regime where energy cooperation will be crucial. The region needs a viable energy regime. A meaningful and multilateral energy regime addressing the distinct needs of all South Asian countries and regulating the energy cooperation is essential for future energy security in South Asia.

Chapter 9

Environmental Security and Regional Cooperation: What is Feasible?

Col. P.K. Gautam

Introduction

SAARC has not delivered. It needs to do so now. Is it possible? As high politics animates the realist discourse, the path has many obstacles, as environment is not yet 'high politics'. Environmental issues will propel countries to make common cause by thinking regionally. The epistemic community such as the Consortium of South Asian Think Tanks (COSATT) is perhaps one innovative avenue through which problems of the environment can be addressed in a cooperative framework. This paper is thus a preliminary study, focusing on the feasibility of regional cooperation. In this paper, after locating and placing availability of data at national level, the next section summarizes the discourse on regional cooperation including at the level of SAARC. Then the paper examines why not much has been achieved and further deliberates on some new thinking and ideas for consideration. Finally suggestions for common understanding within SAARC and what further work that needs to be done by think tanks and policy makers follow.

Availability of Data at National level

That the region is suffering from various types of environmental degradation is no longer in doubt. Combined with this is the new challenge of the impact on nature and humans as a result of global warming. The countries of the region are also developing with a substantial number of people in poverty. Economic growth appropriate to each country is expected to deliver development. Rising population and expectations demand more resources and the concomitant pollution flows. Priorities thus clash. Should focus be first on getting rid of poverty by known economic models or should the environment be protected from pollution, degradation and decline for sustainable development for the present and future? This is an unending question that begs an answer. Perceptions, both scientific and social differ. Even if problem is known, their solutions are competing.

At the national level two reports summarise the status of a nation's environment. First is the national communications submitted by countries to have one essential

chapter on National Circumstances.[1] This by itself explains the problems well. However this is a report which is submitted with climate change as a driver. Based on climate change India came out with a National Action Plan on Climate Change of June 2008. Bangladesh has also come out with a Climate Change Strategy and Action Plan in September 2008. In November 2008, Pakistan's Environment Protection Agency (EPA) formed a special committee on climate change to combat the climate change issue and the impact of climate change. Nepal established the Climate Change Management Division in 2010. Similarly documents and country specific initiatives can be found for other SAARC countries.

In the second variety each country also produces an annual state of the environment report focused on the nation and policies like *Environmental Policy* 2006 of India. Theoretically enough data is available. Rather it seems that there is an overload of data with jargon. But most of the date is inward looking. A number of environmental issues are cross- country. Both internal and external factors must be now combined where linkages exist. Regional issues are yet not central, and they must be as charity needs to begin at home. This now needs to expand to SAARC. Institution building is the first small and difficult step. After having created institutions, delivery needs to be the focus.

The Discourses on Regional Cooperation

If scholarly work is examined, in the 1990s surface water was the most important driver of environmental discourse. Ground water though vital and depleting has not much policy focus as yet. Much work has been done on regional cooperation on environmental matters where the driver is water.[2] In recent years The KAS Foundation has also provided incentives to Indian Council for Research on

[1] The initial national communications (Natcom) by SAARC countries to the UN Framework Convention on Climate Change is one primary source of ecological health and circumstances. It was submitted by Pakistan in 2003, Sri Lanka (no date), Maldives in 2001, Bhutan in 2000, Nepal in July 2004, Bangladesh (no date, not available in soft electronic copy on the internet) , India in 2004. Status of Afghanistan is not known.

[2] Shaukat Hassan, Environmental Issues and Security in South Asia, Adelphi Paper Number 262, London , International Institute for Strategic Studiers, 1991, Graham P. Chapman, The Geopolitics of South Asia: From Early Empires to India, Pakistan and Bangladesh, Aldershot, Ashgate , 2000, M.A Salman and Kishor Uprety, Conflict and Cooperation on South Asia's International Rivers: A Legal Perspective , London, Kluwer Law International, 2002, Manas Chatterjeee, Saul Arlsoroff and Gauri Guha (ed), Conflict Management of Water Resources, Hampshire, Ashgate Publications, 2002, Asit K. Biswas, Olli Varis and Cecilia Tortajade(Ed), Integrated Water Resource Management in South and South- East Asia, New Delhi, Oxford University Press, 2005, Imtiaz Alam (ed), Managing South Asia's Waters, Lahore, South Asia Policy Analysis(SAPNA) Network, , South Asian Studies, Vol.II, 2006, Jayanta Bandyopadhyay, "Water System Management in South Asia: Need for a Research Framework", Economic and Political Weekly, March 10, pp.863-873.,

International Economic Relations on water and energy which is dominated by the climate change discourse. In seminar circuits and journals there has been a proliferation of environmental issues.[3] The *South Asian Journal* of April- June 2010 was a special issue on the environment. It had essays on climate change, glaciers, water, forests and policies of countries.

At the IDSA four annual conferences have been held on South Asia since 2007.[4] In the first conference Peljor Dorji, Advisor to the National Environment Commission, Kingdom of Bhutan in his speech had hope on individual behaviour, combined with civil society action, and motivated private sector. He suggested initiatives such as paying for carbon offsets associated with travel to such meetings, renewable energy for homes and vehicles powered by renewable fuels, living in passive solar houses, recycling and composition of green waste, and using public transport, cycling and walking.[5]

The second conference in November 2008 also picked up certain important environmental issues. Speakers drew attention to environmental issues such as food, water, climate change, energy security;[6] the need to cooperate from a human security perspective on issues such as food security, water, climate change.[7] To increase farm productivity it was pointed out that shift was essential in reducing vulnerabilities resulting from climate change and inadequate attention to cross-boundary water management.[8] The most dramatic speech was by Aly Shameem from the Maldives where he presented Maldivian soil in a jar as a souvenier to commemorate his island nation going under water in the near future due to sea level rise induced by climate change.[9] Perhaps the most innovative suggestion

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[3] Workshop on "Water and Energy", ICRIER and Konard Adenauer Stiftung, New Delhi, December 16, 2008.

[4] The fourth conference held in November 2010 did not have environment. The fifth on comprehensive security is being planned in November 2011.

[5] Peljor Dorji, " The Environment and Security in South Asia ", unpublished speech during International Seminar on Economic Cooperation for Security and Development in South Asia , New Delhi, IDSA, March 16-17, 2007.

[6] Hamid Ansari, "Changing Political Context in South Asia and Prospects of Security and Regional Cooperation in Ashok K. Behurai (Ed), *South Asia: The Quest for Regional Cooperation*, New Delhi, IDSA, 2009, pp.3-7 and Mafuz Anam, "Changing Political Context in South Asia: Implications for Regional Security", unpublished paper presented at Second Annual Conference on India's Neighbourhood, November 5-6, 2008.

[7] Ataur Rehman, "Common Challenges Facing South Asia: A Perspective from Bangladesh" and Sadiq Ahmed, "Regional Cooperation for Food Security in South Asia", in Ashok K. Behuria (Ed), *South Asia: The Quest for Regional Cooperation,* New Delhi, IDSA, 2009, pp.9-21 and pp.35-78

[8] Sadiq Ahmed, "Regional Cooperation for Food Security in South Asia", in Ashok K. Behuria (Ed), *South Asia: The Quest for Regional Cooperation,* New Delhi, IDSA, 2009, pp.5-78.

[9] Aly Shameem, "Alternate Approaches to Security", unpublished paper presented at Second Annual Conference on India's Neighbourhood, New Delhi, IDSA, and November 5-6, 2008.

was the need for research on the cost of non- cooperation by quantifying the economic losses that accrue to the states because of their unwillingness to cooperate with each other.[10] This is difficult to quantify but is an important future research agenda for think tanks.

In the third conference held in November 2009 the environmental consciousness (may be guilt when assessed by historians in future) had shown a marked increase. When facing common challenges, single country mentality was urged to be replaced by a regional one, particularly on issues such as harnessing of joint rivers, energy, flood control and sharing of flow data.[11] Speakers as a ritual spoke on the need to address common issues such as food security, climate change, including glacier melt and inundation of low lying areas.[12] The bulk of critical drivers in future scenarios were related to environmental issues such as demography, economic growth, energy, climate change, food and water security.[13] The most fundamental question that was raised was whether SAARC has a future? It was argued that environmental issues will propel countries to make a common cause by thinking regionally.[14]

As the crescendo for the Cancun summit in December 2010 increased, South Asian scholars, fellows and policy makers met in a IDSA- PRIO(International Peace Research Institute , Oslo) Conference on "Climate Change : Political and Security Implications" in Nepal in November 2010.[15] The conference examined the interface between state security, societal or human security, and climate change in South Asia. As global warming impacts on glaciers, waterways, oceans and weather patterns, the conference conceptualized that there has been a growing realisation that climate change as a global and transboundary challenge which can only be addressed by enhanced regional cooperation and knowledge sharing across countries. To tackle climate change and water disputes in South Asia the following steps were suggested:

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[10] This idea quoted was of Mahfuz Anam, a Bangladeshi journalist. See Preface, Ashok K. Behuria (Ed), *South Asia: The Quest for Regional Cooperation,* New Delhi, IDSA, 2009, pp.i to viii.

[11] Smruti S. Pattanaik, " Introduction" in Smruti S. Pattanaik(Ed), *South Asia: Envisioning a Regional Future,* New Delhi, IDSA, Pentagon Press, 2011, pp. xvii- xxviii.

[12] Nirupma Rao, "South Asia 2020: Moving Towards Cooperation or Conflict" in Smruti S. Pattanaik(Ed), *South Asia: Envisioning a Regional Future*, New Delhi, IDSA, Pentagon Press, 2011, pp. 3-10.

[13] Arvind Gupta, " South Asia in the Next Decade: A Futuristic Perspective " in Smruti S. Pattanaik(Ed), *South Asia: Envisioning a Regional Future*, New Delhi, IDSA, Pentagon Press, 2011, pp.11-23.

[14] Smruti S. Pattanaik, " Does SAARC have a Future?' in Smruti S. Pattanaik(Ed), *South Asia: Envisioning a Regional Future,* New Delhi, IDSA, Pentagon Press, 2011, pp.237-252.

[15] Event Report at http://www.idsa.in/event/ClimateChangePoliticalandSecurityImplicationsinSouthAsia

- An international treaty may not be successful. Regional level cooperation will be more useful and meaningful
- Network of dialogue is required
- Capacity building and sharing knowledge
- Regional coordination and funding
- Formation of a regional climate change model
- Strengthening existing institutions
- Private and public participation
- Strengthening and sharing of data base
- Use SAARC structure as template
- Inclusion of China in the discussion

Thus in think-tank communities it appears that there is sufficient overlap on environmental issues and also overlap of scholars interchanging and presenting papers at various seminars. The academic train it appears is now slowly chugging. Fruits are ripe to be plucked and there is a need to be proactive.

SAARC

Since 1987, successive summits have expressesed concerns on environmental degradation and increased frequency and intensity of disasters.[16] Nepal and Maldives have staged world media attention grabbing environmental events, by having ministers assemble at Mount Everest and underwater respectively before the climate summit at Copenhagen in 2009. SAARC also theoretically has been upfront in the documentation part. *South Asia Environmental Outlook 2009*[17] read together with areas of cooperation on SAARC web pages is impressive.[18]

The 1997 SAARC Plan of Action on Environment and the Dhaka Declaration and Action Plan on Climate Change of July 2008 are positive initiatives for regional cooperation. At Male a Comprehensive Framework on Disaster Management (2006-2015) was adopted in 2006 to address the specific needs of disaster risk reduction and management in South Asia. SAARC regional centres such as the Meteorological Research Centre in Bangladesh, Coastal Zone Management Centre in the Maldives, Disaster Management Centre in India and Forestry Centre

[16] Message from H.E. Fathimath Dhiyana Saeed, Secretary General , SAARC, this volume.

[17] South Asia Environmental Outlook 2009, United Nations Environmental Programme, SAARC and Development Alternatives, 2009.

[18] http://www.saarc-sec.org/SAARC-Charter/5/ . Area of cooperation related to environment being environment, energy, forestry, agriculture, climate change, natural disasters, science and technology

in Bhutan are some promising frameworks. Time is now ripe to have a centre on Hindukush- Karakoram – Himalayan Ecology.

Climate Change was the theme at the Sixteenth SAARC Summit at Thimphu in Bhutan from 28 to -29 April 2010. Cooperation in the field of environment and sustainable development through exchange of best practices and knowledge, capacity building and transfer of eco-friendly technology in a wide range of areas related to the environment was addressed.

A common SAARC position on Climate Change was presented by Sri Lanka as the SAARC Chair at the COP 15 Conference on Climate Change (Copenhagen, December 2009). Later the common SAARC position was presented at COP 16 at Cancun by Bhutan as the then chair of SAARC. This by itself is an excellent demonstration of a common cause which unites the SAARC. United we stand. The new South Asian University (SAU) will also provide academic rigor to policy.[19] It is hoped that multidisciplinary field of environmental security gets stared which can cut across disciplines of arts and science. The mandate of the South Asian University, as set out in the Agreement of the SAARC Member States under which the University has been set up envisages that the University should:

- *enhance learning in the South Asian community that promotes an understanding of each other's perspectives and strengthen regional consciousness;*
- *provide liberal and humane education to the brightest and the most dedicated students of South Asia so that a new class of quality leadership is nurtured; and*
- *enhance capacity of the South Asian nations in science, technology and other areas of higher learning vital for improving their quality of life.*

The South Asian University aims to become the focal point for the search for common ground and socio-economic development of the region. The SAU, therefore, aims to provide for programs of study which have the potential to promote regional understanding, peace and security which ultimately enhance the wellbeing of the people of the region; It must reach newer, common and challenging frontiers in various disciplines, and inter-disciplinary outfits, usually not available in individual countries. It should lead to creation and sharing of knowledge that has the potential of creating a South Asian Community of intellectuals, endowed with expanding mutual trust and appreciation of one another's problems. The SAU has to deliver and what is important is that it develops its own unique theory, models and discourse. This probably is the most

[19] http://southasianuniversity.org/SAU/about_us.html

difficult part as in South Asia and elsewhere in the developing world. South Asian academic institutions are not generators of knowledge but rather consumers. Self confidence has now to be established.

Why Not Much Has Been Achieved

Content analysis of the four conferences at IDSA from 2007 to 2010 itself shows that terrorism is top of the agenda and that environmental issues are a low priority. Also the field of environmental studies is contested and political will is yet to achieve the desired momentum.

Some of the reasons for the lack of results are

Inadequate Tools for Research on Social, Physical and Life Sciences in South Asia

In the two largest neighbouring South Asian countries in India and Pakistan social science research and teaching about each other is absent.[20] Theoretical frame work within which social sciences are taught and researched in non- western world is still based on irrelevant European models.[21] South Asian universities and academics have not developed theories and original ideas on environmental security including methodologies.[22] The debate and idea on environmental security (barring the human security dimension of the HDR) are borrowed from European or North American perceptions. Hadley climate model does the data crunching for South Asia. Ideas, knowledge and data of South Asian conditions needs more conceptual clarity. In its absence, artificial structures imported on South Asia rarely resonate with traditional ecological knowledge (TEK). Water war thesis, resource scarcities leading to violent conflict are then assumed to be given as a premise. This may be termed third world academic syndrome.

Non Availability of Data

Yet another reason is non availability of environmental data. All agree that environmental degradation has set in. Absence of time series satellite photos of ecosystems makes it very difficult to express this anxiety to readers. Narratives are not enough. Extensive field work is needed. Mass balance studies of glaciers are

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[20] S. Akbar Zaidi, " A Conspicuous Absence: Social Science Teaching and Research on India in Pakistan" in See E. Sridahran(Edited) , *International Relation Theory in South Asia : Security, Political Economy, Identity and Images* , Volume II, New Delhi, Oxford University Press, 2011, pp.367-390.

[21] Claude Alvares, " A Critique of Eurocentric Social Science and the Question of Alternatives," *Economic and Political Weekly*, Vol. XLVI, No.22, May 28, 2011, pp.72-81.

[22] Similar is the case for international relation theory . See E. Sridharan (Edited) , *International Relation Theory in South Asia : Security, Political Economy, Identity and Images* , Volume II, New Delhi, Oxford University Press, 2011.

only rare samples on which much hullabaloo has been created. Sensational items for realist impact are generally picked up by scholars and public from shallow media stories. The IPCC made a 300 year error in editing and for 2305 wrote 2035.[23] The SAEO 2009 also carries this virus of glaciers disappearing by 2035 in the foreword, executive summary and main report. At present the IPCC has admitted the error in suggesting that glaciers will disappear by 2035.[24] But this does not mean that we become complacent. Reduced rainfall in the Kashmir valley has forced farmers to replace paddy with apple orchards. Age old agricultural and horticulture practices are suffering. Lifestyle of local people is being negatively impacted dependent on glaciers in Ladakh, and higher reaches of Himachal Pradesh. Glacier melt contribution in an ICIMOD paper shows Brahmaputra basin with about 12 per cent of glacier melt in river flow, about 9 % for the Ganga with Indus system 50 percent.[25] In 2007 out of 9,575 glaciers in India, research had been conducted only on around 25 to 30.[26] Group of scientists working in different departments have also researched and found that "small glaciers and ice fields are significantly affected due to global warming since the middle of last century. In addition large glaciers are being fragmented into smaller glaciers. In future, if additional global warming takes place, the processes of glacial fragmentation and retreat will increase, which will have profound effect on availability of water resources in the Himalayan region".[27] According to the latest (2011) Indian Space Research Organistaion(ISRO) study of 2,190 glaciers, 75 per cent glaciers have retreated, 8 per cent have advanced and 17 per cent are stable.[28]

Water flows are also securitized or not easy to monitor, in river basins that cut across regions. This sharing of data is one issue that may take a long time to be

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[23] Pallava Bagla, " Himalayan glacier deadline ' wrong'" , BBC News, December, 12, 2009, http://news.bbc.co.uk/2/hi/south_asia/8387737.stm accessed on December 7, 2009.

[24] *Hindustan Times*, January 20, 2010. In Chapter 10 of *Fourth Assessment Report Climate Change: Impacts, Adaptation and Vulnerability* on Asia at para 10.6.2 on page 493 mentions that "Glaciers in the Himalayas are receding faster than in any other part of the world (table 10.9) and, if the present rate continues, the likelihood of them disappearing by the year 2035 and perhaps sooner is very high if the Earth keeps warming at current rate.

[25] Matas Erikkson et al, *The Changing Himalayas : Impact of Climate Change on Water Resources and Livelihoods in Greater Himalayas*, December 11, 2009, The International Centre for Integrated Mountain Development(ICIMOD)

[26] As told by former Deputy Director General of Geological Survey of India Shri V.K. Raina, *The Hindustan Times,* March 03, 2007.

[27] Anil V Kulkarni, I M Bahuguna, BP Rathore and , SK Singh , SS Randhawa and RK Sood and Sunil Dhar , " Glacial retreat in Himalaya using IRS satellite data", *Current Science*, Vol. 92, No.1. January 10, 2007, pp. 69-74.

[28] Jayshree Nandi, "ISRO: 75% of Himalayan Glaciers Retreating ", *The Times of India*, May 16, 2011 and Aditya Ghosh, "Himalayan Glaciers Thinning", *Down to Earth*, June 1-15, p.16.

realized. With climate change current and projected data will further change. That change must be established by joint studies and understanding so that countries do not blame each other on flow data.

Lack of Early Warning and Response Capacity: **Disaster Based Evidence**

July - August 2010 witnessed an unprecedented cloudburst at Leh in the Ladakh region of Jammu and Kashmir (August) and the worst floods in Pakistan's history. Yet not much work seems to have been done in South Asia to know the reasons and mitigation or adaptive measures. Was it just climate change or climate variation? For the floods in Pakistan, the initial reaction was weather extremes are getting worse and[29] climate change disaster was the usual suspect.[30] "Unusual jet stream" was the provisional finding of studies into the intense rainfall.[31] From a disaster management point of view a study established that the scale of catastrophe would have been less if European weather forecasts had been shared with Pakistan.[32] Perhaps the most apt finding shared was of Prof J Srinivasan (Centre for Atmospheric and Oceanic Sciences, Indian Academy of Science) Bangalore who wrote in August 2010:

The recent Pakistani floods could have been predicted a few days in advance. This requires high resolution short weather forecasting model that can assimilate the large amount of satellite data that is available now. You will see a lot of papers in the next few years that will hindcast this event. In addition to good weather forecasting, we need a good decision support system. Most people in South Asia will not leave their houses and farms even if the local officials issue a flood alert. Hence there is a needed for local shelters that people can rush to at a few hours notice. This has been provided in coastal Andhra Pradesh and Bangladesh for those exposed to storm surges during cyclones.[33]

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[29] Justin Gillis, "Is Weather Chaos Linked to Warming? Probably", New *York Times* reproduced in *The Hindu*, August 16, 2010.

[30] Nathanial Gronewold and Climatewire, "is the Flooding in Pakistan a Climate Change Disaster?" *Scientific American*, August 18, 2010.

[31] Kate Larkin, " Pakistan's Floods: is the worst still to come?", *Nature* online, August 13, 2011

[32] "Pakistan flood warning 'not passed on'", *BBC News*, February 1, 2011.

[33] I thank US based Professor Kiran Magiawala (see note 1) in forwarding his correspondence with Prof J. Srinivasan. One needs to be careful in analysing shelters, better early warning or even governance as the reasons why Bangladesh suffered least casualties from cyclone Aila of 2009 or Sidr of November 2007 when compared to cyclones of period of 1970s and earlier where half a million were the figures. As pointed out by Professor Jamilur Reza Choudhury, the landfall of the two recent cyclones did not combine with high tide, else result would have been much more devastating. See Gawher Nayeem Wahra, " Shelter from the Storm" , *Himmal SouthAsia*, Vol.24, No.3, March 2011, pp. 54-56.

Harsh Words Used by Academics

Academics also stick to wild ideas. Granted that sea level rise will displace populations, to term such events as a search of *Lebensraum* is totally negative. A section of scholars in India and Bangladesh (but not the Maldives) continue to misuse this term regularly. The concept of *lebensraum* was developed by Karl Haushofer a lecturer in Geography during the rise of Nazi Germany. Haushofer defined *Lebensraum* in practical terms as the right and duty of a nation to provide ample space and resources for its people. To obtain *Lebensraum,* a state could resort to empire (direct or indirect), peaceful expansion, or ' just war'.[34] Equating Nazi conquest and expansion by war to movement of impoverished Bangladeshi immigrants due to pull or push factors to India under the theory of *lebensraum* draws us back to an era of pre World War II which is not related to the present situation and is therefore untrue . The problem of population movements is genuine and needs to be tackled with entry rules, and a future India living in cross border cooperation with its South Asian neighbours with work permits. It also needs to be pointed out that sensationalism sells. Although *National Geographic* is admired for its photography, there is something very uncomfortable with their text. In a recent article on environmental refugees due to sea level rise from Bangladesh the author[35] has overplayed the negative aspects and downplayed the resilience and innovation of South Asian people. Rather by quoting Muniruzzaman that "those trigger happy Indian border guards would run out of bullets" has not been well received. This sort of rhetorical quote then propels some Indian authors to counter accuse Bangladesh of not controlling its population with other harsh words and thus a renewed vicious cycle is revived. While academic freedom is a fundamental right, its negative butterfly effect must now be factored.[36]

The 'Weight' of Western Academic Understanding

To Western academics, the region seems to be an ideal place to research conflicts, environmental and resource war. To a great extent, creation of resource conflict

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[34] Holger H Herwig, " Geopolitik: Haushofer, Hitler and Lebensraum", in Colin S Gray and Geoffrey Sloan(Ed), *Geopolitics, Geography and Strategy*, London, Frank Cass, 1999, p.226.

[35] Don Belt, "The Coming Storm", *National Geographic*, Vol.219, No.5, May 2011, pp.58-83.

[36] During the seminar in June 2011 at Colombo , Maj Gen Muniruzzam felt that one can not be a state of denial . He pointed out that from period 2001 to 2009 about 1,000 people had been killed, in 2010, 88 killed and in 2011 till date over 40 killed. The author while interacting with Border Security Force officers at IDSA was informed that there are strict orders not to kill and non-lethal methods are employed. Much more mutual transparency in this field is now required as even without sea level rise , the population is increasing and inflows of migrants will only increase due to pull factor. Anecdotal accounts will only fuel suspicion. More mutual understanding on root cause of migration, joint patrolling etc needs to be on Indo- Bangldesh agenda for sea level rise.

literature from the West has given birth to similar mindsets in South Asian academic and policy circles. What is missed out is South Asian social and cultural ecology. South Asians have lot of tolerance and resilience. Fatalism is also present and can not be denied. While this does not mean that poverty needs to be worshiped, but simplicity and frugality is the cultural strength. Yet being fair to the West, everything being unsustainably imbibed by our societies should not be placed at their doorsteps, as a result of own shortcomings. Here I give example of rapid consumerism of the growing middle class and the false ideas of being rich like owing a number of cars and houses. Reducing material and energy use while being happy is not easy. Bhutan is the role model, but it also faces the 'bull dozer' that is the march of materialism. Concerns of a consumerist society have also been voiced in Bhutan[37] which now need policy and societal attention , before it is beyond control. Many are watching the Bhutanese model of gross national happiness with great hope to give South Asia the lead in this new and necessary thinking.

South Asia Specific Scientific Research not yet World Class

Research in South Asia on climate change and environment related natural and life sciences is not yet world class. In the past false data on methane from cattle and paddy field generated by the West was refuted. Now there is another 'threat' being manufactured on the Asian Brown Cloud (ABC) as a root cause of climate change. South Asia's poor who burn biomass (which is scientifically carbon neutral) will now be held responsible for global warming at par with fossil guzzling West. Here it needs to be pointed out that biomass burning for cooking is an ancient practice much before the industrial revolution began emitting carbon in the atmosphere due to fossil fuel use. It needs to be pointed out that in no way ABC is being justified. Major air pollutants like black carbon, methane and ground level ozone mostly results from soot and gases formed by the incomplete burning of fossil fuel, wood and biomass. What is at issue is that scientific efforts must be made to separate them out and not club all together, importantly biomass?[38] It is unlikely that the people of South Asia will be provided with energy or fuel such as electric stoves , kerosene or gas for cooking. Even if all villages are electrified, that energy will be used for lights and not for cooking. This switch over from biomass will be a very long process in poor parts of South Asia. Thus poverty or survival related smoke from use of biomass chullahs may be yet another scientific tool

[37] Tashi Choden, " A View from Bhutan", this volume.

[38] The UNEP report of June 2011 on black carbon is at http://www.unep.org/newscentre/Default.aspx?DocumentID=2645&ArticleID=8780&l=en

for applying political pressure by the industrialized countries to pass off unaffordable mitigation to South Asia , when it is well know that South Asians never caused the problem of luxury related fossil fuel emission stocks which have led to global warming . Rather the region is only adapting with great pain.

High Expectations

While national plans have been formulated, within each country the states or federal units have not done much. It is therefore expecting too much from SAARC.

Revisiting Concepts

Development, GDP and Growth

What are reasons for the looming ecological threats? One reason is the concept of "development" itself combined with our obsession with "growth" of mainstream economic tools such as gross domestic product (GDP) at all costs. We know that GDP = consumption + investment + government expenditure + net exports (exports minus imports). But it does not account for say jobless (also called joyless growth) growth or the ecosystem services. Thinking has to be beyond GDP. It is only a means and not an end. Individual fossil fuel based transport is one example. Motor transport generates good amount of GDP and jobs, from manufactures, users, drivers, conductors, to tire puncture boys at road side highway teas stalls and dhabas. More number of people in South Asia are now living in a cultural space of motor vehicles than fishermen. The culture of motor vehicles seems to be the central focus in countries in development and urbanization. National level traffic jams, cyclists, and pedestrians are ignored. I can give an example of Sri Lanka. The drive from Colombo to Kandy will soon become a nightmare. A decent public transport system may be better. Sri Lanka can learn from Indian traffic jams. Surely business as usual is not sustainable.

Struggle of Environmentalists and Economists

While growth is essential for a developing country it hides many truths. Gross Natural Product has not yet been factored into mainstream economic planning. Thus we find that to restore the ecology after economic activity, we need to spend money to restore the ecology. At times the damage may be so severe that recovery may not be possible. This is called the "Humpty Dumpty Effect".[39] This is the crux of the dilemma between development and the environment. Mainstream economists argue that in the initial phases pollution rises but as income increases

[39] Andrew Simms, *Ecological Debt*, mentioned by Larry Elliot in the *Guardian Weekly* 20-26 May 2005. .

environmental matters start getting addressed. This is called the Environmental Kuznets Curve (EKC), which in other words is an empirical relation purporting to show that with ongoing growth in GDP, pollution at first increases but then reaches a maximum and declines.[40] EKC may not always be true. How do we relate it to the falling quality of Himalayan ecology, the shrinking of the deltas and other scars? In SAARC although this is well known to policy makers, what needs to be appreciated is that new thinking is emerging. Environmentalists and economists need each other.[41] In water issues there is now greater attention downstream. The science underpinning environmental flows assessment has advanced considerably. Only the civil engineering perspective of 1950s is now layered with that of the economist, environmentalist, sociologist, displaced people and downstream impact till the delta.[42] The Indian Planning Commission has even suggested that anthropologists be taken on board of water projects.[43] Initiatives such as The Economics of Ecosystems and Biodiversity(TEEB) are attempting to produce analysis of the economics of biodiversity loss parallel to that of existing analysis of climate change.[44] These must be mainstreamed at policy and academic level in SAARC

Using insights of South Asian scholars, there is a need for environmental scarcity, environmental security, shallow environment and deep ecology to be deliberated. Environmental scarcity is a negative understanding. Environment tinkers with status quo in which shallow ecology is narrowly 'anthropocentric'. Deep ecology is bio- centric and has the interests of nature at heart.[45] This is nothing else but the Gaia hypotheses. Prithvi needs to be protected. SAARC countries must appreciate what Bolivia has done for the Andean goddess of Mother Earth called *Pachamama*. It has laws for legal rights of Mother Nature in its constitution. The

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[40] Herman E Daly. "Economics in Full World", *Scientific American India*, September 2005, pp. 64-71. The author criticizes reliance on the concept of the EKC. Ramaswamy Iyer in *Towards Water Wisdom* (2007) has doubts on this EKC argument. At the other end Pradipto Ghosh has praised the EKC and has shown its positive impact in India. See Prodipto Ghosh, "Harmonizing Environmental Concerns and Economic Growth", *Environment Matters,* World Bank, 2004.

[41] Paul Collier, *The Plundering Planet: How to Reconcile Prosperity with Nature*, London, Allen Lane, 2010, p.9.

[42] Rafik Hirji and Richard Davis, *Environmental Flows in Water Resource Polcies, Plans, Projects: Finding and Recommendations,* Washington D.C., The World Bank, 2009

[43] Gargi Parsai, "Take Anthropologists on Board in Executing Water Projects: Planning Commission", *The Hindu*, May 2, 2011.

[44] Pushpam Kumar and Joan Martinez- Alier, " The Economics of Ecosystem Services and Biodiversity: An International Assessment", *Economic and Political Weekly*, Vol.XLVI, No.24, June 11, 2011, pp. 76-80.

[45] Ramachandra Guha, *How Much Should a Person Consume: Thinking through the Environment*, Delhi, Black Kite /Permanent Black, 2006, p.32.

Law of the Mother Earth mentions that "every human activity has to achieve dynamic balance with cycles and processes inherent in mother – Earth".[46]

Theory of Himalayan Degradation

The traditional Theory of Himalayan Degradation (THED) asserts that anthropogenic or accelerated erosion is a serious problem in the steep- sloped and fragile natural environment of the Himalayan region. THED suggests that this land degradation is driven by population growth, increased number of livestock, and inefficient local agricultural techniques.[47] It was believed that over-use by local farmers and pastoralists threatened fragile mountain and river environment. This understanding led governments to strictly curtail traditional land-use practices. This model is called the "expert – led policy model". In this, results of scientific study are treated as authoritative and apolitical. Policy accordingly is framed. Since the 1980s scholars began questioning the science of this policy. The other model called "political and discursive". In this model the knowledge foundation of policy is much broader. In a more democratic system, besides powerful and wealthy people who stand to gain, there are many other voices of small farmers, social movements and so on which have an effective role in shaping policy. The common notion is such abandoned plots would regenerate by themselves. But this is not so. There is a need to regenerate terraced field due to the out-migration of village labour force to get jobs and earn income in the plains.[48] In the old THED, conversion of forestland to agriculture on steep mountain slopes with a fast pace due to population growth was considered one main cause of environmental degradation and poverty in Nepal. This theory was challenged. It was shown that forests in hills and mountain areas have remained more or less intact, despite population growth after 1950s. Further, the positive impact on geomorphic processes due to the modification of hill slopes for agricultural use through terrace construction and runoff management by local farmers was highlighted.[49] A large area of agricultural land was being left idle, resulting in geomorphic damage like that due to landslide. Farmland abandonment does not automatically lead to plant colonization. "Careful land management is necessary even after abandonment to minimize adverse geomorphic and ecological consequences."

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[46] "Mother of all Laws", *Down to Earth supplement, Gobar Times*, May 1-15, 2011, p.71.

[47] Piere Blaike and Joshua Muldavin, *The Politics of Environmental Policy with a Himalayan Example, Analysis from East- West Center, No.74*, Jun 2004, Honolulu, East- West Center.

[48] Narendra Raj Khanal and Teiji Watanbe, "Abandonment of Agricultural Land and Its Consequences: A Case Study in the Sikles Area, Gandaki Basin, Nepal", *Mountain Research and Development*, Vol. 26, No.1, February 2006, pp. 32-40.

[49] Ibid.

Forests and Flood

There is a tendency to blame all natural disasters on human abuse of natural environment like floods and landslides. Each disaster is followed by a predictable response. Upland farmers and loggers are blamed for clearing and degrading forests. Scientific evidence says otherwise.[50] Drainage congestion and infrastructure is also to be blamed. Within river systems, flooding is the natural way of the system to discharge the water arising from occasional large rainfall events. Much more work in tropical South Asia needs to be done.

Suggestions for Common Understanding within SAARC and what to Be Done by Think Tanks , Institutes, Universities and Governments

Civilisational View

The SAARC region is a civilisation across natural and social ecosystems of the subcontinent. Political boundaries are recent, but ecological system knows no boundaries. This needs to be the guiding philosophy.

Centre(s) of Excellence in SAARC and Theory Building

Good academic inputs are essential for sound policy. There is a need to have centres of excellence where multidisciplinary ecological issues could be researched with a policy focus. The SAARC University is a good beginning.

It is worthwhile to research the cost of non- cooperation by quantifying the ecological losses that accrue to the states because of their unwillingness to cooperate with each other.[51] This is difficult to quantify but is an important future research agenda for policy makers and think tanks. Reading material and text books by far the most difficult task on environmental subjects also now need to be written. Environmental and climate science for policy needs well developed social science. Environmental issues now give an opportunity and window to move ahead with new vigour. SAU and COSSAT can take the lead in propelling such multidisciplinary studies which will also encourage scholars to study their neighbours as it pertains to the ecosystem and civilization of the region. In theory building , taking a leaf out of international relations(IR) as argued by Shibashis Chatterjee, constructivitism may provide the path as opposed to structural

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[50] *Forests and Floods: Drowning in fiction or Thriving on Facts?* RAP Publication 2005/03, Forest Perspectives 2, Barat, Indonesia, Food and Agricultural Organization of the United Nations (FAO) and Center for International Forestry Research (CIFOR), 2005.

[51] This idea quoted was of Mahfuz Anam (for economics), a Bangladeshi journalist. See Preface, Ashok K. Behuria (Ed), *South Asia: The Quest for Regional Cooperation,* New Delhi, IDSA, 2009, pp.i to viii.

realism.[52] The environmental security discourse therefore needs to be constructed and I daresay the process has begun.

Teaching and Educating Children

According to a ruling by the Supreme Court of India, environmental issues are to be included in the syllabus for schools. In the wisdom of the pedagogic community, chapters on disaster management have been included. Probably to mix up a topic such as environment to young minds already under pressure with other subjects would have lead to inhibition and non performance in examinations. More text books need to be written on common ecological themes in SAARC countries. Most are forgetting the traditional ecological knowledge. Many aspects of traditions have evolved over centuries. Thus the future of SAARC now needs to be invested in children. Bulk of our people will have their livelihood dependent on Mother Nature. Most festivals, seasons and music are based on an agricultural foundation with lunar cycles. As urbanization and industrialisation march ahead, it becomes all the more important to reconnect with nature for its gentle and sustainable use.

Agriculture

Cooperative research needs to be undertaken to develop water stress resistant cultivars and changes in agricultural practices. To avoid global warming, tilling is being discouraged in order to keep the soil carbon in the earth. Ideation and implementation of no till agriculture is one good area of further study. But will no till agriculture ever be accepted by South Asian farmers where the climate is not temperate and landholdings are small?[53] South Asian specific work needs to be done . On priority, biodiversity seed banks must be set up at SAARC level. Much biodiversity is lost and with it resilience. The political economy of water intensive crops such as rice or cotton in semi arid or water short regions needs to be given a fresh look for a change and virtual water taken into consideration. The Indus Water Treaty's survival is more dependent on the agricultural and irrigation communities. Wrongly named 'coarse' grains such as jowar, and bajra (sorghum etc) are less water intensive. Internal crop adjustments can reduce water demand.

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[52] Shibashis Chatterjee, " Structural Realism and South Asian Security ", in E. Sridharan(Edited) , *International Relation Theory in South Asia : Security, Political Economy, Identity and Images* , Volume II, New Delhi, Oxford University Press, 2011, pp.35-75.

[53] Jyotika Sood, " Organic V Conservative", *Down to Earth*, April 1-15, 2011, p.42.

Food Security

For each degree Celsius rise in mean temperature, wheat yield losses in India are likely to be around 6 million tons per year.[54] The most practical methods is to focus on water use intensities in agriculture and attempt to change the crops according to the best ecological needs. This may also bring down demand for water for agricultural use which is over 80 %. For fuel, there is a need for planting bio fuels crops as opposed to food crops, feed or agro- forestry. This requirement competes with arable land and also the livelihood concept of Common Property Resource (CPR). CPR to the land less and pastoralists is a legitimate and traditional grazing ground for livestock. Loss of biodiversity has also made us lose the diversity in plant and animal breeds. Monoculture has made us vulnerable as we now lack resilience such as having water tolerant crops or crops suitable for arid conditions. This revival of traditional knowledge could also be an area of cooperative framework.

Small Island Nations and Fragile Countries

The 1200 plus islands that make up the Maldives are only six to eight feet above sea level. Out of these only 200 or so are inhabited as they have fresh water resources.[55] Sea level rise is an existential threat. Although more number of people may be impacted in India (Coastal Indian peninsula and Lakhshwadeep islands) or in Bangladesh, special attention needs to be given to small island nations such as Maldives which may cease to exist with sea level rise. Small countries like Bhutan who depend on Himalayan waters and forests also need special attention as their resilience to absorb the impacts of climate change is questionable. The hopeless basket case Afghanistan, is of great concern. Poppy is easy to grow. The future will be in irrigated agriculture and Afghanistan must be allowed to recoup. De-mining is one challenge. With new mineral wealth to be mined, ecological issues will need more focus and long-term strategies.

Himalayas, Neighbourhood, Tibet and Setting up of Regional Centre

Within SAARC, a complete study of Himalayan, Karakoram and Hindukush glaciers is a gigantic task which needs to be done urgently . Tibet is the key. Tibet is a regional if not a global common and China as observer in SAARC must be made conscious of its unilateral designs and down stream concerns of Pakistan, Nepal, India and Bangladesh. More than climate change; the discourse is on lower

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[54] M. S. Swaminathan, "Copenhagen, tsunami and hunger", *The Hindu*, December 26, 2009.

[55] I thank Ambassador Arun Banerjee, the former Indian ambassador to the Maldives for providing this insight at a seminar at the IDSA on May 27, 2011.

riparian worries about water sharing norms. Three issues are to dam (which will change natural flows) or divert(which will reduce flows) and quality of water due to pollution in future as polluting industries, are set up in Tibet combined with increased waste flows of urban waste and pesticide pollution. All three will cause harm and injury to lower riparian South Asian countries. A three track approach is suggested. The first studies the impact of climate change of river flow, affecting treaties such as the Indus Water Treaty (between India and Pakistan over the Indus basin), Ganga Water Treaty (between India and Bangladesh on the Ganges at Farakka barrage) and the Mahakali Treaty (on Mahakali/Sarda River between India and Nepal). In the second track common understanding must be reached on rivers on which there is no treaty like the Brahmaputra (China, India and Bangladesh) and the Kabul River in the Indus system between Afghanistan and Pakistan. The clichéd water war hypotheses can be falsified if a new approach is taken for agriculture, irrigation and water use intensities. In the third track pollution of rivers like Yarlung Tsangpo to sewage drains (as is the historic experience of China or for that matter the Jamuna and Ganga in India) must not be allowed to happen. Proper waste disposal and technologies will not allow this to happen. It is also suggested that SAARC sets up a regional centre for Himalayan ecology.

Research and Sharing of Scientific Data

According to Pakistan Meteorological Department, the centre of precipitation is no longer Punjab, but it has shifted to north and west to the Khyber- Pakhtunkhwa province (KPK).[56] Much more joint work with the Indian Meterological Department needs to be done in establishing changing pattern of rain and snow fall. Scientific inputs must guide the understanding of the changed river regimes and not anecdotal media stories. As alluded degradation of Himalayas, floods and forests need much more work including field work. We need to share a common scientific data base such as on emission norms, Atmospheric Brown Cloud (ABC), methane from paddy and livestock and should not rely solely on outsourced agencies commissioned by industrialized countries to generate data for us. For this, regional measuring station need to be set up and those in place need to be coordinated. The Indian Network for Climate Change Assessment (INCCA) has released a study on climate change science.[57] It shows that there are significant data gaps. Multiple data sets are required for climate, natural

[56] Christine Fair, " Pakistan's Security- Governance Challenge", *Current History*, April 2011, pp.136-142.

[57] Indian Network for Climate Change Assessment, **Climate Change and India: A 4X4 Assessment - A sectoral and regional analysis for 2030s, New Delhi , November 16, 2010 at** http://moef.nic.in/modules/others/?f=event

ecosystems, soils, water from different sources, agricultural productivity and inputs, and socio- economic parameters. It further suggests that a new systematic observation on a long –term basis must be taken in India and the South- South database on physical and biological systems. On the models being used, it suggests going beyond the Hadley Centre model of the UK. Regional models need to be made, work for which needs to be done by building capacity. Cooperation is the key methods and policies to revive forests is another issue of cooperation. This can also facilitate countries to get funds under Reducing Emissions from Deforestation and Forest Degradation(REDD) as deliberated during the Cancun climate negotiations in December 2010.[58] South Asian think tanks must now encourage generation of South Asia specific data for regional matters.

Climate Related Disasters and Extreme Weather Events

Key issues here are warning systems and response mechanisms. Much work is needed to be done. A study of drainage congestion and the neglect of flood plains will help achieving common adaptation practices. It will also make planners more sensitive to long term problems. Disasters are made worse by human interference. Urbanisation, roads, communication networks and infrastructure have changed the nature of the landscape. Cushions such as wet lands or seasonal rivers have been encroached. Thus natural events have been changed into nature's devastating fury. The Kosi floods in Nepal and Bihar in August 2008 cannot be attributed to climate change. Rather they were a manmade disaster due to embankments, drainage congestion and poor workmanship, and operation and maintenance of structures. The Frequency and intensity of natural disasters will increase. Floods and drought will be more common. Extreme weather events such as in Ladakh in August 2010 and record breaking floods in Pakistan uprooting 20 million people are still fresh in our memory. Greater cooperation in creating a common scientific understanding and disaster preparation between countries will benefit all.

The draft SAARC Agreement to establish mechanism for Rapid Response to Natural Disasters concluded at Male in May 2011 is an important step.[59] After its finalization at the 17th SAARC summit (The Maldives, November 10-11, 2011), the next challenge is how to reduce and provide early warning of disasters. Between countries, an integrated dialogue in managing and reducing the scale of disasters needs to be carried out. Watershed restoration and bioshield restoration of coastal areas by planting suitable ecologically friendly trees in any case need not wait and must be done in an emergency mode.

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[58] Ibid, "The Way Forward," pp.31-32.

[59] R.K. Radhakrishnan, "SAARC drafts disaster response agreement", *The Hindu*, May 30, 2011.

Climate Refugees

A recommendation of IDSA working group in 2009 suggested:

"For inter country migration, so far "environmental migrants" or "climate refugees" are currently not provided for in international law. Case may be initiated to have a protocol for the same, especially in the light of future influx from Bangladesh and Nepal. Diplomatic initiatives within SAARC need to be taken to deliberate the issues before it becomes flashpoint of conflict."[60]

This must be discussed further between countries. Some attempts to have a protocol have been suggested and these must be studied by governments.[61]

Maritime South Asia

The maritime neighbours need to be engaged in pollution response measures. All coastlines are vulnerable to oil spills. Greater military to military cooperation and planning for contingencies would make our maritime neighbours more responsive. Presently capacity of the Indian Coast Guard is to handle 10,000 tons of oil spills. What is a grey area is once oil spill hits the shore, then the labour intensive task of clean up is that of an organization on land. There is a limit to collect volunteers for such sustained work. Joint strategies need to be worked out for dealing with oil spill spreading to a neighbouring country's coastal region.

South Asian waters are also a convenient dumping ground of derelict obsolete and obsolescent bottoms. Taking advantage of lax insurance and monitoring mechanisms, it becomes easy for ships carrying flags to beach their derelict and hulls with polluting or hazardous cargo. Coast guards and navies of the region need to gear up to prevent the Indian Ocean being treated as a dumping ground.[62] As single hulled shipped get phased out in developed countries, they are most likely to head to Indian waters. Also with growth of the world economy shipping is

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[60] P.K. Gautam, " Climate Change and Migration" and Arvind Gupta, Sunil Chauhan and P.K. Gautam, "Conclusion", in Report of the IDSA Working Group, *Security Implications of Climate Change for India* , New Delhi , Academic Foundation, 2009, p.103 and pp.168-169 respectively.

[61] Frank Biermann and Ingrid Boas, "Preparing for a Warming World: Towards a Global Governance System to Protect Climate Refugees", *Global Environmental Politics*, Vol.10, No.1, February 2010, pp.60-88.

[62] Trends of maritime coastal pollution incidences show an increase. On June 12, 2011(see http://timesofindia.indiatimes.com/city/mumbai/Cargo-ship-in-Mumbais-Juhu-beach-stirs-pollution-worries/articleshow/8831517.cms

an old cargo ship MV Wisdom which was being towed for ship breaking/dismantling from Colombo to Alang at the coast of Gujarat drifted away when cable of its tug snapped. She ran aground on the Juhu beach in Mumbai. At the time of writing in June 2011, attempts are being made to tow it away during high tide. If that is not possible then it will have to be dismantled in situ This will impact the fragile marine ecology.

growing. In other words more oil spill disasters are in the making impacting both the marine and coastal zone.

More than 80 per cent of sea pollution(manifest as coral dead zones caused by algal blooms feeding on fertilizer rich run- off) is due to pollution from land based activities. Sewage and industrial run-off adds on further to the waste. Global Warming will further damage the sensitive marine ecosystem and its biodiversity. Trawlers using large nests destroy small marine life and the natural food chain. Pollutants like fertilizer and pesticide runoff, sewage, and industrial waste has made South Asian coast line next to metropolitan cities akin to sewers. The Ocean is no longer a sink or a waste material basket as imagined. This consciousness must be used positively to save the Bay of Bengal and Arabian Sea from further pollution. More research needs to be done to adapt and mitigate this by practical policies.

Conclusion

The political boundaries pale in comparison to the ecological and civilisational overlap between South Asian countries. Yet worldly political issues of the moment inspired by sovereignty are the dominant discourse. The paper has argued for the need to further boost and develop the regimes and mechanisms on environmental issues that are slowly getting policy focus within SAARC. It identifies the obstacles to be negotiated and crossed in achieving environmental security. For long- term viability and a sustainable future there is also need to revisit and debate concepts of thinking beyond GDP and old theories of Himalayan degradation, forests and floods. The earth is a living system. Seeds of deep ecological thinking based on the Gaia theory need to be broadcast. The suggestions on common understanding within SAARC are those that can not be ignored. The suggestions for common understanding need further work by think tanks and policy makers. Ideas matter. It is hoped that visionary policy makers of present and future generations will also take these into consideration now in a more focused manner.

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CONSORTIUM OF SOUTH ASIAN THINK TANKS (COSATT)

The Consortium of South Asian Think Tanks (COSATT), is an informal organization of leading think tanks in SAARC, was set up in January 2008. Since 2008, the COSATT has undertaken three regional dialogues on connectivity, countering terrorism and energy and environmental security.

The COSATT facilitates cooperation among policy institutions in South Asia to address common peace and security issues in the region. The Consortium organizes a series of dialogues at the regional level every year on selected themes; results of these discussions are published as a book, along with a summary of policy recommendations to the SAARC.

The COSATT dialogues are undertaken in collaboration with the Regional Programm SAARC of the Konrad Adenauer Stiftung (KAS)

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